



**EARNINGS LOSSES OF DISPLACED WORKERS IN THE 1990s**

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### **Abstract**

The large-scale downsizings of the 1990s has renewed interest in the earnings losses of displaced workers. This study uses administrative data to follow 833,004 workers in California between 1989 and 1994, providing estimates of the extent of losses in quarterly earnings associated with the recent downsizings. Patterns of earnings loss that are similar to those found in studies using different data for different regions and periods are documented. However, we do not find that earnings decline substantially prior to displacement, which has been found in previous research. The study also finds that earnings losses: i) vary substantially among workers, ii) differ by the period of displacement, iii) are related to the economic conditions at the time of displacement, iv) vary by firm size, industry of new employment, and the number of subsequent separations, v) are similar within versus across firms, and vi) in the long-run are 17 to 25 percent. The effects on quarterly earnings versus hourly wages are also explored.

## EARNINGS LOSSES OF DISPLACED WORKERS IN THE 1990s

### INTRODUCTION

In the single year 1993 there were 3.4 million workers displaced from their jobs, representing approximately 2.7 percent of the entire U.S. work force.<sup>1</sup> A similar number of workers were displaced in each year of the recession in the early 1990s, with the strategy of “downsizing” adopted by many failing firms throughout the economy as a way to counteract declining profits. Moreover, downsizings have not been limited to poor performing firms; financially sound firms, such as General Electric and Proctor & Gamble, are also downsizing. These firms expect downsizing to create more flexibility, lower costs, raise productivity and profits, and improve stock performance. While recent research has examined the effects of downsizing on firms’ financial performance (Cascio and Morris, 1994) and the morale, commitment, and performance of “surviving” workers (Brockner et al, 1993), we know little about how “downsized” workers have fared during this period. It is the objective of this study to address this issue.

As summarized by Jacobson, LaLonde, and Sullivan (1993a), there are several reasons why a worker’s wages are expected to change when they are displaced from a firm. First, some of the worker’s skills may only be valued by their former firm, and workers lose the wage advantage associated with this firm-specific human capital when they become re-employed with a new firm (Becker, 1975). Second, the worker’s old firm may have been paying a wage premium due to the influence of unions in contracting. Alternatively, workers may have been, for whatever reason, earning efficiency wages from their former firm and not on their new job. Third, wages of higher tenure workers may also decline because the worker had agreed to work at a wage below their marginal product at the beginning of their career, perhaps to increase the incentive of the firm to invest in their skills, in exchange for wages above their marginal product later in their careers. Of course this theory also implies that low tenure employees whose wages were below their marginal product may actually experience an immediate rise in their wages if their new employer pays them wages equal to their current marginal product. And fourth, wage losses associated with displacement may also be an artifact of the declining value of the worker’s skills in the changing economy; displaced workers may be the ones whose skills are becoming obsolete, and unless one is able to control for skill differences accurately, the wage deterioration may be inappropriately assumed to be caused by the displacement *per se*.

Although there are few estimates of the wage loss of workers displaced in the 1990s,<sup>2</sup> a long list of studies have calculated estimates for earlier periods using different data sets and analytic approaches.<sup>3</sup> Despite these differences, there appear to be some common empirical patterns across studies, including:

- Quarterly earnings decline as much as three years prior to displacement as a result of lower hourly wages or reduced hours of work on that job (Jacobson, LaLonde, and Sullivan, 1993a).
- Workers experience large wage losses even three to five years after displacement; perhaps a 15 percent loss (in weekly wages) for workers regardless of tenure (Ruhm, 1991a; Stevens, 1995), and a 20 to 25 percent loss (in quarterly earnings) for high tenure workers (Jacobson, LaLonde, and Sullivan, 1993a).
- The amount of wage loss depends on whether the worker finds new employment in a similar industry (Krueger and Summers, 1988; Carrington, 1993; Jacobson, LaLonde, and Sullivan, 1993a; Neal, 1995).
- Local economic conditions at the time of displacement influence the amount of wage loss (Carrington, 1993; Jacobson, LaLonde, and Sullivan, 1993a).

