Laid-Off Workers in a Time of Structural Change

Yolanda K. Kodrzycki

Senior Economist, Federal Reserve Bank of Boston. *The author is grateful to Suzanne Teegarden and the staff of the Massachusetts Industrial Services Program for providing the data used in this study and for encouraging research on displaced workers; to Katharine Bradbury, Lynn Browne, Kathryn Lasch, and Robert Triest for detailed comments on an earlier draft; and to participants in a meeting of the New England Study Group for additional suggestions. Margaret Enis provided excellent research assistance throughout the study, Karen Therien was instrumental in the initial preparation of the data while at the Boston Fed, and Ann Kinsella of MIT was responsible for estimating distance to the new job.*

Labor markets have undergone considerable change in recent years. A rising share of unemployment is accounted for by workers who have been permanently laid off. When laid-off workers search for a new job, they often find that job opportunities are different from when they were last hired. Some observers have asserted that the available openings are increasingly for bad jobs. Regardless of whether this is generally true, some types of workers seem destined to settle for jobs that are worse than what they had before. Manufacturing positions are shrinking, especially in blue-collar occupations, and real wages for workers with little education are declining.

This article examines the experiences of workers laid off in this recent period of structural change. Aside from examining the characteristics of individual workers, the research addresses industry effects. That is, do former manufacturing workers have a tougher readjustment following layoff than workers from growing industries such as services? And within manufacturing, do those formerly employed by defense contractors suffer disproportionately as a result of a lack of experience in nondefense work? The article uses data on displaced workers from Massachusetts who sought government-provided reemployment assistance in the early 1990s. Massachusetts experienced a very sharp recession starting around 1989, combined with noticeable shifts in the importance of different industries.

The article starts with a review of previous research on displaced workers. It then analyzes displaced workers from Massachusetts, first examining their duration of unemployment and then, for those who found work, their new wages and other job attributes. The evidence shows that workers from declining industries suffer especially sharp wage cuts, in large part because they tend to have extensive experience at their previous employer which is not highly valued by their new employer. Former defense workers have the most severe adjustment costs of all, in terms of both above-average difficulty in finding work and in

very severe wage losses. The research also indicates that early sign-up for adjustment services tends to reduce the duration of joblessness. However, laid-off workers who participate in education and training programs do not necessarily find better jobs than those who avail themselves only of more basic forms of assistance such as counseling sessions and information on job postings.

I. The Costs of Structural Change

When an economy undergoes structural change, laid-off workers have difficulty finding new jobs comparable to their previous positions. Because of changes in job requirements and job opportunities, laid-off workers are likely to be offered lower pay by new employers. This has two effects. First, absent any change in workers' willingness to accept pay cuts, workers experience a longer duration of unemployment as they search for the best possible job. Second, reemployed workers are likely to incur a pay cut, as even the most attractive job offered within a reasonable time pays less than their previous job. Presumably, adjustment costs should be most severe for workers laid off from declining industries, since they appear least likely to find a new job that is similar to their previous job.[1]

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An extensive literature has investigated which types of workers tend to experience longer spells of joblessness and sharper pay cuts. A longer work history, weaker education, poorer prospects in one's former occupation or industry, and abnormally high previous pay have all been found to lead to greater earnings reductions. The findings are less conclusive with respect to the duration of joblessness, as search techniques appear to vary considerably among otherwise comparable workers. That is, some workers with poor prospects for reemployment at comparable pay do take longer to find a job. Others quickly lower their expectations or broaden their search, so as to minimize their unemployment spell. The duration of joblessness depends both on employers' willingness to offer jobs to different types of workers and on differences in these workers' job search strategies.

Inapplicability of Previous Work Experience

As a result of changes in the structure of jobs, laid-off workers' experiences are not fully transferable to their new job. This has implications for expected earnings at their new job, for several reasons. The pay of employees with a long work history at their previous employer may have reflected the development of job-specific skills, or simply the returns to seniority.[2] When they switch employers, their wage losses are likely to be particularly large. In addition, older or more experienced workers may be at a disadvantage, regardless of whether they spent many years at a single employer or had experiences at many employers. Employers may perceive them as being less malleable in adjusting to a new work environment or more costly in terms of benefit costs per year of expected service.[3] Previous studies overwhelmingly indicate that displaced workers with longer job tenure, and those who change their line of work, face larger wage reductions (or smaller wage gains) at their new job, holding all other factors constant.[4] These workers also experience a longer duration of unemployment.

The Changing Value of Education and Skills

Another aspect of recent structural change is that formal education is becoming more highly valued in the job market relative to "learning by doing." As employers' demand for educated workers has increased, college graduates have been paid a higher wage premium compared to workers with only a high

[1] These workers may be more negatively affected by structural change than those in other industries, although Browne (1985) correctly cautions against ascribing layoffs solely to structural, as opposed to cyclical, changes.

[2] Long tenure may also be a sign that the employee is particularly well suited to the job.

[3] Studies usually are not able to distinguish the separate effects of age and experience. Lacking information on employees' complete work history, they examine potential work experience, assuming that workers participate in the labor force without interruption upon completion of their schooling.

[4] See, for example, the surveys by Hamermesh (1987) and Fallick (1995).

school education.[5] This trend has implications for displaced workers. One study concluded as follows: "[T]he good jobs being created in growth sectors today are concentrated in white-collar work to a degree that they were not previously. The economy is trading decent blue-collar jobs for a range of service sector ones. It is the education and training gap between the high-wage, less educated displaced and their comparable-wage, growth-sector counterparts that is creating difficulties for job-losers" (Seitchik and Zornitsky 1989, p. 82). Indeed, a number of studies have found smaller wage losses for displaced workers who are highly educated and who have been in white-collar jobs. Findings on the duration of unemployment vary.[6] Highly educated workers have skills that are increasingly demanded by employers and they are thought to be more knowledgeable about how to search for work, both of which would tend to shorten their spell of unemployment. On the other hand, they may have at their disposal greater financial resources, which would enable them to stay out of work longer.

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The Disappearance of "Good Jobs"

Some observers believe that displaced workers face a tough adjustment for a broader reason; they allege that "good jobs" are being eliminated and a greater proportion of new openings are for "bad jobs." It has been well documented that certain industries, including transportation and public utilities and most manufacturing industries, pay higher-than-average wages given the experience, occupation, and education profiles of their work forces. Other industries, most notably trade, pay less than expected.[7] When workers lose "good jobs," they are unlikely to find new opportunities that are as attractive, especially if the "good jobs" have been concentrated in industries that are not growing. Indeed, previous studies have found that displacement from an industry that pays high wages increases the likely duration of unemployment and the pay cut at the new job.[8]

Some Unanswered Questions

In addition to providing new evidence on the issues enumerated above, the current study addresses some questions that have been raised in the literature on worker displacements, but that have received little empirical attention. The available studies confirm that workers from declining industries are more likely to switch to a different type of work, but they leave unanswered some other questions pertaining to industry differences. Little evidence exists on whether workers from declining industries have longer-than-average job tenure or more overall work experience. Nor do previous studies indicate whether potential employers judge former defense workers to be particularly ill-suited for nondefense jobs.[9] Anecdotally, it has been pointed out that prime defense contractors serve one customer, the Pentagon, while nondefense firms must market their products more broadly. Also, defense firms specialize in high-precision products that are manufactured in small quantities. By contrast, the typical nondefense firm is engaged in mass production of goods or services that are not as intricate in terms of their technological content or engineering standards. Accordingly, defense employees may be regarded as less able to identify market trends, satisfy a diverse set of customers, or control production costs.

[5] According to the U.S. Department of Labor, in 1992 male college graduates earned 74 percent more than high school graduates and 133 percent more than high school dropouts. In 1979, these differentials had been only 36 and 70 percent, respectively. For further statistics and discussion, see Kodrzycki (1996).

[6] See, for example, the surveys by Hamermesh (1987) and Fallick (1995).

[7] See, for example, Gittleman and Wolff (1993). High levels of concentration may enable firms in some industries to earn above-average profits which they share with workers. In other cases, well-paying jobs may be the result of a high degree of unionization or high productivity. High pay may also serve to compensate employees for unpleasant or dangerous working conditions, as in construction. Economists are continuing to study the reasons for pay differentials by industry.

[8] See, for example, Kletzer (1991), Jacobson, LaLonde and Sullivan (1993), and Carrington and Zaman (1994).

[9] Kodrzycki (1995) studied adjustment costs for New England defense workers, and compared them with findings for national samples of displaced workers from a variety of industries. New England defense workers appear to have been at a disadvantage, especially judging by their likelihood of replacing their former earnings. The study did not examine whether the defense workers did worse because they had been employed in defense industries, as opposed to other characteristics of workers or of the New England economy.

Previous research has looked at the duration of joblessness without distinguishing between time that workers actively spend searching for work and time spent in education and training programs that prepare them for work. This distinction is important, as workers who are most severely affected by structural change may have the greatest need for augmenting their skills. To the extent they participate in education and training programs that enable them to find better-paying jobs, longer spells of nonemployment may not be undesirable.

Another under-researched topic is worker adjustment costs apart from the duration of joblessness and wage changes. New jobs may be less attractive to the extent they are located far away (and therefore entail greater commuting costs or require a move) or offer less generous benefits.[10]

II. Experiences of Displaced Workers

To examine the experiences of displaced workers, this article uses a large sample of Massachusetts workers who were laid off in the early 1990s. This section describes the sample and the economic backdrop, and then turns to examining worker adjustments to layoffs.

