Business-cycle Influences on Work-related Disability in Construction and Manufacturing

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PRODUCTION AND EMPLOYMENT IN MATURE CAPITALIST economies exhibit distinct cyclical patterns. Levels of output rise and fall in response to spurts in investment behavior, which in turn reflect firms' expectations concerning future levels of consumer demand and production costs. Fluctuations in output reverberate through the labor market in the form of layoffs, quits, and hiring. These fluctuations in production and employment impose undeniable costs on the economy and the society it supports. Above-average unemployment rates are the most obvious index of the waste in human resources imposed by economic downswings. Business cycles impose another burden on the work force, however, in the form of exceptionally high levels of work-related injuries. The hiring process in cyclical upswings, through which firms compensate for the layoffs announced during preceding downswings, introduce new and less-experienced workers into the work place, generating in turn a surge of injuries. Controlling for changes in employment, the increase in production during growth periods demands a speedup in work practices and a concomitant disregard for safety precautions. Occupational injuries, and the residual disability that follows in their wake, constitute a major but largely unmeasured social cost of economic fluctuations.

This article examines the impact of business-cycle fluctuations on

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rates of work-related injuries, fatalities, and acute illnesses. Several published studies, including those by Mendeloff (1979), Catalano (1979), and Arno (1984), have identified the cyclical pattern of injury rates using data from the 1960s and 1970s. The usefulness of these studies is limited, however, by their exclusive focus on the manufacturing sector and by their tendency to analyze all forms of occupational injuries and illnesses as a group rather than separately. (Mendeloff analyzes some accident types separately.) In this article we study both the construction and manufacturing sectors in the state of California, using data from the state Workers' Compensation reporting system. More important, we investigate cyclical patterns for each major category of occupational injury and for occupational fatalities and acute illnesses separately. Not surprisingly, different types of injuries reveal different degrees of sensitivity to business-cycle pressures.

This focus on cyclical rather than secular patterns in work-related disability can shed important light on a major controversy concerning the influence of economic factors on disability. Since the 1960s, rates of recorded occupational injuries and of reported disability among working-age people have increased substantially (Parsons 1980; Chirikos 1986; Robinson 1988). The dominant explanation on the part of economists focuses on the increased availability and generosity of disability, welfare, and Workers' Compensation programs (Parsons 1980; Chelius 1982; Butler and Worrall 1983). In this "labor supply" interpretation, workers with some functional impairment choose to remain in the labor force only so long as their after-tax earnings from doing so significantly exceed the expected value of the (untaxed) benefits they would receive if they successfully defined themselves as entitled to disability compensation.

An alternative view focuses on "labor demand" factors that could be responsible for rising injury and disability rates (Weisskopf, Bowles, and Gordon 1983; Yelin 1986; Robinson 1988b). This minority interpretation emphasizes the role of the changing industrial and occupational mix, rising unemployment rates, and increased labor management strife during the course of the 1970s. The current article adds some empirical evidence in support of the basic argument that labor-demand factors influence trends in worker disability. Cyclical movements in injury rates cannot be explained by labor-supply factors such as the ratio of expected disability payments to after-tax wages,

since these ratios do not fluctuate cyclically. Labor-demand factors such as the rates of unemployment, layoffs, and hirings do fluctuate in marked cyclical patterns.

Studies of cyclical trends in disability can, therefore, distinguish between labor-supply and labor-demand theories in a manner that studies of secular trends cannot. Both labor-supply factors, such as ratios of disability payments to wages, and labor demand factors, such as industrial restructuring, have evolved in recent decades. Studies of long-term secular trends face inherent difficulties in distinguishing their separate roles.

This theoretical debate has obvious and important implications for the design of disability policy. The labor-supply-oriented perspective has provided the conceptual foundations for policies designed to reduce eligibility and benefit levels for Workers' Compensation and disability programs. In contrast, the labor-demand-oriented perspective directs attention toward policies designed to influence the availability and quality of jobs, both overall and for workers with functional impairments.

The first section of the article describes trends in rates of work-related fatalities, strains and sprains, fractures, crushing injuries and contusions, cuts and punctures, and acute illnesses in construction and manufacturing, respectively, over the period from 1953 to 1985. The following section analyzes the sensitivity of each of these variables to employment fluctuations, after controlling for long-term trends and for serial correlation in the rates themselves. The third section summarizes recent economic thinking on why fluctuations in product markets create fluctuations in labor markets. The concluding section draws upon the empirical findings and theoretical discussion to present some limited proposals for reducing the amplitude of the cycles of occupational injuries.

Long-term Trends in Occupational Injury Rates

National data on occupational injury rates are published on an annual basis by the U.S. Department of Labor's Bureau of Labor Statistics. These data do not distinguish the various types of injuries, and hence represent a very heterogenous group of work-place events. As an alternative to the national data we use information from California's