However, none of these studies have examined the period covered by the downsizings of the 1990s. We re-address these issues by examining the patterns in quarterly earnings of workers separating from declining firms between 1989 and 1994 using administrative data from California. Our study is most like Jacobson, LaLonde, and Sullivan (1993a), who use administrative data similar to ours, but from a different period (1974 to 1986) and a different state (Pennsylvania) that had a very different industrial structure. Although California was experiencing a severe recession in the early 1990s, the Pennsylvania recession of the early to mid-1980s was unusually deep; given that the local economy influences the cost of displacement, earnings losses for Pennsylvania as a whole in the 1980s may be unusually large.<sup>4</sup>

We also examine other dimensions of the problem which, in some cases, lead to results that are not consistent with previous findings. In particular, we find that quarterly earnings do not decline prior to separation. This implies that perhaps wages and hours are not as flexible as previously assumed. Second, because we obtained data for *all* workers within some large firms, we are able to look fully within firms to validate the patterns of earnings loss estimated across workers in different firms. Jacobson, LaLonde, and Sullivan (1993a) were able to control for firm fixed effects on earnings,

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<sup>1</sup>Tabulations were made by the authors using the 1994 Displaced Worker Supplement to the Current Population Survey.

<sup>2</sup>An exception is Farber’s (1993) analysis of the 1992 (merged with the 1984, 1986, 1988, and 1990) Displaced Worker Surveys, although that study was only able to examine workers displaced by 1991, and the post-separation wage data was only for 1992.

<sup>3</sup>See, for example, Carrington (1993), Gibbons and Katz (1991), Hamermesh (1989), Jacobson, LaLonde, and Sullivan (1993a, 1993b), Neal (1995), Ruhm (1991a), Stevens (1995), and the many studies examining the effects of advanced notice on earnings losses.

<sup>4</sup>One advantage of Jacobson, LaLonde, and Sullivan’s data is that it contains geographic identifiers, which allowed them to examine areas within Pennsylvania with different economic conditions.

but they were not able to determine whether the pattern of earnings loss was the same across firms. Firms have different policies regarding displacement of workers; for example, out-placement services, severance pay, allocation of accrued vacation and pensions, and training and re-training vary among firms (U.S. Department of Labor, 1995). As a result, earnings losses may also differ among workers in different firms. Third, all previous studies have focused on average earnings losses. As we demonstrate, the variation in earnings loss is large, with some workers handling the transition well and others receiving substantial earnings losses. Fourth, we examine the role of subsequent firm separations in determining the pattern of pre-separation earnings. Fifth, part of the loss in quarterly earnings estimated by Jacobson, LaLonde, and Sullivan (1993a, 1993b) was due to reduced hours or weeks worked within the quarter. We utilize information on the number of weeks each worker was enrolled in the Unemployment Insurance program to help bound the effects of displacement on *hourly* wages, which then allows us to more closely compare our findings with previous studies that have examined the effects on weekly or hourly wages (Topel, 1990; Ruhm, 1991a, 1991b; Stevens, 1995). Finally, we test, in our data, the assumption implicit in Jacobson, LaLonde, and Sullivan's statistical approach that the effects of displacement do not vary by the period displaced, given the observables.

Because the data set is unique, we begin by describing its characteristics. The statistical approach and the sample selections are then discussed. Using the California data we replicate the basic earnings patterns found by Jacobson, LaLonde, and Sullivan in Pennsylvania with emphasis on the decline in earnings prior to separation. Given this finding for pre-separation earnings, we then estimate the amount of post-separation earnings gain and examine a counterfactual earnings path for displaced workers if they would not have been displaced. The amount of variation in earnings loss among workers displaced within and across different periods is then estimated. Finally, we investigate the reason why there may be variation among workers displaced at the same time by examining differences by firm size, number of subsequent separations, and changes in industry. A final section summarizes.

## DATA

The analysis uses a unique data set that was constructed from administrative information in California and consists of workers in California's durable goods manufacturing sector in the first quarter of 1989 (i.e., 1989:1), which preceded by about two years the beginning of the large scale decline of this sector in California. Specifically, the sample consists of *all* workers who were employed in the aerospace sectors (i.e., SICs 366, 372, 376, 381, and 382) and a random sample of 20 percent of all individuals who worked in non-aerospace durable goods manufacturing. This constitutes a total of 833,004 workers, 517,148 of whom were in aerospace.