The Dislocated Worker Sample

To respond to the needs of displaced workers, the federal government established assistance programs under the Economic Dislocation and Worker Assistance Act (EDWAA), a 1988 amendment to Title III of the Job Training Partnership Act (JTPA). These programs are available for workers who lose their jobs in mass layoffs or plant closures, as well as others who have been laid off and are unlikely to return to their jobs. States apply for worker assistance grants under the auspices of these federal programs and design services within the guidelines set by the federal government. The data on displaced workers in this study are drawn from the administrative records of the 23 assistance centers that served over 20,000 Massachusetts residents laid off between January 1991 and September 1994. (For further information on the sample, see the appendix.) These centers provide various forms of employment assistance to laid-off workers. In addition to offering basic readjustment services such as counseling and job market information to all users, the centers often fund enrollment in education and training programs on a case-by-case basis.

The data base provides considerable information on demographic and job characteristics for the displaced workers, as well as on the assistance services they used while out of work. For those individuals who found new employment through a center, information is available on the duration of joblessness and the characteristics of the new job. Thus, the data can be used to measure the economic costs of job loss and the influences of factors such as the worker's age, educational background, occupation, pay and length of experience at the previous employer, industry, and reemployment services used, as well as local economic conditions.[11]

The Massachusetts Economy in the Early 1990s

In the early 1990s, the Massachusetts economy experienced a severe reduction in employment and a pronounced shift in its composition away from manufacturing and towards services. Between 1989 and 1992, employment in Massachusetts fell 10 percent (Table 1).[12] The losses were disproportionately concentrated in manufacturing and construction, while

[10] New jobs could also entail psychological costs, if, for example, they are considered by the worker to be less prestigious. More fundamentally, being laid off could lead to health problems that might impair a worker's productivity in a new job.

[11] Most of the studies reviewed in Section I were based on the national biennial survey of dislocated workers. The Massachusetts Industrial Services Program (ISP) data have several advantages and disadvantages relative to the Displaced Worker Survey (DWS). First and most obviously, the ISP data are limited to Massachusetts. However, the ISP sample is much larger, as recent samples for the DWS cover only about 3,800 workers. The ISP data are limited to those dislocated workers who chose to seek government assistance in finding a new job, while the DWS is based on representative samples of households across the nation and therefore is thought to produce representative cross sections of displaced workers. The DWS asks questions of individuals about job experiences over the past several years; this retrospective aspect has been shown to result in errors, especially with respect to recalling information concerning the more distant past. By contrast, most of the ISP data are recorded on a current basis, and therefore are less subject to errors due to individual forgetfulness. A somewhat offsetting disadvantage is that they are maintained for administrative rather than statistical purposes, and therefore may contain more data entry errors. Finally, the ISP data set provides more information on employers than is available in the DWS. (Over 5,000 employers are represented in the ISP data set, but almost half of the sample come from 57 employers that laid off at least 50 workers each. Athough many of large layoffs took place at companies with a national or even international reputation, some of them involved employers with only a local presence—such as community hospitals or municipal governments.)

[12] These statistics are based on annual averages, and therefore may disagree slightly from employment changes based on monthly or quarterly data.

Table 1
Composition of Massachusetts Nonagricultural Employment, 1989 to 1994, and of the Displaced Worker Sample

	Massachusetts Employment (Thousands)			Percent of Massachusetts Employment Level		Percent of Massachusetts Employment Loss, 1989–92	Percent of Massachusetts Employment Gain, 1992–94	Number in Displaced Worker Sample	Percent of Displaced Worker Sample
	1989	1992	1994	1989	1994				
All Industries	3,108.4	2,795.0	2,903.6	100.0	100.0	100.0	100.0	20,624	100.0
Manufacturing	561.1	465.7	447.2	18.1	15.4	30.4	−17.1	10,913	52.9
Durables	372.0	299.6	278.2	12.0	9.6	23.1	−19.7	8,363	40.5
Nondurables	189.1	166.1	168.9	6.1	5.8	7.3	2.6	2,550	12.4
Nonmanufacturing	2,136.9	1,945.6	2,065.2	68.7	71.1	61.0	110.1	7,093	34.4
Construction	126.8	73.7	86.0	4.1	3.0	17.0	11.3	341	1.7
Transportation and Public Utilities	128.3	121.4	127.3	4.1	4.4	2.2	5.4	473	2.3
Trade	740.5	640.4	669.4	23.8	23.1	31.9	26.6	2,398	11.6
Finance, Insurance, and Real Estate	217.3	196.7	206.9	7.0	7.1	6.6	9.5	842	4.1
Services	924.0	913.5	975.6	29.7	33.6	3.4	57.2	3,039	14.7
Government	408.8	382.5	390.0	13.2	13.4	8.4	6.8	1,188	5.8
Other and Not Known[a]								1,431	6.9
Memo:									
Computer Manufacturing	36.5	27.6	25.4	1.2	.9	2.8	−2.0	1,357	6.6
Defense-Related									
Private Industry	168.9	143.4	127.8	5.4	4.4	8.1	−14.4	3,089[b]	15.0
Government	21.8	18.2	16.0	.7	.6	1.1	−2.0	477	2.3

[a]"Other" includes agricultural workers.

[b]Includes 2,960 workers in defense-related manufacturing and 129 in other industries.

Source: Except for the memo items, Massachusetts employment from New England Economic Indicators machine readable data; computer manufacturing from New England Economic Project machine readable data; defense-related from Kodrzycki (1995). Displaced worker sample are author's calculations.

job losses in the services industry were minimal. The recovery was uneven. Durables manufacturing firms continued to shed jobs. The services industry, which accounts for about one-third of all jobs, was responsible for over one-half the job growth between 1992 and 1994. Construction employment also rebounded, although the number of construction jobs remained far below the pre-recession level.

Reflecting the extensive job losses in manufacturing, about half of the displaced worker sample consists of former manufacturing workers. The bottom part of Table 1 shows employment in two prominent durables manufacturing industries in the state. Computer industry employment shrank sharply in the early 1990s as demand fell for minicomputers and other products in which Massachusetts manufacturers had specialized. Over 1,300 displaced workers from this industry are included in the sample. Many defense-related jobs disappeared as a result of decreases in the federal defense budget; about 3,000 former employees of prime defense contractors in manufacturing industries are in the sample.[13] The computer and defense industries are of interest not only because of the magnitude of their job cuts, but also because they had been a source of many well-paying jobs. Furthermore, the firms in these industries have been among the state's largest employers and have contributed significantly to the state's reputation as a center for high technology. As a further indication of defense downsizing, the government category includes close to 500 laid-off civilians, mostly from the Fort Devens army base.

[13] Undoubtedly additional laid-off workers in the sample had defense-related private-sector jobs at manufacturing subcontractors or outside the manufacturing sector.

Table 2
Employment Status of Displaced Workers after 12 and 24 Months, and Length of Unemployment Spells
Percent

Year of Layoff and Number of Months	Total Reemployed	Of which: Recalled	Of which: Found New Job	No Longer Enrolled	Not Employed	Average Unemployment Spell for Workers Who Found a New Job (months)[a]	Sample Size
1991							
12 months	14.8	.9	14.0	4.4	80.8		
24 months	53.0	2.0	50.9	29.7	17.4	15.1	3,741
1992							
12 months	45.4	4.0	41.4	15.6	39.0		
24 months	64.8	4.4	60.4	27.7	7.5	8.7	7,394
1993[b]							
12 months	46.1	4.2	42.0	16.1	37.8	6.8	5,897
1994[c]							
12 months	21.7	5.3	16.4	6.7	71.6	4.1	1,332

[a]Calculated for all workers who found a job, regardless of the length of job search.
[b]Includes some workers laid off less than 12 months prior to the end of the sample.
[c]All workers laid off less than 12 months prior to the end of the sample.
Source: Author's calculations based on a sample of displaced workers in Massachusetts.

Jobless Spells

One important measure of the cost of adjusting to a layoff is the length of time workers remain without a job. The displaced worker sample includes people who were laid off between January 1991 and September 1994, but the complete jobless spell is known only for those who found a job by the end of this period. A valuable alternative measure is the percentage of workers who have found work as of a given number of months after being laid off, as opposed to those who are still without work.

Reemployment rates vary, depending on when a worker was laid off. Those losing their jobs later in the period, when the Massachusetts economy was recovering, had more success in their first year of job search than those who were laid off while the state was still in recession. Of those laid off in 1991, only about 15 percent found a job through a worker assistance center within 12 months. By contrast, 45 percent of those laid off in 1992 and 46 percent of those laid off in 1993 had found a job within a year (Table 2).[14]

The probability of reemployment also rises as more time passes since the date of layoff. Consider those laid off in 1992. In the second year after layoff, the reemployment rate rose from 45 percent to 65 percent, as another 19 percent of the sample found new jobs and a few more were recalled. The percentage looking for a job or preparing for a new job through enrollment in vocational or general education classes fell from 39 percent to less than 8 percent.[15]

The industry results show considerable variation (Table 3). Combining the 12-month results across all four years, workers previously employed in the transportation and public utility industry, by defense contractors, and by government had the lowest rates of reemployment. The reemployment percentage for the former defense manufacturing workers would look substantially worse were it not for the relatively high

[14] The 1991 reemployment rate is understated as a result of sample selection bias. The sample includes workers in the assistance center data base as of July 1992. Thus, the data do not reflect the experiences of workers laid off in 1991 who found jobs promptly. (This sample selection bias also results in an understatement of the percentage who are "no longer enrolled.") But the 12-month results for those laid off in the second half of 1991 (which should be less subject to sample selection bias than those from the first half of the year), as well as the 24-month results in general, nevertheless suggest that the recession had a negative effect on job-finding rates for laid-off workers. The 1993 reemployment rate also is somewhat understated, since workers laid off after September were not observed for the full 12 months.

[15] The remaining workers, almost 28 percent, had stopped using the services of the center. Relatively little is known about this last group. Some of them may have found a job on their own, while others may have remained unemployed or were no longer actively looking for a job.