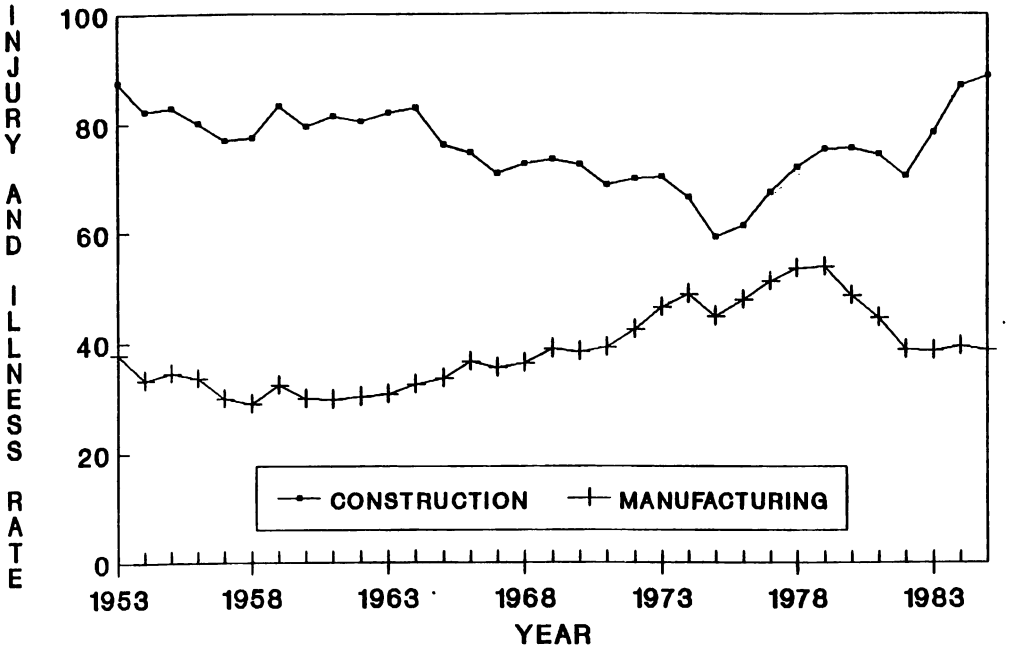

FIG. 1. Total occupational injuries and illness per 1,000 workers, California, 1953–1985

Workers' Compensation system, which requires employers to notify the state upon the occurrence of any work-related fatality or any work-related injury or illness expected to require time lost from work. These data are not influenced by the ultimate compensation or lack of compensation for individual cases, but are based upon initial incidence reports.

Annual numbers of fatalities, strains and sprains, fractures, crushing injuries and contusions, cuts and punctures, acute illnesses, and total injuries and illnesses in the construction and manufacturing sectors were obtained from annual issues of *California Work Injuries and Illnesses* for the period from 1953 to 1987. Employment data, used in the calculation of incidence rates, were obtained from the California Employment Development Department. Fatality rates were calculated in terms of deaths per 100,000 workers per year; rates for each category of injury and for acute illnesses were calculated in terms of events per 1,000 workers per year.

Figure 1 presents the rates of all fatalities, injuries, and acute

illnesses per 1,000 workers in construction and manufacturing over the period from 1953 to 1985. Both cyclical and secular trends are clearly evident. Working conditions in the construction sector improved gradually over the two decades prior to 1973, at which point injury rates began to climb rapidly. In manufacturing, rates declined to a low point in 1958, and then began a remarkable 20-year increase until the end of the 1970s. This increase in manufacturing-sector injury rates was responsible in part for the atmosphere of crisis leading to the passage of the Occupational Safety and Health Act in 1970. It has been variously ascribed to the influx of young and inexperienced workers in the "baby boom generation" and to increased conflict between management and labor (Oi 1974; Mendeloff 1979; Weisskopf, Bowles, and Gordon 1983; Arno 1984). These data from California closely follow trends in national construction and manufacturing data (Robinson 1988b).

As interesting as the long-term secular trends are, the cyclical variation in injury rates are of particular concern here. Both the construction and manufacturing rates fall during economic recessions and rise during economic expansions, but the amplitude of the cyclical fluctuations is much more pronounced for the construction sector. Clearly visible are the dips corresponding to the recessions of 1957–1958, 1974–1975, and 1981–1982.

Rates of occupational fatalities per 100,000 workers are portrayed in figure 2. The most serious but the least frequent of all categories of occupational safety and health events, fatalities per 100,000 workers have been diminishing in California over most of the postwar period. The rate of decline is especially dramatic in construction, but is evident in the manufacturing sector as well. These figures do not reveal any obvious relation to underlying cycles of production and employment.

By far the largest category of occupational injuries is strains, sprains, dislocations, and hernias, accounting for 43 percent of all injuries and illnesses in 1985. A heterogenous category itself, this group of injuries includes both the results of a single traumatic event and the cumulation of repeated minor traumas to the body. It is to be supposed that the incidence of single traumatic events would be more cyclically sensitive than cases caused by cumulative insults to the body. As portrayed in figure 3, this broad category of problems shows no major trend in construction but an upward trend in manufacturing through the late 1970s. Cyclical trends are evident, with upswings during the