Drawing from administrative files, we follow each of the 833,004 workers through the third quarter of 1994 (i.e., 1994:3). For each quarter, we obtain information on each worker's quarterly earnings, employer identification number (scrambled), industry (four-digit SIC code), and number of weeks they received Unemployment Insurance (UI) payments. All earnings are reported in real terms for the fourth quarter of 1994 using the California Consumer Price Index.<sup>5</sup> Quarterly earnings are the total of earnings from the three highest paying jobs within each quarter; very few workers have earnings from more than three firms within any quarter. (The construction of the data files is discussed in detail in the appendix, including a comparison of earnings reports with external sources.)

Associated with the earnings received from each firm in each quarter for each worker is a unique Federal Employer Identification Number (FEIN). We use the changes in the worker's primary employer's FEIN, as defined as the firm from which the worker receives the greatest earnings within each quarter, to identify a separation from the firm. (The appendix discusses changes in a firm's FEIN associated with mergers, acquisitions, and spin-offs.) In addition, to be considered a valid separation we require that upon separation the worker not return to that firm (as the primary employer) for at least one year; we do this to abstract from temporary layoffs of workers who are eventually recalled. In the data, most workers who eventually return to a firm return within one quarter; of the 13.8 percent of separators who returned to the same firm within one year, 77 percent returned within one quarter.<sup>6</sup>

One advantage of these data is that they cover the early and mid 1990s, when downsizings have (presumably) become more prevalent.<sup>7</sup> In addition, the samples we use are far larger than in other studies. The California data include as many separators in *each* quarter as Jacobson, LaLonde, and Sullivan's (JLS's) administrative data contain over the entire period 1979 to 1986 (9,507 separators in total and 6,435 in their mass-layoff sample). And both of these administrative data sets have far more separations than national longitudinal surveys such as the PSID, in which only 441

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<sup>5</sup>The price index was constructed from three-month simple averages of the CPI for California as reported by the California Department of Industrial Relations (based on estimates from the U.S. Department of Labor), which are population weighted averages of indices from the three major metropolitan areas in California: Los Angeles-Anaheim-Riverside, San Francisco-Oakland-San Jose, and San Diego.

<sup>6</sup>This pattern is not a result of a firm having missing data for all workers for a given quarter. Because we have a large number of workers within most (initial) firms, we were able to determine that a worker who was missing earnings for one quarter did not have co-workers from the previous period's firm who were unusually likely to also have missing earnings. Moreover, these workers did not have unusually high earnings in the quarter they returned to the firm, which we would expect if the firm simply missed reporting that worker's earnings in the previous quarter and made up for it by reporting the previous quarter's earnings in the current quarter. Finally, workers who leave one quarter and return the next are lower wage workers, on average, which is consistent with the hypothesis that they are hourly wage workers who are simply not employed by the firm in the quarter under question.

<sup>7</sup>Despite the apparent rise in downsizings, Farber (1995) finds that the prevalence of long-term employment has not declined over time for workers as a whole. However, less educated men are becoming less likely to hold high tenure jobs, and this has been offset by a rise in high tenure jobs among women.

workers experienced a displacement over the 18 year period 1969 to 1986 (Stevens, 1995). These large samples allow us to test some restrictions on the path of earnings that previous studies have not, including examining earnings patterns fully within firms.

Like JLS's data, these data include earnings several years prior to displacement, which is not the case for the most commonly used data on displaced workers, the Displaced Worker Supplement to the Current Population Survey (DWS). This allows us to determine whether earnings decline prior to separation, as found by JLS.<sup>8</sup> In addition, the administrative data on earnings presumably have very little measurement error because they are used by the state to calculate UI benefits, and they are not top-coded, as is the case with most survey data.

On the other hand, some labor market earnings is not reported to the UI system and, therefore, not captured by our data. Specifically, self-employed workers and workers in casual occupations (i.e., domestics), federal/military employees, many non-profit institutions, clergy, employees paid entirely on commission, railroad transportation employees, domestic workers earning less than \$750 per calendar quarter, students working for private or public colleges or universities, and underground employment are not covered by the data. However, in total this accounts for at most five to ten percent of California employment (correspondence with California's Employment and Development Department). The data also have limited information on the worker. Age, sex, and ethnicity are available for workers who have ever received UI, which is 63 percent of the analytic sample; we do not utilize this information because the sample for whom it is available is highly selective. However, JLS (1993a), who do have information on age and sex, find that earnings losses "depend only slightly on their age and sex" (page 685), so this limitation may not be substantial.