Table 3
Percent of Displaced Workers Reemployed after 12 Months, by Former Industry[a]

Former Industry	Total Reemployed	Recalled to Old Job	Found New Job	Sample Size
All Industries	37.7	3.5	34.2	18,364
Manufacturing	37.7	4.4	33.3	9,778
Defense-Related	34.7	7.6	27.1	2,879
Computers	39.2	2.3	36.9	1,294
Other	38.9	3.2	35.7	5,605
Nonmanufacturing	39.0	2.8	36.1	6,512
Construction	40.7	3.0	37.7	337
Transportation and Public Utilities	30.2	2.4	27.8	417
Trade	39.5	3.7	35.8	2,244
Finance, Insurance, and Real Estate	33.7	1.0	32.8	818
Services	41.2	2.7	38.5	2,629
Government	28.9	3.1	25.7	766
Defense	26.6	1.3	25.3	79
Nondefense	29.1	3.3	25.7	688
Other and Not Known	36.6	1.0	35.6	1,309

[a]Excludes workers whose layoff date or termination date at the assistance center was not known. Includes some workers laid off less than 12 months before the end of the sample.
Soruce: Author's calculations based on sample of displaced workers in Massachusetts.

recall rate for this industry. At the other extreme, laid-off services and construction workers had the highest rates of reemployment. These patterns are fairly consistent with the hypothesis that workers laid off from declining industries have greater difficulty finding a new job than those laid off from growing industries. But some puzzles remain. For example, computer manufacturing employment fell precipitously during the early 1990s, but computer manufacturing workers did not appear to have unusual difficulty finding new jobs.

Probability of Reemployment

To further explore the role of the former industry versus other factors that make reemployment more or less difficult, regressions were run to explain the likelihood of finding work (Table 4). These regressions take into account information on employment outcomes at all intervals, instead of looking at progress after an arbitrary number of months, as did Tables 2 and 3.

The Cox proportional hazards model was used to estimate the coefficients, which represent the relative likelihood of finding employment in any given time period, for a unit increase in the value of the explanatory variable.[16] (Similarly, for dummy variables, the coefficients represent the difference in the likelihood of finding employment when the variable equals one rather than zero.) The effect of a two-unit change in the value of an explanatory variable is obtained by taking the square of the estimated coefficient, and, similarly, the effects of larger changes are measured through exponentiation to the appropriate power.

The two regressions differ only in the measurement of the duration of participation in education and training programs. In the first regression, the actual duration is used, but the number of observations is reduced because duration could not be calculated for over half the sample. The second regression uses estimated duration for these workers, based on an auxiliary regression (Appendix Table 2). The coefficients indicate that spending an additional month in an education or training program lowers the probability of reemployment to about 90 percent of what it would

[16] For each individual in the sample, define h(t) as the probability of becoming reemployed in month t divided by the probability of becoming reemployed after time t. In the Cox model, $h(t) = h_0(t)e^{b_1x_1+\ldots+b_nx_n}$, where $x_1 \ldots x_n$ are the explanatory variables and $h_0(t)$ is the so-called baseline hazard function—that is, the value of h(t) if all the explanatory variables equal zero. The parameters $b_1 \ldots b_n$ are estimated using maximum likelihood. Note that the change in the relative likelihood of becoming reemployed if the value of variable x_k changes by one unit equals $(e^{b_1x_1+\ldots+b_k(x_k+1)+\ldots+b_nx_n})/(e^{b_1x_1+\ldots+b_kx_k+\ldots b_nx_n}) = e^{b_k}$. These are the values reported in the table under the heading "Hazard Ratio." The model takes into account time censoring—that is, some workers sever their relationship with the assistance center prior to taking a job, while in other cases, the sample period ends before an employment outcome is observed. The Cox technique is efficient, in that the lack of employment for such workers during the time period in which they were observed is taken into account in estimating parameters. The term "hazard" reflects the original use of the Cox technique to analyze the probability of an undesired outcome; however, the technique is equally applicable to analyzing the probability of a desired outcome.

Table 4

Reemployment Probabilities—Estimates Using Cox Proportional Hazards Model

Independent Variable	(1) Hazard Ratio	(1) Standard Error	(2) Hazard Ratio	(2) Standard Error
Experience				
Potential Work Experience Squared	.99978**	.00004	.99971**	.00002
Job Tenure	.99389*	.00243	.99668*	.00153
Schooling (Omitted = Less than High School)				
High School	.89*	.04	.95	.03
Some College	.80**	.04	.93*	.04
College Degree	.72**	.05	.81**	.04
More than College	.55**	.08	.76**	.06
Previous Occupation (Omitted = Services)				
Professional, Technical and Managerial	1.06	.09	1.04	.06
Clerical and Sales	1.12	.09	1.03	.06
Production	1.15	.09	1.10*	.06
Other	1.04	.12	1.01	.08
Not Known	1.36**	.12	1.25**	.07
Previous Industry				
12-Month Employment Growth Rate	1.02**	.005	1.01**	.003
Wage Premium	1.0002	.003	.9951*	.0019
County Unemployment Rate at Time of Layoff				
Level	.98	.01	1.01	.01
12-Month Change	.94	.04	.96	.02
Difference between Statewide and County Unemployment Rate at Time of Layoff				
Level	.97	.02	1.00	.01
12-Month Change	.95	.05	.91**	.03
Pre July 1992 Dummy	.94**	.005	.94**	.003
Demographic Characteristics				
Gender and Marital Status (Omitted = Unmarried Male)				
Married Male	1.37**	.07	1.23**	.04
Married Female	1.20**	.06	1.10**	.04
Unmarried Female	1.10	.05	1.07*	.03
Nonwhite	.85**	.04	.84**	.03
Number of Dependents	.97*	.01	1.01	.01
Recalled	2.73**	.24	4.11**	.16
Enrolled Prior to Layoff	1.70**	.14	1.58**	.07
Duration of Employment and Training	.90**	.004	.92**	.003
Proxied Duration?	No		Yes	
Pseudo R^2	.023		.018	
Number of Observations	7,122		16,723	

*Significantly different from one at 5 percent level.
**Significantly different from one at 1 percent level.

be otherwise, presumably because these workers are less likely to be actively searching for a job. In most other findings, the two regressions also are quite similar.

Added years of work experience, either generally or in the previous job, lower the probability of reemployment. The coefficients are close to one, which means that small increments in overall work experience or tenure at the previous job have little impact. But extensive experience can be a substantial impediment to finding a job. The estimates imply that having 30 years' general work experience lowers the probability of reemployment by about one-third.[17]

Workers with less education were more likely to be reemployed. Controlling for education, previous occupation was not a reliable predictor of reemployment, except that former production workers were more

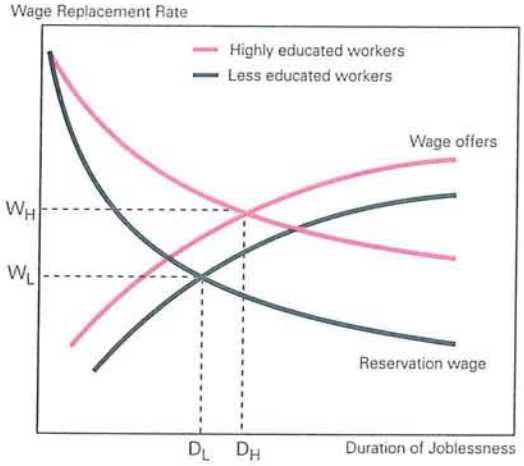
[17] Generalizing the formula in the previous footnote, the effect of an additional n years of experience for someone who has E years of experience is computed as $[e^{-.00022(E+n)**2}]/[e^{-.00022E**2}] = e^{-.00022E(E+2n)}$, where −.00022 is the natural logarithm of the hazard ratio, .99978. This formula is most appropriate for small values of n; that is, the effect of the last year of experience should be rather similar to the effect of the next year of experience. Nevertheless, calculations with larger values of n are suggestive. At the margin, 10 years' experience decreases the probability of reemployment by 6 percent for someone with 10 years' experience, 16 percent for someone with 20 years' experience, and 28 percent for someone with 30 years' experience. Thirty years' experience for someone with E = 30 is calculated to decrease the chance of reemployment by 33 percent. Another version, not shown, estimated the Cox model using age categories instead of experience. That version indicated that the probability of reemployment falls with age, and the results for older workers are fairly consistent with the version with experience (assuming that age and experience are closely related). Relative to the reference category of workers under 25 years of age, the probabilities were .77 for 25- to 44-year-olds, .73 for 45- to 55-year-olds, and .54 for those 55 years old and above.

Job Search for Workers with Different Levels of Education

Figure 1 depicts a simplified economic model of job search. The wage offer curve indicates that displaced workers most readily find jobs with low wages. (The wage replacement rate, measured on the vertical axis, refers to the new wage in relation to the worker's previous wage.) As they extend their job search, however, they are offered jobs with successively higher wages. The reservation wage is the lowest wage workers are willing to accept. At first, workers are not willing to accept much, if any, reduction in their wage. But their reservation wage falls as they become more familiar with job opportunities and as their financial situation deteriorates. The intersection of these two curves indicates how long they will search for a job and the wage replacement rate at their new job. The evidence in this study points to two differences between highly educated and less educated workers. First, as a result of changing labor market demands for skill, less educated workers typically generate inferior wage offers relative to their old pay than highly educated workers. Second, less educated workers are less patient in their search. That is, their reservation wage falls relatively quickly with time.