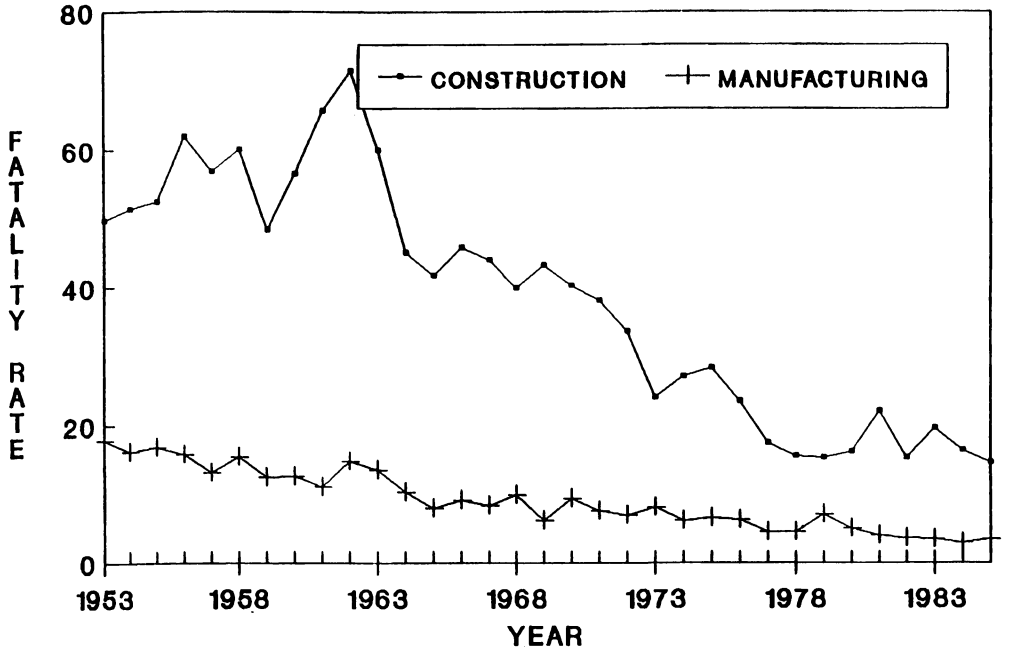

FIG. 2. Occupational fatalities per 100,000 workers, California, 1953–1985

economic recoveries following the recessions of the mid-1970s and early 1980's.

Figures 4, 5, and 6 present incidence rates for the three remaining major categories of occupational injuries, consisting of (1) crushing injuries, contusions, and bruises, (2) fractures, and (3) cuts, lacerations, and punctures. These accounted for 8 percent, 9 percent, and 14 percent of all occupational injuries and illnesses in 1985, respectively. Crushing injuries and contusions reveal a distinct rise in both construction and manufacturing up through the late 1960s, followed by a significant decline. Fractures reveal no major trends up through the late 1970s, at which point they rose dramatically, especially in construction. Cuts and punctures declined in construction and increased in manufacturing up through the 1970s, and then fell during the recession of the early 1980s. The mid-1980s witnessed increases in cuts and punctures in construction and relative stability in manufacturing. The jump in rates of cuts and punctures in 1976–1977 is a statistical artifact caused by a change in reporting classifications

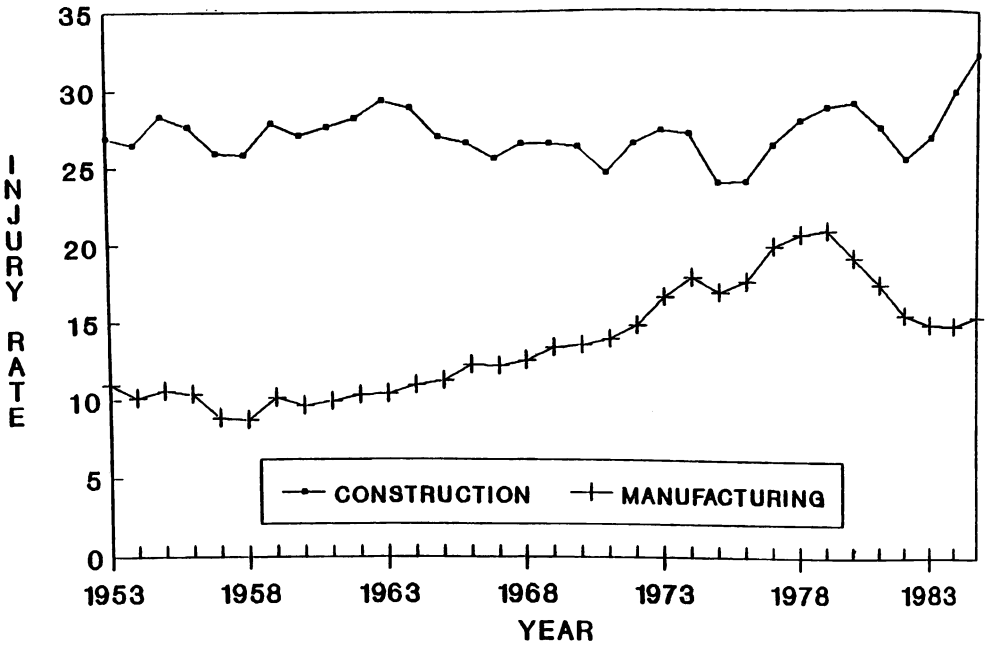

FIG. 3. Occupational strain injuries per 1,000 workers, California, 1953–1985

in that year. These three groups of injuries all manifest cyclical patterns, but ones that vary considerably.

Figure 7 presents rates of acute occupational illnesses per 1,000 workers in construction and manufacturing. This category is extremely heterogenous, comprised of (in order of relative importance in 1985) diseases of the circulatory system, systemic poisonings, anxiety and mental disorders, dermatitis, eye disease, infective or parasitic disease, inflammation or irritation of bones, joints, tendons, or muscles, radiation effects including welder's flash, and serum and toxic hepatitis. It accounted for 7 percent of all occupational injuries and illnesses in 1985. Rates of these events declined in construction and held relatively constant in manufacturing until the mid-1970s, at which point they began to climb rapidly. The sharp jump in 1976–1977 is due to a one-time change in the way the cases are reported and is a statistical artifact. The general increase in illness cases over the past decade is largely due to more liberalized criteria for compensability and increased societal recognition of health problems as occupational in origin, rather

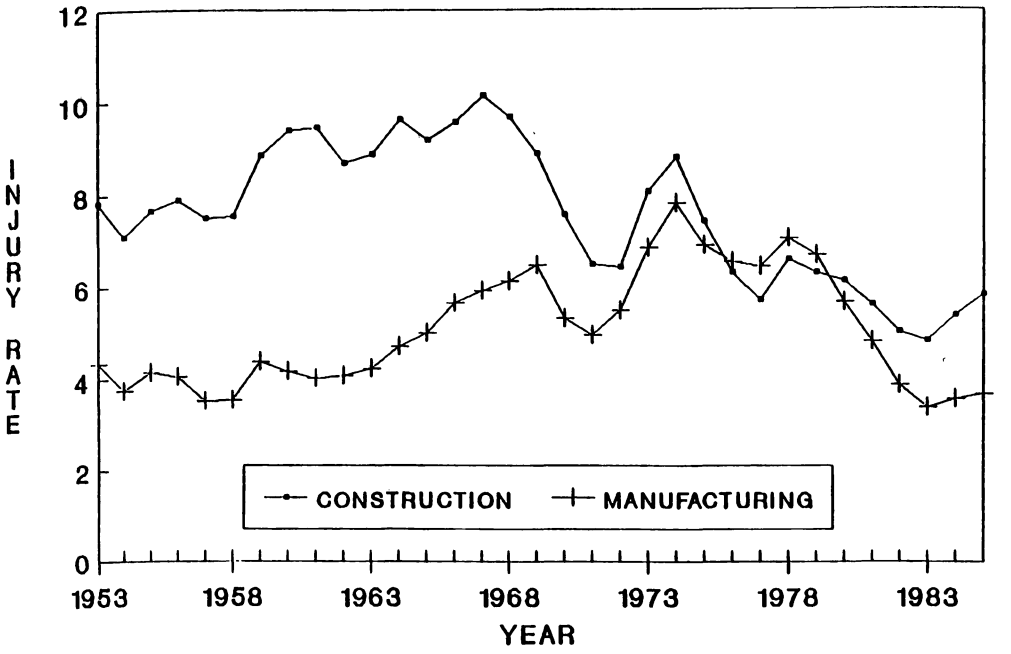

FIG. 4. Occupational crushing injuries per 1,000 workers, California, 1953–1985

than to actual increases in the underlying incidence rates themselves (Shor 1987). No clear cyclical patterns are discernible in these data.

Cyclical Patterns in Incidence Trends

In order to isolate business-cycle effects from long-term trends in work-related morbidity and mortality, the rates of fatality, injury, and illness were transformed into logarithmic units and regressed on various business-cycle measures and on linear and quadratic time-trend variables. We experimented with a number of business-cycle measures, including the rate of change in employment, average weekly hours, unemployment, and (in manufacturing) the deviation of output per hour worked from its trend. These various measures each reflect slightly different facets of the cyclical path of the economy over time. A very long and well-measured series of injury and illness rate data could, in principle, document their separate roles, if they were entered

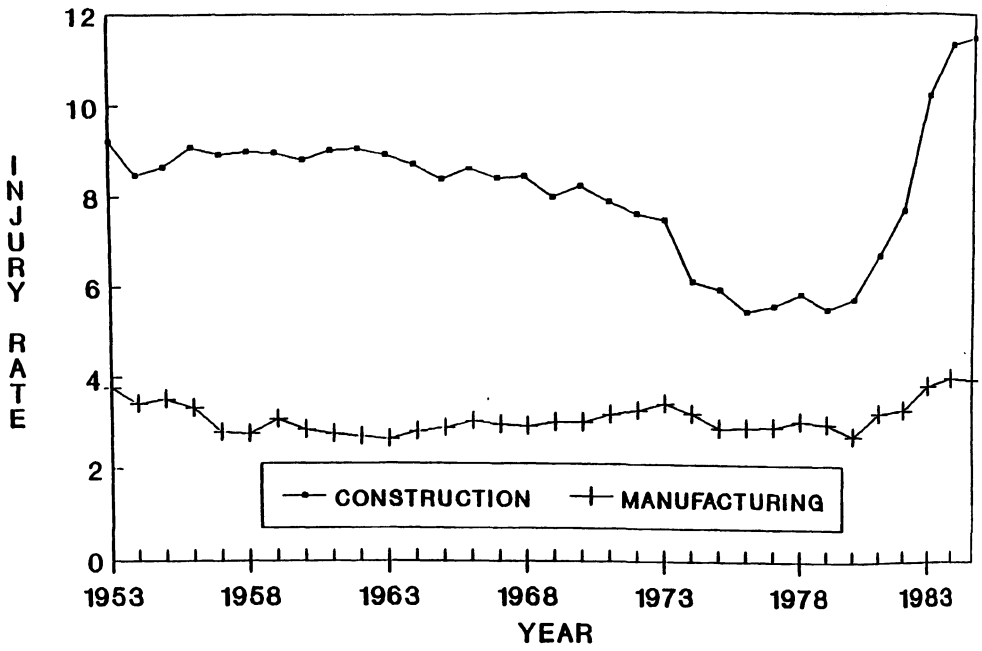

FIG. 5. Occupational fracture injuries per 1,000 workers, California, 1953–1985

into a regression equation simultaneously. An analysis of this sort was conducted by Robinson (1988b) using national data. The various measures are strongly correlated with one another, however, and the California injury and illness data were not rich enough to distinguish their separate effects. We thus restricted the statistical analysis to the simplest cyclical measure, the percentage rate of change in employment, and to the two time-trend variables. Separate regressions were conducted for each sector and for each type of injury and illness rate, after controlling for autocorrelation using the Prais-Winston method (Maddala 1977, 274–84).