Figure 1

Simplified Model of Job Search



likely to be reemployed (compared to those in the omitted occupation, service workers).[18] Regressions presented below indicate that less educated and production workers on average accepted job offers with low pay relative to their old job; more highly educated workers searched longer, but their patience paid off in terms of obtaining jobs with a smaller reduction (or greater increase) in earnings. Thus the reemployment results appear to reflect the greater willingness of less educated and production workers to accept job offers, as opposed to the alternative explanation that employers have greater demand for these types of workers. (See the box.)

Workers laid off from faster-growing industries were quicker to find employment. Table 5 shows the growth rate in each industry in the 12 months subsequent to when workers were laid off.[19] According to the estimates in Table 4, all else equal, workers from the construction industry, which was growing at a 5 percent rate, were 7 percent more likely to be reemployed than the average laid-off worker. Services industry workers' likelihood of reemployment were about 5 percent above average.[20]

Industry wage premia varied considerably and appear to have had a modest effect on the probability of reemployment. The premia shown in Table 5 were derived from

[18] Examples of service workers include cooks and chefs, caterers, medical attendants, security guards, police officers, janitors, waiters, hairdressers, and amusement and recreation service occupations. Production workers include occupations such as mechanics, machinists, metalworkers, food processors, welders, benchwork occupations, construction occupations, tailors, and landscapers. Production workers may be employed in service-producing industries (such as a mechanic in an auto repair shop), and service workers may be employed in goods-producing industries (such as a security guard at a factory). The professional, technical, and managerial category includes general managerial and administrative occupations, as well as specialized positions such as drafters, educators, librarians, computer programmers, scientists, and health care professionals. Bookkeepers, secretaries, sales and stock clerks, cashiers, tellers, and billing clerks are examples of sales and clerical workers. The "other" category includes truck drivers and materials handlers; graphics specialists included under this occupational category were reassigned to the professional, technical, and managerial category.

[19] That is, the growth rate depends on both the industry and the date of layoff. The value shown by industry is the average for all workers laid off from that industry.

[20] These findings refer to the second regression; the first regression indicates somewhat larger effects.

Table 5
12-Month Employment Growth and Wage Premium, by Industry
Percent

Industry	Employment Growth[a]	Wage Premium[b]
Manufacturing		
Defense-Related	−3.2	12.4
Computers	−14.1	8.8
Other	.2	−2.4
Construction	5.1	12.7
Transportation and Public Utilities	1.4	5.7
Trade	1.3	−8.0
Finance, Insurance and Real Estate	1.7	−.0
Services	3.2	−1.9
Government		
Defense	−2.3	0
Nondefense	−.1	0
Other and Not Known	1.1	−.1

[a]Based on the 12 months following layoff. Sample average is −0.05 percent.

[b]Relative to government. Sample average is 0.7 percent.

Source: Author's calculations based on machine readable data from the New England Economic Project, the sample of displaced workers from Massachusetts, and Appendix Table 3.

a regression of the worker's previous wage as a function of individual qualifications and industry dummies (Appendix Table 3). Defense-related manufacturing and construction paid over 20 percent above trade after adjusting for the education, occupation, and experience profiles of their workers and, as a consequence, their reemployment probabilities were 8 percent lower.[21]

Local economic conditions influenced employment somewhat. For the period July 1992 onward, a worker laid off in a county where the unemployment rate rose by 1 percentage point in the 12-month period following layoff was about 5 percent less likely to be reemployed after a given number of months than a worker laid off in a county where the unemployment rate was stable.[22] Moreover, an increase in the statewide unemployment rate in the 12-month period following layoff or increases in either the county or state unemployment rate in the 12-month period following layoff also reduced the chances of finding work. The experiences for those laid off before July 1992 are captured by a dummy variable. Workers laid off relatively early, when total employment in Massachusetts still had comparatively far to fall, had notably lower success in finding reemployment. The coefficient suggests, for example, a one-third lower reemployment likelihood for those laid off at the beginning of 1992 than six months later. However, the interpretation of this result is somewhat unclear (especially for the very early layoffs), as the dummy variable picks up the effects of both economic conditions and sample selection bias.[23]

Married and white workers had higher reemployment probabilities than unmarried and nonwhite workers, after adjusting for other qualifications. Those recalled to their old job were reemployed much more quickly than those who looked for a new job.

Finally, those who registered for services prior to being laid off were far less likely to remain without a job for an extended period of time. This last result suggests that employers can mitigate adjustment costs for laid-off workers. By announcing layoff plans in advance, they can help assure that state reemployment services are in place promptly in the local area.[24] Workers then have the opportunity, if they choose, to receive counselling about new job opportunities and to develop search strategies prior to losing their old job.

Explaining Reemployment Differences by Industry

To explore the reasons behind industry patterns further, the estimated coefficients from the Cox regression were used to calculate the reemployment probability for a worker with the average characteristics (job tenure, experience, and so forth) for selected industries, relative to a worker with the average characteristics for the sample as a whole. Then the calculation was redone, assuming sequentially that in each respect the "average" worker in the industry was the same as the "average" worker for the sample.[25] The

[21] This result refers to the second regression shown in Table 4; the coefficient in the first regression indicates an unexpected, though very small, association between the wage premium and reemployment.

[22] There is little correlation between the number of sample layoffs in a given county and the change in that county's unemployment rate over the subsequent six- to twelve-month period. Thus, the regression results appear to reflect the effect of local labor market conditions on the fortunes of displaced workers, not the reverse.

[23] Total state employment reached its trough in August 1992. The "pre-July-1992" dummy is equal to the number of months between the layoff and July 1992, or zero if the layoff occurred after July 1992. The sample includes those workers for whom the center had enrollment records in July 1992 or later. Thus, workers laid off prior to this date were included in the sample only if they had not found work by around the middle of 1992.

[24] Anecdotal evidence in Kodrzycki (1995) further suggests that laid-off workers are more likely to use government-provided reemployment services if they are available without delay.

Table 6

Contribution of Key Regression Variables to Differences in Reemployment Probabilities for Selected Industries

	Mean Value of Regression Variable					Contribution to Difference in Reemployment Probability[a]			
	All Industries	Defense-Related Manufac-turing	Computer Manufac-turing	Transpor-tation and Public Utilities	Services	Defense-Related Manufac-turing	Computer Manufac-turing	Transpor-tation and Public Utilities	Services
Recalled to Previous Job	.04	.09	.03	.03	.04	7.1	−1.3	−1.2	−.2
Early Notification of Layoff	.06	.07	.24	.03	.05	.2	6.8	−1.9	−.8
Length of Education and Training	5.3	4.6	5.9	4.5	5.0	5.6	−4.6	6.4	2.6
Unemployment Rates at Time of Layoff[b]						3.2	10.6	−.9	1.1
County Unemployment Rate	7.3	6.7	6.3	7.3	7.6				
12-month Difference in the County UR	−1.1	−.9	−.9	−1.1	−1.2				
State minus County Unemployment Rate	.0	.2	.8	−.1	−.2				
12-month Difference in State minus County UR	.2	.2	.0	.1	.1				
Wage Premium for Previous Job	.7	12.4	8.8	5.8	−1.9	−6.2	−3.6	−2.6	1.3
Percent Change in Employment of Previous Industry	−.4	−2.8	−14.3	1.3	3.2	−3.6	−18.6	2.4	5.6

[a]Calculations based on the second set of regression results in Table 4.

[b]Unemployment rates for layoff dates after June 1992. Contributions to reemployment probability based on pre-July-1992 dummy in addition to unemployment rates.

Source: Author's calculations based on sample of displaced workers from Massachusetts who were reemployed at a new job.

results are shown in Table 6 for those variables that accounted for large differences across industries. The left side of the table shows the average values of key characteristics by industry, while the right side of the table shows their estimated contributions to the probability of reemployment.

The roles of industry wage premia and employment growth rates, as well as the high recall rate for defense manufacturing workers, have already been highlighted. For computer workers, the table indicates two reasons why reemployment was less problematic than might be expected based on the extensive layoffs in this industry. Twenty-four percent of the computer sample started receiving reemployment assistance prior to being laid off, far above the 6 percent rate overall. These were mostly employees of a single large computer manufacturer.[26] Second, computer layoffs took place in areas where the economy was relatively strong: The county unemployment rate averaged a full percentage point below that for the sample as a whole.[27] Unlike the case for computer industry workers, the regressions were not able to shed much light on the reasons behind lengthy jobless spells for workers from the transportation and public utilities industry.

[25] For education, occupation, and demographic mix, the shares of workers in each category were used. The recall rate and the use of assistance services prior to layoff were industry averages. In interpreting the results, it is useful to bear in mind that, because of the nonlinear specification of the Cox model, the average probability of reemployment for workers in an industry is not the same as the probability of reemployment for a worker with average characteristics for that industry.

[26] Of those laid off by this employer, more than one-third registered for services in advance of their layoff.

[27] The study did not investigate another potential explanation: the extent to which computer manufacturing workers were able to be reemployed in related nonmanufacturing industries such as computer software, which were expanding.

Table 7
Earnings and Job Characteristics for Workers Employed in a New Job

	Nominal Hourly Wage at Previous Job (Mean)	Nominal Hourly Wage at New Job (Mean)	Percent Difference Between Real Hourly Wage at New and Old Jobs (Mean)	No Medical Insurance at New Job (Percent)
All Industries	13.12	11.34	−12.7	24.7
Manufacturing	13.90	11.69	−16.4	22.7
Defense-Related	16.66	13.31	−21.6	24.9
Computers	17.50	15.12	−14.4	16.9
Other	12.27	10.40	−15.0	23.2
Nonmanufacturing	12.36	11.02	−8.8	26.4
Construction	13.88	12.20	−10.6	30.7
Transportation and Public Utilities	14.51	12.55	−9.9	22.2
Trade	11.53	9.68	−10.7	28.8
Finance, Insurance, and Real Estate	11.52	10.09	−11.1	27.7
Services	12.82	12.05	−6.2	24.2
Government	12.58	11.48	−7.1	21.8
Defense	12.53	12.34	3.3	8.9
Nondefense	12.59	11.26	−9.7	27.6
Other and Not Known	11.86	10.54	−9.7	32.1

Pay and Other Job Characteristics for Reemployed Workers

Table 7 examines earnings and other job characteristics for workers employed in a new job. Average earnings at the new job were $11.34 an hour, $1.78 less than at the previous job. Adjusted for inflation, the mean wage loss was 12.7 percent.

Earnings fell for displaced workers in every private industry, but the losses were most severe for manufacturing workers. On the whole, displaced defense and computer manufacturing workers found new jobs with relatively high pay—17 percent and 33 percent, respectively, above the displaced-worker sample average. But these workers had earned even greater premia in their old job. The real wage loss averaged 21.6 percent for former defense workers and 14.4 percent for former computer workers. Other manufacturing workers had been earning less than the sample average, and they slipped further behind at their new job. Their real wage losses averaged 15 percent. The lowest rate of real earnings decline, 6.2 percent, was experienced by service industry workers. At their old jobs, they had been earning about 50 cents less per hour than other displaced workers; but at reemployment, their pay was about 70 cents higher than average. The only group to experience a wage increase on average were government defense workers. The results may convey too positive an impression, however, because the bulk of the layoffs took place at the end of 1993, so the statistics refer mostly to workers who accepted a new job rather quickly after being laid off.[28]

A more comprehensive measure of the income loss at the new job would take into account losses of benefits, but the data set includes information only for the new job. One-quarter of reemployed workers had no medical insurance at their new job, and 38.5 percent had no pension benefits.[29] Altogether, 8.5

[28] Only 78 government defense workers are represented in the statistics on new wages, compared to a total of 477 laid off.

[29] The information on medical insurance indicates only whether the employer offered a group plan, not the fraction of the insurance premium paid by the employer. It is not clear how the responses regarding pension plan coverage treat retirement plans funded entirely by the employee (such as individual retirement accounts with investment options set by the employer). To provide a context for the estimates for reemployed workers, 13 percent of all employed New Englanders were estimated to lack medical insurance in 1994 (Sum et al. 1996). This rate ranged from a low of 5 percent in government to a high of 32 percent in construction. About 8 to 9 percent of manufacturing, transportation and public utilities, finance-insurance-real estate, and professional services workers lacked health coverage. Greater percentages of trade and nonpro-

Table 7 continued
Earnings and Job Characteristics for Workers Employed in a New Job

No Pension at New Job (Percent)	Real Hourly Wage Reduced by One-Third or More and No Benefits at New Job (Percent)	Miles to New Job (Median)	New Job Between 30 and 100 Miles Away (Percent)	New Job More Than 100 Miles Away (Percent)	Observations in Sample
38.2	8.5	9.2	7.0	2.7	10,374
37.6	8.4	9.9	7.6	2.7	5,281
37.1	13.0	11.4	8.4	3.3	1,136
35.0	5.9	11.1	9.0	3.5	696
38.3	7.4	9.1	6.9	2.2	3,449
38.0	8.2	8.2	5.9	2.3	3,821
44.9	9.6	11.1	7.8	3.4	194
37.9	8.7	9.6	11.4	6.4	225
42.0	9.6	8.7	6.5	1.8	1,358
40.3	10.3	7.0	3.5	1.6	466
33.3	6.3	8.2	5.2	2.3	1,578
34.6	4.0	11.4	9.5	9.5	418
12.5	3.9	19.3	18.9	20.8	78
44.7	4.1	8.3	5.2	4.3	340
46.0	12.5	7.9	7.9	2.8	854

Source: Author's calculations based on sample of displaced workers from Massachusetts who were reemployed at a new job.

percent of the reemployed workers had their real hourly wage reduced by at least one-third, while not receiving medical or pension benefits. By this measure, severe income impacts were most common among former defense manufacturing and finance, insurance, and real estate workers. Interestingly, even though former employees of computer manufacturers had high average wage losses, relatively few ended up in new jobs that lacked medical insurance and pension benefits. Service industry and government workers, the groups with the lowest average wage declines, also had a low incidence of severe wage-and-benefit losses.

Another indicator of adjustment costs is the relative convenience of the new job. Some workers may accept greater wage losses in return for being able to get a job locally. Local jobs mean that workers are able to avoid either the expenses of a long commute or the financial and psychological costs of moving. Again, the data set is imperfect, as it permits only the calculation of the distance between the worker assistance center (not the worker's home) and the new job, and it does not specifically indicate whether a move took place. Nevertheless, the data suggest that manufacturing workers' sharp wage losses were not offset by shorter commutes. At 11-plus miles, the average commutes for former defense and computer manufacturing workers were more than 20 percent longer than the sample average; for other manufacturing workers, typical commutes were comparable to the sample average. On the other hand, the data suggest that federal government defense workers were able to replace their former wages in part because many moved away from the area, presumably to places where the local economy was stronger.[30]

Determinants of Earnings Losses

Regressions were used to measure the effects of individual factors on real earnings replacement rates. Table 8 indicates the results of regressions that in-

fessional services workers were without insurance. Sum et al. estimate that 57 percent of New England workers lacked pension plan coverage, but this ratio is skewed by very low coverage among young workers. The ratio also varies by industry; only about one-third of the employees in durables manufacturing and transportation and public utilities were without pension benefits.

[30] As was the case with the Loring Air Force Base sample discussed in Kodrzycki (1995), some of the civilian employees at Fort Devens probably were married to military personnel who were transferred when the base closed.

Table 8

Real Hourly Wage Replacement Rate: Regression Results

Dependent Variable = New Real Hourly Wage as a Percent of Previous Real Hourly Wage

	(1)		(2)	
Independent Variable	Coefficient	Standard Error	Coefficient	Standard Error
Experience				
Potential Work Experience	−.22**	.04	−.23**	.04
Job Tenure	−1.77**	.13	−1.71**	.13
Job Tenure Squared	.04**	.00	.04**	.01
Education and Skills				
Schooling (Omitted = Less than High School)				
High School	−.59	1.49	−.56	1.49
Some College	1.15	1.58	1.14	1.59
College Degree	4.22**	1.75	4.07**	1.76
More than College	4.79*	2.48	4.98**	2.48
Reading Test Score	.23	.17	.25	.17
Previous Occupation (Omitted = Services)				
Professional, Technical, and Managerial	−2.47	1.98	−2.41	1.99
Clerical and Sales	1.67	2.01	2.21	2.03
Production	−7.01**	2.05	−6.18**	2.10
Other	−2.69	2.80	−2.58	2.82
Not Known	−8.76**	2.14	−7.51**	2.21
Switched Occupation	−5.43**	.99	−5.18**	.99
Duration of Unemployment	−.76**	.06	−.74**	.07
Location of New Job				
Distance	.02**	.01	.02**	.01
Distance Squared	−8.1e-06**	3.0e-06	−8.0e-06**	3.0e-06
Work Effort				
Full-Time at Previous Job	−1.46	2.40	−1.07	2.41
Switched to Part-Time	−1.82	1.19	−1.90	1.19
Switched to Full-Time	8.09**	3.11	8.39**	3.11
Demographic Characteristics				
Gender and Marital Status (Omitted = Unmarried Male)				
Married Male	−1.42	.99	−1.37	.98
Married Female	1.97	1.20	1.71	1.20
Unmarried Female	1.44	1.04	1.10	1.04
Nonwhite	2.36*	1.30	2.23*	1.30
Previous Industry				
12-Month Employment Growth Rate	−.14	.09	−.03	.19
Wage Premium	−.29**	.07	.03	.29
Dummies (Omitted = Government)				
Defense-Related Manufacturing			−9.73**	3.15
Computer Manufacturing			−1.96	4.37
Other Manufacturing			−2.17	3.00
Construction			[a]	
Transportation and Public Utilities			−5.94*	2.91
Trade			−2.30	4.38
Finance, Insurance, and Real Estate			−2.40	2.88
Services			−.95	2.98
Other and Not Known			−4.45	2.97
Switched Industry	−3.32**	.77	−3.03**	.86
Constant	109.68**	3.75	111.27**	4.46
Adjusted R^2	.140		.143	
Number of Observations	5,492		5,492	

*Significantly different from zero at 5 percent level.

**Significantly different from zero at 1 percent level.

[a]Dropped because of collinearity.

Source: Author's calculations based on sample of displaced workers from Massachusetts who were reemployed but not recalled to their previous job.

cluded as explanatory factors the worker's experience and skills, education, occupation, industry characteristics, work effort, duration of unemployment, distance from the new job, and demographic characteristics such as gender, race, and marital status. The second regression also includes industry dummies.[31]

Previous experience was discounted. Potential work experience measures the maximum number of years a worker could have spent in paid employment, and is measured as age less years of education less six. The estimated coefficient implies that, assuming equal years of education and other characteristics, 10 years of added age results in a 2 percent greater wage loss.[32] The job tenure coefficients imply that specific work experience at the previous employer generally was discounted even more heavily. For example, someone who had spent 20 years in his or her last job would expect to have a real wage loss about 6 percentage points greater than someone employed in the same job for only 10 years.[33]

The greater wage losses for defense manufacturing workers suggest that employers discounted their previous experience more than that of other job applicants.

Employers valued a college education. Graduating from college or pursuing postgraduate studies reduced the average wage loss (or increased the average wage gain) by 3 to 5 percentage points, compared to receiving only a high school education or less. The worker's score on a reading test administered by the worker assistance center had only a tiny effect on the wage outcome (as well as being statistically insignificant).[34]

Previous production workers had the worst wage outcomes. Their losses were 4 to 7 percentage points greater than those in clerical, sales, or services positions. Regardless of initial occupation, however, those who switched occupations in their new job lost out.