Table 1 presents the elasticities of the fatality, injury, and illness rates with respect to changes in employment after controlling for the trend variables. These figures represent the estimated effect of a 10 percent change in employment on each of the incidence rates.

The overall influence of the business cycle on injury rates is evident in the first row of the table, which presents results for all categories of fatalities, injuries, and illnesses combined. A 10 percent increase

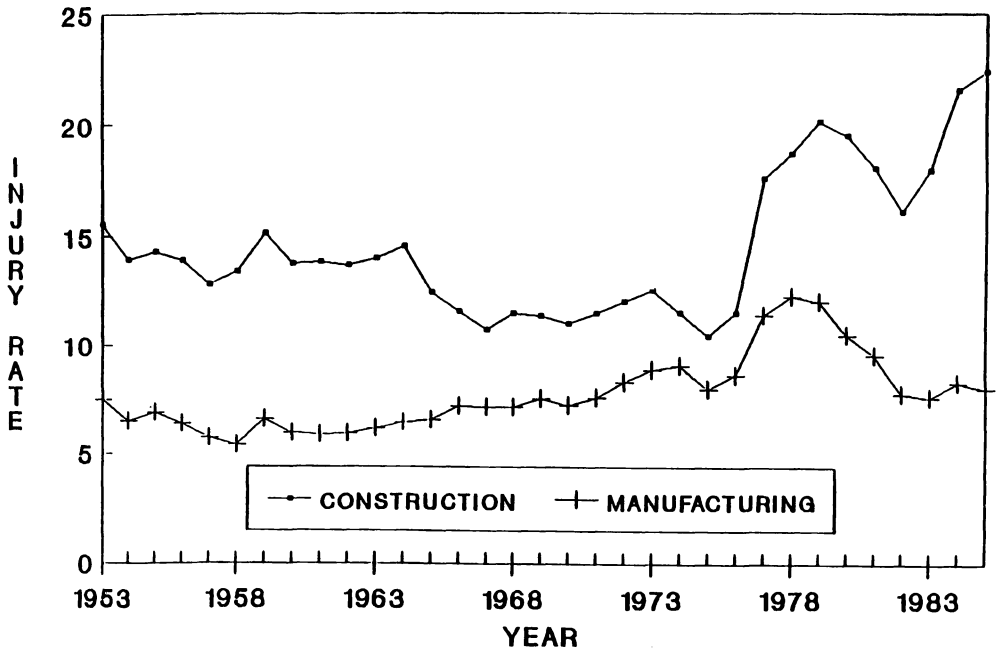

FIG. 6. Occupational cuts and puncture injuries per 1,000 workers, California, 1953–1985

in employment in any one year causes a 3.4 percent increase in total injury and illness rates in construction and a 6.9 percent increase in total rates in manufacturing in California. These effects are significant in health and economic terms as well as statistically. The elasticity of injuries with respect to employment is larger in manufacturing than in construction. Employment in the construction sector is much more volatile than in manufacturing, however, with a standard deviation of 8.1 over the period from 1953 to 1985 compared to a standard deviation of 4.4 in manufacturing (both sectors had mean growth rates of 2.2 percent). Combined with the higher mean injury and illness rate in construction (75.8 per 1,000) than in manufacturing (38.8 per 1,000), this greater relative variability in employment produces the larger absolute cycles in construction relative to manufacturing injury and illness rates evidenced in figure 1.

Fatality rates in California construction and manufacturing did not reveal a response to the business cycle over the period from 1953 to 1985, as indicated in the second row of table 1. The estimated effects

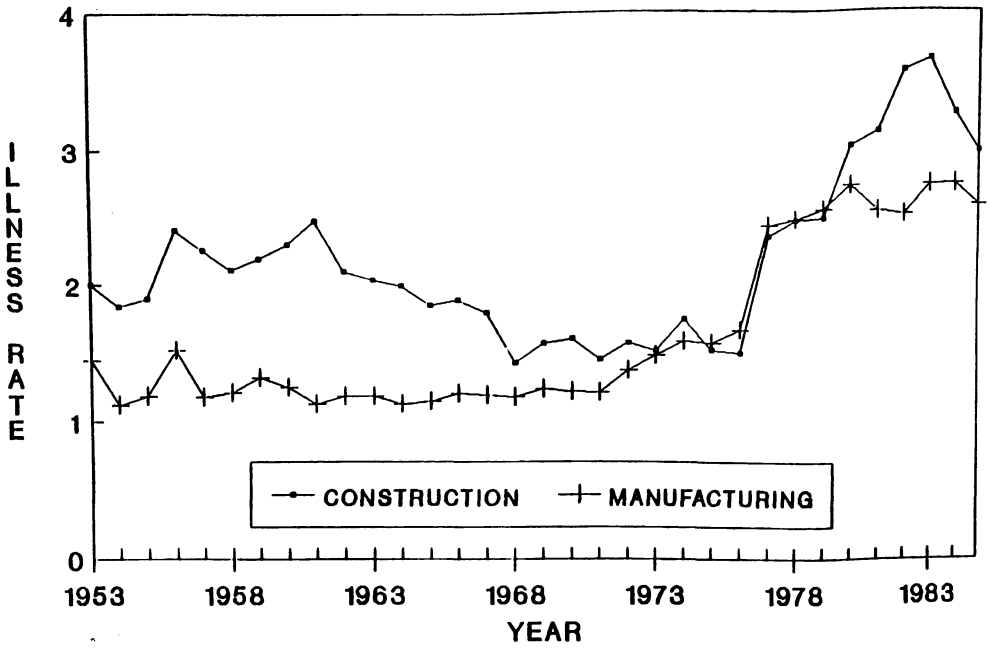

FIG. 7. Occupational illnesses per 1,000 workers, California, 1953–1985

TABLE 1
Percentage Changes in Occupational Injuries and Illnesses Associated with a 10% Cyclical Increase in Employment

	Construction	Manufacturing
Total injuries and illnesses	3.4%**	6.9%**
Fatalities	−2.0	−1.0
Strains and sprains	3.2**	5.9**
Crushing injuries and contusions	0.05	9.2**
Fractures	2.5	6.3**
Cuts and punctures	6.1**	10.2**
Acute illnesses	−4.1	6.2**

** $p < .01$.

are actually negative, but are small and statistically cannot be considered different from zero. These rare events seem to be due to idiosyncratic characteristics of particular work places rather than to general patterns of economic activity and changes in employment patterns.

The four major categories of occupational injuries, presented in the third through sixth rows of table 1, are all positively related to changes in employment. Cuts and punctures are the most sensitive to the business cycle. The elasticities of strains and sprains and fractures, respectively, with respect to employment changes are of approximately similar relative proportions. Crushing injuries, contusions, and bruises are quite sensitive to employment changes in manufacturing but not in construction.

The final row in table 1 presents the influence of employment changes on rates of acute occupational illness. As noted earlier, this is by far the most heterogenous category of events, and it here produces the most heterogenous pair of responses to cyclical employment patterns. While strongly procyclical in manufacturing, rates of acute illness actually decline during business upswings in construction. Given the dramatic changes over recent decades in illness compensability and in the social willingness to define health problems as occupational in origin, we feel that these patterns should be interpreted with extreme caution.

Overall, the statistical analysis reveals that occupational injury rates are consistently and positively influenced by changes in employment, whereas rates of fatalities and illness are not. Upswings in the business cycle, which generate increased rates of new hiring, increased recalls of workers temporarily laid off, longer average hours worked per week, and increased levels of output per hour worked, lead to exceptionally high numbers of occupational injuries. Using 1985 data, one can estimate the number of new cases of each type of injury that will result from a given fluctuation in the pattern of economic activity, over and above the increased number of injuries that would result simply from having a larger population at risk. A 10 percent increase in employment in construction would lead to 1,456 extra disabling injuries of all kinds. It would generate an extra 498 disabling strains and sprains, an extra 138 fractures, an extra 14 crushing injuries and contusions, and an extra 660 disabling cuts and punctures. A 10 percent increase in manufacturing employment would generate a total

of 5,594 extra occupational injuries of all types. This would include an extra 1,919 disabling strains and sprains, an extra 528 fractures, an extra 713 crushing injuries and contusions, and an extra 1,713 disabling cuts and punctures. These estimates pertain to California alone. Given that California accounts for approximately 10 percent of the nation's work force, it is to be expected that the national increases in disabling occupational injuries would be ten times this size.

Economic Theories of the Business Cycle

Cycles in the level of production result largely from the intermittant pattern of private investment. There is no necessary reason for cycles in production levels to create cycles in employment levels so long as firms can adjust the relative mix of labor, capital, and other inputs they use. If wage rates were flexible, one would expect declines in production that reduced employers' demand for labor services to put downward pressure on wages, in turn stimulating employers to substitute labor for other inputs and thereby offset the initial decline in demand for labor. In the upward portion of the business cycle, in contrast, the increased demand for labor services would lead to upward adjustments in wage rates, in turn dampening the initially increased demand for labor.

It is a characteristic feature of modern capitalist economies that wage rates do not respond in this manner to short-term fluctuations in production and labor damand. Over extended periods of time, economic expansions do raise wage rates while economic depressions do reduce them. Over the four-to-eight-year cycles so common in contemporary economies, however, wage rates are remarkably rigid. Instead of fluctuations in the price of labor over the business cycle, we observe fluctuations in the quantity of labor services utilized.

Business downswings in the manufacturing sector are accompanied by a shortening of the average number of hours worked per week and, more importantly, by layoffs and firings of unneeded workers. Upswings are accompanied by an increase in the length of the work week, recalls of previously laid-off workers, hiring of new employees, and increased intensity of utilization of those employees on the payroll (measured by increased output per hour worked). Worker-initiated

separations, in the form of quit rates, move in a pattern opposite to employer-initiated separations, declining in business downswings and rising in upswings. These cyclical patterns are clear evidence, if data on the rigidity of wage rates were not directly available, that wages do not decline enough in downswings to induce employers to maintain their existing work force and do not rise enough in upswings to induce workers to stay with their existing jobs rather than seek better opportunities elsewhere.

A different but ultimately equivalent cyclical pattern of employment occurs in the construction industry. Here, most jobs are by definition temporary, and so separations occur without formal layoffs and quits. Changes in employment are due to changes in the level of hiring for new projects, with increased hiring during periods when many new projects are initiated and decreased hiring when new projects become rare. In both construction and manufacturing the cycles in layoffs, quits, and hiring produce fluctuations in the overall rate of utilization of the labor force. While the rate of unemployment at any one time is fairly low, rarely exceeding 10 percent, the flows of labor in and out of unemployment are very large.