On average, those who searched longer for a job and those who ended up reducing their work hours tended to accept greater pay cuts. The coefficient on the duration of unemployment indicates that, for each additional year of looking for a job, the real replacement rate falls by 9 percentage points.[35] A switch from part-time to full-time work increased the hourly replacement rate substantially. Expanding one's job search to faraway locales boosted wages, but not by much. Being willing to commute 100 miles was estimated to raise pay by only 2 percent. Gender, marital status, and race had little effect on wage outcomes, controlling for other factors.

The remaining variables address industry effects, apart from inter-industry differences in years of experience, education, and so forth. In the absence of industry dummy variables, the average wage premium enters with a negative sign, as expected under the hypothesis that wage losses are the result of the disappearance of good jobs. But with the addition of industry dummies, the industry wage premium has no remaining effect on the wage replacement rate. *The wage losses for defense manufacturing workers are 4 to 10 percentage points greater than for workers from other industries, holding all else constant.* This suggests that employers discounted the previous experience of defense workers more than that of other job applicants. Finally, the regressions indicate that those who switch industries had about a 3 percent greater wage loss on average.

[31] Unemployment rate measures, which helped to explain reemployment probabilities, were never significant in the wage regressions. Thus, the improvement in economic conditions from the early to the mid 1990s was not found to raise the quality of jobs obtained by displaced workers, after adjusting for other factors. In addition to the specifications shown, another version used the two-step Heckman procedure to adjust for sample selection bias. Results with the Heckman correction were indistinguishable from those using ordinary least squares.

[32] These estimates were quite similar when previous occupation was excluded from the regression. Thus the occupation results, mentioned below, are not picking up some of the effects of education, even though average education levels vary somewhat across occupations.

[33] The effect of additional years of job tenure diminishes as tenure increases, but remains negative up to 41 years. The average job tenure for all workers in the sample was about 7 years.

[34] The effect of scoring in the 75th as opposed to the 25th percentile was estimated to increase the wage replacement rate by only one-half of a percentage point. This small contribution may be due to the fact that the test does a poor job measuring differences in reading ability across individuals; on a scale of 1 to 13, only 2 percent of the sample scored below 7 and 24 percent scored above 9.

[35] This result reflects workers' falling reservation wage (that is, the wage required for them to accept a job) as time passes. However, it also reflects a negative trend in real wages over this period. Another version used the unemployment spell predicted on the basis of a regression, in order to correct for the fact that, all else equal, those workers who accept a job offer have lower reservation wages than workers who reject job offers. This had very little effect on the estimates.

Table 9
Contribution of Regression Variables to Differences in Real Wage Replacement Rates for Selected Industries

	Mean Value of Regression Variable					Contribution to Difference in Real Wage Replacement Rate[a]			
	All Industries	Defense-Related Manufacturing	Computer Manufacturing	All Other Manufacturing	Services	Defense-Related Manufacturing	Computer Manufacturing	All Other Manufacturing	Services
Education	12.8	13.5	13.5	12.0	13.5	.4	.5	−.4	.4
Tenure	7.3	10.6	10.4	8.3	5.2	−3.0	−3.9	−.4	2.1
Occupational Mix						−.7	.1	−.9	1.2
Professional, Technical, and Managerial	.29	.35	.54	.19	.47				
Clerical and Sales	.21	.13	.15	.15	.21				
Services	.04	.01	.00	.01	.12				
Production	.27	.38	.15	.45	.10				
Other Occupations	.04	.01	.06	.05	.02				
Occupation Not Known	.19	.14	.16	.19	.10				
Switched Occupation	.30	.23	.29	.29	.32	−.3	.0	.2	−.1
Industrial Mix	[b]					−6.6	1.2	.9	2.2
Switched Industry	.65	.97	.86	.64	.52	−.6	−.4	−.0	.2
Length of Unemployment	7.9	7.8	7.1	8.1	7.1	.1	.1	−.2	.5
All Other Variables						−.1	.5	−.8	.6
Total Difference in Real Wage Replacement Rate									
Explained						−8.1	−1.8	−1.6	7.0
Actual						−9.1	−1.5	−2.0	6.6

[a]Calculations based on the second set of regression results in Table 8.
[b]See Appendix Table 1.
Source: Author's calculations based on sample of displaced workers from Massachusetts who were reemployed at a new job.

Additional regressions explored whether education and training courses helped to boost wage replacement rates. The results were mixed, and are discussed below in the section on "Education and Training."

Explaining Wage Changes by Industry

The regressions were used to examine why workers from declining industries did worse than others (Table 9). At 21.8 percent, the average real wage loss of reemployed defense manufacturing workers was 9 percentage points greater than the sample-wide average. Roughly two-thirds of this gap is explained by the defense dummy. That is, prospective employers discount the skills and experience of former defense workers more than those of other workers. Almost all defense workers who were not recalled switched industries. In addition, many laid-off defense workers had been in production jobs, the occupational category with the largest earnings declines across all industries. Finally, on average, defense workers had been employed at their previous employer for over 10 years, compared to about 7 years for the full sample. As found in the regressions, each added year of experience at the past employer is valued less by the new employer.

Service industry worker wages fell only 6.1 percent, 6.6 percentage points less than average. Low job tenure, favorable occupational mix, and better-than-average education were especially significant in explaining their relatively high wage replacement rates.

Service industry workers also did not have to look as long, so they were not as desperate. Interestingly, however, the fraction of service workers remaining in service work was only 48 percent, even though on the whole service industries were increasing their employment during this time period. This is one indication of the pervasiveness of structural change in labor markets.

III. Education and Training

All displaced workers in the sample were offered basic readjustment assistance. This consisted of group workshops designed to help them cope with unemployment and undertake a job search, as well as individual meetings with job counselors. The centers also made available resources that could be used directly in their job search, such as phone banks and job listings.

In addition to receiving basic assistance, 42 percent of the sample enrolled in education or training classes approved and funded by the centers (Table 10). The most common course of study was occupational training. This consisted of preparing for a new job by taking classes related to a particular employment field at a local university, community college, or specialized training facility. Typical subjects included computer programming, equipment or machinery repair, accounting, culinary arts, truck driving, and health sciences.[36] Two percent received entrepreneurial training, to help them start their own businesses. Education programs took three forms: basic education to improve reading, writing, mathematics, and computer literacy skills; English as a second language (ESL); and GED classes, to obtain a high-school equivalency diploma. Between 1 and 4 percent of the sample enrolled in at least one of these courses of study. Education and training programs on balance appear to have had mixed but generally small effects on wage outcomes (Table 11). According to the first regression, workers enrolled in education and training programs had approximately the same wage replacement rates as those who did not, holding other qualifications constant. When the effects of various types of education and training were measured separately (equation 2), occupational skills training (the most popular course of study) remained unhelpful in explaining wage outcomes. Adult basic education, ESL, and integrated training were associated with a positive effect on wages, and GED classes a negative effect. However, the standard errors were large, implying that these effects were measured with a high degree of uncertainty. Those receiving entrepreneurial training had substantially lower wage replacement rates than others, confirming the findings of Bradbury (1994) that self-employment was a useful, but not very lucrative, stopgap in the early 1990s. It is possible, however, that entrepreneurs received some measure of satisfaction from being their own boss, or that, at least for some, earnings grew rapidly as their business became more established. The third regression includes a dummy variable equal to one for those workers whose new job was related to the training they received; this variable indicated a small positive effect on wages.

The final two regressions include length of enrollment in education and training programs. The first of these specifications indicates that longer enrollment was associated with a small reduction in the new wage: Displaced workers enrolled for six months had wage replacement rates 2.5 percentage points lower than those who did not enroll at all, assuming all other characteristics were similar. Workers who got very

Table 10
Summary of Education and Training Programs

	Participation Rate (percent)	Median Duration (months)	Maximum Duration (months)
Education			
Adult Basic Education	4.2	4	23
English as a Second Language	3.0	6	32
GED Class	1.4	5	33
Training			
Occupational Skills	33.6	4	44
Entrepreneurial Training	2.0	2	18
Integrated Training[a]	.4	6	30
On-the-Job Training	.0	5	5
All Education and Training Programs	42.0	4	44

Note: Long maximum duration of education and training reflects workers who enrolled in training prior to being laid off.

[a]Integrated Training combines occupational classroom training with ESL, Basic Education, or GED training. This single integrated training program is not the same as occupational and basic education courses taken concurrently or sequentially.

[36] This list is drawn from the anecdotal evidence used in Kodrzycki (1995). The subject matter of the occupational training is not available in the computerized records obtained for the current sample.

Table 11
Real Hourly Wage Replacement Rate: Regression Results
Including Various Measures of Education and Training

Independent Variable	(1)	(2)	(3)	(4)	(5)
Experience					
Potential Work Experience	−.23**	−.22**	−.22**	−.18**	−.18**
Job Tenure	−1.71**	−1.73**	−1.72**	−2.43**	−2.43**
Job Tenure Squared	.04**	.04**	.04**	.06**	.06**
Education and Skills					
Schooling (Omitted = Less than High School)					
High School	−.59	−.09	−.66	2.49	2.42
Some College	1.11	1.89	.95	2.87	2.77
College Degree	4.02**	5.07**	3.98**	3.35	3.25**
More than College	4.90**	6.11**	4.97**	9.69	9.52**
Reading Test Score	.24	.30	.27	−.00	.08**
Previous Occupation (Omitted = Services)					
Professional, Technical, and Managerial	−2.40	−1.96	−2.42	−8.18**	−8.15**
Clerical and Sales	2.23	2.28	2.11	.76	.73
Production	−6.15**	−6.18**	−6.12**	−7.78**	−8.01**
Other	−2.57	−2.62	−2.51	−1.87	−1.86
Not Known	−7.53**	−7.80**	−7.38**	−5.55	−5.74
Switched Occupation	−5.15**	−5.10**	−5.20**	−2.04	−2.16
Duration of Unemployment	−.75**	−.72**	−.74**	−.53**	−.45**
Location of New Job					
Distance	.03**	.02**	.02**	.04**	.04**
Distance Squared	−8.08e-06**	−8.48e-06**	−7.63e-06**	−1.73e-05**	−1.72e-05**
Work Effort					
Full-Time at Previous Job	−1.08	−1.20	−1.07	−3.43	−3.42
Switched to Part-Time	−1.86	−2.23	−2.07	.17	−.05
Switched to Full-Time	8.41**	8.53**	8.36**	11.77**	11.69**
Demographic Characteristics					
Gender and Marital Status (Omitted = Unmarried Male)					
Married Male	−1.34	−1.17	−1.42	−.48	−.49
Married Female	1.81	1.71	1.38	1.64	1.48
Unmarried Female	1.17	1.19	.89	.34	.22
Nonwhite	2.22	2.09	2.24	4.22	3.97
Previous Industry					
12-Month Employment Growth Rate	−.04	−.04	−.02	.11	.24
Wage Premium	.02	.05	.02	−.40	−.44
Dummies (Omitted = Government)					
Defense-Related Manufacturing	−9.84**	−9.76**	−9.39**	−4.86	−3.75
Computer Manufacturing	−2.19	−1.99	−1.45	5.94	8.54
Other Manufacturing	−2.21	−1.75	−2.30	−2.98	−2.90
Construction	[a]	[a]	[a]	[a]	[a]
Transportation and Public Utilities	−5.95*	−5.70*	−6.06**	−7.17	−6.98
Trade	−2.34	−1.60	−2.43	−5.06	−5.48
Finance, Insurance and Real Estate	−2.43	−2.10	−2.58	−4.32	−4.34
Services	−.98	−.42	−1.08	−4.18	−4.33
Other and Not Known	−4.25	−2.42	−5.20	−7.17	−7.21
Switched Industry	−2.83**	−2.91**	−3.59**	−1.71	−1.61

continued

Table 11 continued

Real Hourly Wage Replacement Rate: Regression Results

Including Various Measures of Education and Training

Independent Variable	(1)	(2)	(3)	(4)	(5)
Education and Training					
Received Education or Training	−.65				
Attended Adult Basic Education Classes		4.17			
Attended ESL Classes		6.44			
Attended GED Classes		−2.21			
Received Occupational Skills Training		.18			
Received Entrepreneurial Training		−13.55**			
Received Integrated Training		10.51			
New Job Related to Training			−2.11**		
Total Duration of Education and Training				−.41**	
Adjusted Total Duration of Education and Training					−.23
Constant	111.54**	109.51**	111.06**	115.82**	113.21**
Adjusted R^2	.143	.148	.144	.137	.136
Number of Observations	5,492	5,492	5,492	2,256	2,256

*Significantly different from zero at 5 percent level.

**Significantly different from zero at 1 percent level.

[a]Dropped because of collinearity.

Note: Standard errors available from the author upon request.

Source: Author's calculations based on sample of displaced workers from Massachusetts who were reemployed but not recalled to their previous job.

attractive job offers while enrolled in classes would be likely to cut short their course of study, however, producing a negative correlation between the wage replacement rate and the duration of education and training. The last regression attempts to correct for this bias. The duration of education and training programs was measured only for those enrollees who continued to be registered at the worker assistance center after their last class had ended. Presumably this omits anyone who interrupted his or her coursework as a result of an attractive job offer. The coefficient on the duration variable becomes less negative in this specification; it still does not indicate a positive association between longer education and training and the new wage.

In summary, the regressions tend to indicate little overall wage effect from education and training, while not closing the door on the possibility of a larger effect for some programs. Two explanations for the finding of a minimal wage gain seem plausible while being consistent with the view that education and training is beneficial to displaced workers. The first explanation is that most workers are enrolled for a rather short time. For all individuals receiving education and training programs, the median duration was only four months, and only two programs (English as a second language and integrated training) had median durations as long as six months. The added skills acquired may simply have been too minor to matter much. They might have enabled some to find an entry-level position in another field, but they could not compensate for the lack of a college degree or detailed knowledge of a particular field.[37]

Another possibility is that those who decided to enroll in education and training were, in one way or another, at a greater disadvantage than was apparent in the regressions. For example, their math skills may have been more deficient than indicated by their educational attainment. GED classes may have helped high school dropouts with poor math skills get better jobs than they would otherwise have gotten, but not better jobs than other high school dropouts who had

[37] A similar conclusion was reached by Jacobson, LaLonde, and Sullivan (1994). In a study of education programs for displaced workers in Pennsylvania, they estimated that a year of schooling raised long-term earnings by 6 to 7 percent for male participants, and 3 to 4 percent for female participants. But most participants acquired less than one year of education, despite the fact that the program was subsidized. Therefore the average wage effect was smaller than the estimated annual rate of return.

learned math on the job. Or to take another example, a laid-off physical education teacher who took courses to enter the health care field may have remained a "professional, technical, and managerial" worker in the data. This would be better than settling for a job at a health club, but other professionals with more marketable skills may have gotten still better positions without undergoing occupational training. The regressions can be used to compare wage outcomes of those receiving education and training to the outcomes of those who did not—but not to measure the hypothetical outcomes in the absence of education and training.

IV. Conclusions

This study has examined the experiences of a large group of workers from Massachusetts who were laid off in the early 1990s and who sought government assistance in finding a job. It provides evidence on their difficulty in finding reemployment, the extent to which they were able to obtain new jobs that were as attractive as their former positions, and on the ways in which government services were able to help.

In general, displaced workers experienced noticeable wage losses. Many, though not a majority, ended up finding jobs either without medical insurance or without pension benefits. Most displaced workers experienced an extended period of joblessness, although the duration depended somewhat on general economic conditions. Jobs were easier to find toward the end of the sample period than the beginning, as total Massachusetts employment was increasing rather than decreasing, and as the state unemployment rate fell from 9 percent in 1991 to 6 percent in 1994.

Experiences differed across categories of workers. Older, more experienced workers had longer durations of joblessness and lower wage replacement rates. Educational background had mixed effects. On the one hand, less educated workers tended to be reemployed more quickly than college-educated workers. On the other hand, their new wages tended to be considerably lower relative to their old job. Thus, the study points out that reemployment outcomes depend not only on changes in the relative demand for different types of workers (such as the increasing value placed on education), but also on differences in how long job seekers feel they can hold out without a paycheck.

Being laid off from a declining industry tended to result in a longer duration of joblessness; thus workers from the fastest-growing industries, services and construction, were quicker to find a new job than many former manufacturing workers, including those from defense industries. But other factors sometimes offset the influence of industry trends. Despite extensive layoffs in their industry, computer manufacturing workers did not experience abnormal difficulty finding work, in part because they tended to be located in areas of the state with relatively low unemployment and because many registered for reemployment assistance before losing their old job.

Workers from declining industries tended to suffer sharper earnings cuts than others. Steep earnings losses in part related to long tenure at their former job and the prevalence of production (rather than sales or services) skills. Defense manufacturing workers' large wage cuts upon reemployment appeared also to reflect their new employers' belief that experience at a defense contractor firm was particularly inapplicable to other industries.

Early sign-up at a worker assistance center was found to reduce the period of joblessness. This result indicates that employers can mitigate the costs of layoff, as workers are able to register for government services prior to being laid off only if they receive advance notification of impending layoffs.

Many displaced workers received government funding for education and training, in addition to the counseling and job market information services that were available to all workers in the sample. Participation in education and training tended to lengthen joblessness, as workers were less likely to be actively looking for a job while taking classes. On the whole, however, workers who enrolled in education or training obtained jobs that paid about the same as those who received only basic services, after adjusting for other measurable differences in qualifications. One explanation for this finding is that education and training services were used disproportionately by job seekers who faced particularly large difficulties recouping their former wage or who decided to make more dramatic changes in their line of work, in ways that the available data could not detect. Another explanation lies in resource constraints, which limited the number of classes workers could take, as well as their willingness to turn down job offers in order to train for better opportunities.

Appendix, by Margaret E. Enis

Appendix Table 1 provides statistics for a data base of 20,624 displaced workers provided by the Massachusetts Industrial Services Program. Potential work experience was computed as age minus years of education minus six. Most observations in the data set included a reading test score in the form of a grade level equivalent, but for a few only a raw score on a standardized reading test was given. For those few observations, the actual number of years of education was substituted for the raw score. College graduates, who were not tested, were assigned the highest possible grade level equivalent in reading (13).

The observed length of nonemployment was calculated as the number of months between the date of layoff and the date of termination from the center. The date of layoff was taken as the ending date of work at the former employer. The date of application at the worker assistance center was used as the layoff date if the end date was unknown. In cases where the date of termination was not available because the sample period ended, the observed nonemployment spell was calculated as the number of months between the layoff and the end of the sample (September 1994). The period of unemployment is measured as the months of nonemployment not spent in education and training.

The length of education and training, the total months spent in training programs sponsored by the Industrial Services Program, is measured as the sum of the number of months between the enrollment and completion dates for each of the activities in which the worker participated. If a worker was enrolled in training prior to displacement, the length of this advance training was calculated as the number of months between the first day of training and the layoff date. The adjusted length of education and training is the length of education and training for workers who did not terminate at the center on the same day that they ended training.