This churning in the labor market influences rates of occupational injuries in two ways. Increased hiring in business upswings introduces new and less-experienced workers into the work place, in turn increasing the number of injuries due to a lack of familiarity with the usual hazards in the production process. Injury rates are also influenced by the intensity of utilization of labor services, as measured by the level of output per hour worked. During business downswings firms do not reduce their work forces as much as would be dictated by short-run profit considerations. This "hoarding" of labor during recessions may be due to the fear of not being able to regain laid-off workers when business picks up again or to paternalistic concern for the well-being of the excess employees. The result of this maintenance of excess labor during downswings is a rate of hiring during upswings that is less than proportional to the increase in production levels. Rather, the existing work force is made to work harder. Variability of work intensity may have many desirable economic and sociological effects, cushioning the labor-market response to the production cycle, but it also generates higher rates of injuries when business picks up. Production speedups decrease the priority placed on safety precautions.

The rigidity of wages and the volatility of employment and injury

rates over the business cycle are hard to explain using the standard economic model of price-competitive market equilibrium. The conventional economic explanation appeals to public and private institutions that limit competition through the exertion of monopolistic power over wage rates. The historical candidate for this role is the labor union, with economists differing mainly in the extent to which they view this power as desirable or not. The great depression of the 1930s was universally ascribed to the rigidity of wages in the face of massive declines in production and demand for labor services. Contemporary neoclassical economists such as Pigou (1933) and Robbins (1934) prescribed the conventional remedy of government efforts to reduce wages. The most important theoretical revolution in economics of the century came in the form of Keynes's (1936) repudiation of this position and argument for governmental stimulation of aggregate demand rather than reduction in wages.

There does exist some empirical evidence indicating that labor unions contribute to the cyclical volatility of layoffs. Medoff (1979) finds that layoff rates are higher and fluctuations in wages and weekly hours are lower in unionized than in comparable nonunion industries. He ascribes this to the ability of the senior union members to control the union's bargaining agenda and thereby to influence the employer to lay off junior employees rather than cut wages and hours for all employees.

The obvious problem with theories of employment fluctuations that rely on labor union activities is that only a relatively small fraction of the economy's work force is represented by unions and the formal collective bargaining process. The 1970s witnessed a surge of interest among economists in informal or "implicit" contracting in the labor market, as employers and employees develop mechanisms to allocate the risks inherent in an economy with large fluctuations in consumer demand. This voluminous literature generated models in which workers obtain wage stability in exchange for employment volatility, with temporary layoffs being followed by recalls. The attractiveness of temporary layoffs is increased by the availability of unemployment insurance, which is incompletely experience-rated and thus shifts part of the wage bill from employers using the layoff mechanism frequently to those using it infrequently (Feldstein 1978).

As reviewed by Rosen (1985), the implicit contract literature has proved inadequate in explaining many important facets of the em-

ployment cycle, including involuntary unemployment. It does not appear to provide insights into patterns of permanent layoffs and quits. Hall and Lazear (1984) ascribe the cyclical pattern of layoffs and quits to the failure of contracting mechanisms to deal with opportunistic behavior on the part of employers and employees when they gain access to new information. Employees cannot trust employers to reveal truthfully the real state of the firm's need for labor, which declines during business downswings, and so prefer rigid wages with some risk of layoff to fluctuating wages with guaranteed employment. Employers, on the other hand, cannot trust employees to reveal truthfully the real state of the workers' alternative job possibilities, which improve during business upswings, and so prefer rigid wages with some risk of quits during upswings over fluctuating wages and no employee-initiated separations.

Recent developments in macroeconomic theory have sought explanations for the cyclical pattern of employment, unemployment, layoffs, quits, and hiring in the inability of economic agents to assess adequately the quality of the goods and services (including labor services) traded on the market. Insights have been borrowed from the economics of formal insurance markets to understand the behavior of markets characterized by uncertainty and incentive problems and hence by various informal insurance mechanisms. Adverse selection models such as those of Weiss (1980) and Greenwald (1986) emphasize that employers resist cutting wages in a cyclical downswing since they fear their most productive employees will quit, leaving the employers with less-productive workers and thereby vitiating any savings from lower wages. Incentive ("moral hazard") models such as those of Akerlof (1982) and Shapiro and Stiglitz (1984) argue that wage cuts during business downswings can lead to higher rather than lower production costs by impairing morale and reducing worker effort. The macroeconomic literature on imperfect information has been reviewed by Stiglitz (1987).

Conclusions

Occupational injuries and illnesses result from the interaction of the working conditions of particular jobs and the behavior and biology of particular workers. Their occurrence is random and can never be

predicted with certainty. On another level, however, occupational injuries and illnesses are symptoms of deeper social and economic processes, ones that extend beyond the particular work place in which any one event occurs. Across the economy as a whole, their patterns of occurrence can be identified without exceptional difficulty. One dimension of public health policy to reduce the incidence of these events must focus on cushioning or isolating fluctuations in injury rates from fluctuations in production and employment. The other dimension of public policy must take the opposite tack, however, exploring the extent to which improvements in injury and illness statistics can be achieved through changes in the underlying structure of the economy and the society it supports.