The job tenure variable, measuring the years of employment at the former employer, is the length of time between the start date and the end date at the former employer. The worker assistance centers included a code for those

Appendix Table 1
Displaced Worker Sample Variables

Variable	Mean	Standard Deviation	Number of Observations
Worker			
Potential Work Experience (years)	22.2	10.5	20,495
Age (years)	41.0	10.3	20,624
Education (years)	12.8	2.4	20,495
Number of Dependents	.9	1.2	20,624
Nonwhite (proportion)	.13	.34	20,624
Male (proportion)	.53	.50	20,624
Married (proportion)	.50	.50	20,624
Adjusted Reading Score	8.4	2.4	19106
Employment Status			
Observed Length of Nonemployment (months)	11.5	7.4	20,412
Observed Length of Unemployment (months)	9.2	6.8	20,370
Education and Training			
Observed Duration of Education and Training (months)	5.3	4.4	8,662
Enrollment in Training Prior to Displacement (proportion)	.06	.25	20,624
Duration of Training Prior to Displacement (months)	.17	1.33	20,447
Adjusted Duration of Education and Training (months)	2.7	3.5	4,786
Former Job			
Hourly Wage (dollars)	13.2	6.0	20,371
Hours Per Week	39.4	4.6	20,421
Job Tenure (years)	7.7	7.9	18,479
Recalled to Former Job (proportion)	.04	.20	20,624
Employed Full-Time at Former Job (proportion)	.95	.22	20,624
Proportion formerly employed in:			
Defense Manufacturing	.14	.35	20,624
Computer Manufacturing	.07	.25	20,624
Other Manufacturing	.32	.47	20,624
Construction	.02	.13	20,624
Transportation, Communications, and Public Utilities	.02	.15	20,624
Wholesale and Retail Trade	.12	.32	20,624
Finance, Insurance, and Real Estate	.04	.20	20,624
Services	.15	.35	20,624
Government, Defense-Related	.02	.15	20,624
Government, Not Defense-Related	.03	.18	20,624
Other and Not Available	.07	.25	20,624
Former Industry			
12-Month Employment Growth Rate (percent)	−.4	4.6	20,624
Wage Premium (percent)	.7	6.3	20,624

continued

Appendix Table 1 continued
Displaced Worker Sample Variables

Variable	Mean	Standard Deviation	Number of Observations
Former Occupation (proportion):			
Professional, Technical and Managerial	.30	.46	20,624
Clerical and Sales	.21	.40	20,624
Production	.29	.45	20,624
Service	.05	.22	20,624
Miscellaneous Occupations	.04	.19	20,624
Not Available	.12	.32	20,624
New Job			
Hourly Wage (dollars)	11.5	5.7	9,371
Hours Per Week	38.0	5.3	9,062
Distance to New Job (miles)	33.9	182.6	7,401
Comparison between Old and New Job			
Percent Difference between Former and New Real Wage	−11.7	28.0	9,276
Hourly Replacement Wage (percent)	88.1	28.0	8,811
Switched Occupation (proportion)	.54	.50	20,624
Switched Industry (proportion)	.76	.42	20,624
Hours Decreased from Full-Time to Part-Time (proportion)	.04	.20	20,624
Hours Increased from Part-Time to Full-Time (proportion)	.04	.21	20,624
Unemployment			
Country Unemployment Rate at Time of Displacement (percent)	7.9	1.9	18,717
12-month Change in County Unemployment Rate (percentage points)	−1.0	1.0	18,717
Difference between State and County Unemployment Rates at Time of Displacement (percentage points)	−.1	1.5	18,717
Difference between 12-month Change in State and County Unemployment Rates (percentage points)	.1	.8	18,717

Source: See Appendix text.

recalled to their former job. An individual was also considered to be recalled to his or her old job if the name and location of the former and current employer were the same. For categorization purposes, any individual working 35 or more hours per week was determined to be employed full-time.

The industries of the former and new jobs were grouped using the Standard Industrial Classification codes. SIC codes for the former employers were included in the data base, but they appeared in the form of 2-digit, 3-digit, and 4-digit codes. The 2- and 3-digit SIC codes were changed into 4-digit codes by adding zeros. Observations that did not have an SIC code for the former employer were supplied with one if it could be determined from the name of the employer. Miscoded SICs were corrected using the employer name. Manufacturing jobs were determined to be defense-related if the employer appeared on the 1993 list of "Prime Contractors Plants with Awards Totaling $5 Million of More During FY 1992," from the Department of Defense, or was known to have appeared on previous lists. Defense-related employers whose SIC codes fall in the computer manufacturing category were classified as computer manufacturers. Government jobs were determined to be defense-related if the employer was a military base or otherwise known to be defense-related. The defense-related government workers in this sample are civilians, as military employees have access to separate reemployment services.

The 12-month employment growth rate was computed as the percent change in Massachusetts employment in the industry one year after the time of layoff. The industry employment levels were categorized by SIC code except for defense- and non-defense-related government, which were taken as federal government employment (not including postal workers) and state and local government employment plus postal workers, respectively. The wage premium was computed as the percent difference relative to government and is estimated in Appendix Table 3.

The former and current occupations were categorized using the classification codes from the Dictionary of Occupational Titles. Observations without a DOT code or with a code that does not correspond to any occupation in the Dictionary of Occupational Titles were classified as "occupation not available." Although the Dictionary of Occupational Titles classifies graphic designers as "miscellaneous," they are classified here in the "Professional, Technical, and Managerial" category.

To calculate the distance to new job, the zip codes for the worker assistance center and the new employer were matched to their latitude and longitude centroids using ATLAS GIS for Windows, version 2.0. This software includes data for all U.S. zip codes. The distance between these two centroids was converted to miles using Geodist, a C program written by Philip Thompson at MIT's Computer Resource Lab. The distance to new job was not calculated for the relatively few workers who moved overseas.

The hourly replacement wage was constructed as a ratio of the hourly wage on the new job to the hourly wage on the former job. A worker was deemed to have switched occupation if the former occupation was different from the new occupation, and to have switched industries if the former

Appendix Table 2

Duration of Education and Training: Regression Results

Independent Variable	Coefficient	Standard Error
Experience		
Potential Work Experience	−.04**	.01
Job Tenure	.04**	.01
Schooling (Omitted = Less than High School)		
High School	−.41**	.16
Some College	−.46**	.18
College Degree	−1.32**	.22
More than College	−.96*	.44
Previous Real Wage	−.05**	.02
Full-Time at Previous Job	.50*	.22
Previous Occupation (Omitted = Services)		
Professional, Technical, and Managerial	−.73**	.27
Clerical and Sales	−.57*	.27
Production	−.22	.27
Other	−.25	.36
Not Known	−.09	.29
Previous Industry (Omitted = Government)		
Manufacturing		
Defense-Related	.41	.30
Computers	1.65**	.32
Other	.28	.27
Construction	−.10	.42
Transportation and Public Utilities	.63	.41
Trade	.43	.28
Finance, Insurance, and Real Estate	.35	.33
Services	.40	.28
Other and Not Known	.86**	.30
Unemployment Rate at Time of Layoff		
County	.05	.04
State	1.04**	.07
Demographic Characteristics		
Male	−.21	.15
Married	.04	.14
Married Male	−.50*	.21
Nonwhite	.91**	.15
Constant	−2.36**	.62
Adjusted R^2 = .096		
Number of Observations = 7,079		

*Significantly different from zero at 5 percent level.
**Significantly different from zero at 1 percent level.
Source: Author's calculations based on sample of displaced workers from Massachusetts.

Appendix Table 3

Log of Previous Real Wage: Regression Results

Independent Variable	Coefficient	Standard Error
Experience		
Potential Work Experience	.02**	.0009
Potential Work Experience Squared	−.0003**	.00002
Job Tenure	.02**	.0008
Job Tenure Squared	−.0004**	.00003
Education and Skills		
Schooling (Omitted = Less than High School)		
High School	.10**	.01
Some College	.18**	.01
College Degree	.35**	.01
More than College	.49**	.02
Reading Test Score	.01**	.001
Occupation (Omitted = Services)		
Professional, Technical, and Managerial	.30**	.01
Clerical and Sales	.07**	.01
Production	.14**	.01
Other	−.002**	.02
Not Known	.13	.01
Full-Time	.13**	.01
County Unemployment Rate at Time of Layoff	−.02**	.001
Year of Layoff (Omitted = 1991)		
1992	−.03**	.01
1993	−.09**	.01
1994	−.11**	.01
Demographic Characteristics		
Male	.12**	.01
Married	−.02**	.01
Married Male	.10**	.01
Nonwhite	−.06**	.01
Number of Dependents	.005*	.002
Industry (Omitted = Government)		
Manufacturing		
Defense-Related	.12**	.01
Computers	.08**	.01
Other	−.04**	.01
Construction	.12**	.02
Transportation and Public Utilities	.06**	.02
Trade	−.08**	.01
Finance, Insurance, and Real Estate	−.01	.02
Services	−.02	.01
Other and Not Known	−.02	.01
Constant	1.39**	.03
Adjusted R^2 = .532		
Number of Observations = 15,365		

*Significantly different from zero at 5 percent level.
**Significantly different from zero at 1 percent level.
Source: Author's calculations based on sample of displaced workers from Massachusetts.

industry was not the same as the new industry. Workers whose former or new occupation or industry is not known are considered not to have switched.

County unemployment rates were assigned based on the location of the former employer. If the former employer had locations in more than one county, and the particular location was unknown, the county unemployment rates for all of the possible locations in Massachusetts were averaged. The 12-month change in the county unemployment rate was computed as the difference between the county unemployment rate 12 months after layoff and the county unemployment rate at the time of layoff. The same was done for the state unemployment rate.

Appendix Table 2 shows the results of the regression estimating the duration of education and training.

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