The most attractive solution, in principle, to the business-cycle-related fluctuations in occupational injury rates documented in this article would be to restrict the amplitude of economic fluctuations through countercyclical aggregate-demand management and full employment policies. The brief survey of recent macroeconomic theory in the third section of the article suggests that little consensus exists among theoreticians that the cyclical patterns in employment and unemployment are themselves major social problems in need of solution. Reductions in business-cycle-related injuries through reductions in the amplitude of the business cycle itself do not seem to be on the priority list of economists. It is unlikely that policy makers at the national level, where governmental power to influence economic activity is greatest, will indulge in risky tampering with the economy in the face of such dissension among their advisors.

Macroeconomic theorists spent the better part of the 1970s expounding upon the virtues of layoffs, quits, and unemployment in a market economy beset by unpredictable changes in international prices, resource availability, and other factors. Job turnover plays the essential role of reallocating workers to the jobs where their skills are most needed. Conservative economists reinterpreted unemployment as a largely voluntary process during which workers searched for new jobs (Phelps 1970). While search theory seemed best designed to explain unemployment resulting from quits, implicit contract theory provided a theoretical framework in which temporary layoffs were also voluntary (Rosen 1985). Some economists came to view the traditional distinction between quits and layoffs as meaningless, interpreting both

types of separations as resulting from a less than optimal match between job and worker (Becker, Landes, and Michael 1977).

The 1980s have witnessed a resurgence of liberal macroeconomic theory, led by the "efficiency wage" models of Akerlof, Stiglitz, and their associates. This literature is more likely to use the language of market failure and involuntary unemployment. It is sympathetic, in principle, to governmental interventions that improve on the social outcomes of self-interested actions of individual economic agents. Its tone is cautious, however, and nothing is forthcoming comparable in ambition and scope to traditional Keynesian demand-management attempts to eliminate the business cycle. The view that involuntary job loss provides a necessary function in capitalist economies through the discipline it imposes on workers seems to have adherents that range from Marxists such as Bowles (1985) through to the middle of the professional mainstream (Shapiro and Stiglitz 1984; Lazear 1981).

A thorough documentation of the impact of business-cycle fluctuations on occupational injury rates would support the efforts of those groups seeking to stabilize employment fluctuations for nonhealth reasons. For practical purposes, however, it may be wise to focus efforts on cushioning the impact of the business cycle on injury rates rather than on expecting major changes in macroeconomic policy.

The Occupational Safety and Health Administration is currently seeking ways to target its enforcement efforts toward high-risk job sites. Priorities are being set based on average levels of exposure and injury, but not on the extent of cyclical variability. The strong sensitivity of injury rates to employment changes identifies an additional way in which preventive efforts may be targeted toward high-risk situations where the potential returns to public health interventions are greatest. High-risk work situations should not be defined solely in spatial terms, according to the average level of injury rates in particular firms and industries, but also in temporal terms, according to changes in hiring and production. Periods of business expansion are clearly high-risk periods for occupational injuries.

Improved training programs could possibly exert major beneficial effects on injury rates. In 1985, for example, 43 percent of all occupational injuries and acute illnesses in California occurred to workers with less than one year's seniority on the job (*California Work Injuries and Illnesses* 1987). This safety-related emphasis on training comple-

ments the emphasis placed by "right-to-know" and other related public policies oriented toward the health effects of toxic substances encountered on the job. It is less clear whether the association between work intensity (output per hour) and injury rates presents significant opportunities for public policy. Increases in injury rates associated with increased intensity of labor utilization during business upswings may be merely the mirror image of decreases in injury rates associated with labor hoarding during business downswings. Richer data series would be necessary to examine whether injury rate increases during upswings exceed injury rate decreases during downswings, thereby producing a "ratchet effect" over time.

Public debate over occupational health policy is currently moving beyond the "right-to-know" issue to discussions of the "right-to-act." This term appears to mean different things to different people. Federal labor law already extends to workers the right to join labor unions and bargain collectively with employers over health and safety conditions (Robinson 1988a). A grievance and arbitration system struggles to interpret collectively bargained contract clauses in a consistent fashion (Gross and Greenfield 1985). A number of statutes guarantee to workers limited rights to refuse hazardous work assignments (Ashford and Katz 1977; Drapkin 1980).

The core of the right-to-act proposals includes requirements that employers complement their right-to-know programs with ongoing training programs and that joint labor management health and safety committees be established and endowed with significant powers to influence working conditions (Bureau of National Affairs 1989). The larger horizon of the right-to-act issue must include strategies to reverse the rapid decline of labor union representation in hazardous occupations and industries. From 1977 to 1986, the percentage of workers in those jobs with the highest rates of disabling injuries fell from 44.0 percent to 27.6 percent (Robinson 1988a). This decline has been traced mainly to a dramatic increase in legal and illegal forms of management resistence to union organizing efforts (Freeman 1985; Kochan, Katz, and McKersie 1986). Weiler (1983), Smisek (1983), and Cooke (1985) have proposed several approaches to this problem, borrowing heavily from industrial relations experiences in Canada.

Cyclical patterns in work-related injury and illness reflect underlying social and economic forces but also the individual and collective

efforts by workers to respond to those forces. As is often the case, the policy dilemma consists in finding the best mix of strategies targeting both the deeper underlying causes and the specific factors that make occupational health distinct from other areas of public health and industrial relations. Significant reductions in injury rates will require progress in macroeconomic stabilization, health and safety training, and worker participation in shop-floor decision making. If one principle is to guide the policy process, it should be that the injured worker is to be viewed not merely as a victim of larger social forces beyond his or her control but also as an active protagonist in his or her own behalf.

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