Another limitation of the data is that hours or weeks worked within a quarter is not available; therefore, the effects on quarterly earnings may be due in part to the effects on hours or weeks. This problem confronted JLS as well, and it may be the reason that they find larger long-run losses than, for example, Ruhm (1991), who examines weekly wages. However, we draw on another source of information to help bound the effect on hourly wages. For each worker in our data we obtained the number of weeks that they received UI payments, from which we derive a lower bound of the number of weeks they did not spend working. We use this information to adjust quarterly earnings for weeks worked in each quarter.

The California data are restricted to durable manufacturing workers. To determine the representativeness of the experiences of these workers, we compared the losses of workers displaced from durable manufacturing with the losses of workers displaced from other industries using the Displaced Worker Supplement. In Table 1 we report the wage losses of displaced workers and the share of displaced workers who were re-employed by the time they were interviewed. In this national sample,<sup>9</sup> we found that workers displaced from durable manufacturing firms were slightly more likely to be re-employed; for example, in the 1992 data, 61.2 percent of displaced durable manufacturing workers and 59.3 percent of workers displaced from any other industry were working at the time of the interview. However, among workers who were re-employed, durable manufacturing workers experienced larger wage reductions. This difference in wage loss exists in each year and ranges from 3.9 to 1.6 percentage points, and it suggests that the wage losses experienced by California durable manufacturing workers are likely to be somewhat larger than the losses experienced by California workers as a whole.

## APPROACH

JLS developed an approach, drawing on the program evaluation literature, in which current period earnings of worker  $i$  is a function of a series of dummies that indicate whether the worker was displaced in each past, current, and future period  $k$ ,  $D_{it}^k$ :

$$y_{it} = \mathbf{a}_i + \mathbf{g}_t + X_{it}\mathbf{b} + \sum_{k \geq -m} D_{it}^k \mathbf{d}_k + \mathbf{e}_{it}$$

where  $X_{it}$  are the control variables,  $\mathbf{a}_i$  is an individual fixed effect,  $\mathbf{g}_t$  are period indicators, and  $\mathbf{e}_{it}$  is assumed to have constant variance and to be uncorrelated across periods and individuals. One of the assumptions of this specification is that, conditional on the covariates, the effects of displacement do not vary across periods. That is, the difference in the

<sup>8</sup>The finding of a decline in pre-separation earnings is interesting in its own right, but it also suggests, as pointed out by de la Rica (1995), that calculating the earnings loss associated with displacement as the difference in earnings in the year prior to displacement and the earnings after displacement may lead to an underestimate of earnings loss if one attributes the pre-separation earnings loss to the event of displacement. The DWS is also problematic in that the displacement and pre-displacement earnings are retrospectively reported. Topel (1990) finds evidence that separations that occurred less recently were less likely to be reported, and Evans and Leighton (1995) report that the DWS understates the number of workers displaced by one-third. Moreover, for some retrospectively reported data items it has been found that respondents tend to report the current value for all previous values. Although this type of recall bias may not be as problematic with a significant event such as a job displacement, if it does occur it would suggest that the DWS underestimates earnings loss. In addition, as we find with administrative data, many workers experience several separations, and respondents to the DWS are only asked to report one such displacement. Other shortcomings of the DWS are discussed in JLS (1993a, 1993b).

<sup>9</sup>The samples of displaced workers interviewed as part of the Displaced Worker Supplements are not large enough to conduct separate analyses for durable manufacturing workers in California.

earnings between time  $t$  and  $t - s$  for someone displaced at time  $t - s$  is the same as the difference in earnings between time  $w$  and  $w - s$  for someone displaced at time  $w - s$ , for all  $w$ ,  $t$ , and  $s$ . We may expect the pattern of earnings losses to vary by the period of displacement for several reasons. If declining firms first release workers who have skills that are least valued (given their earnings), and if these workers are also the ones who have more difficulty finding new jobs with comparable wages (because perhaps their skills are becoming obsolete), then the assumption of a common earnings loss by period displaced may be problematic.<sup>10</sup> On the other hand, perhaps the workers who separate first are leaving by choice because they anticipate future layoffs, and these workers experience smaller earnings losses because they initiated their job search earlier. Finally, if the local economy affects the amount of earnings loss and the available controls (e.g., county or SMSA-wide unemployment rates and employment growth rates) do not fully capture this effect, then the estimates will be biased. For any of these reasons, we would expect the earnings loss to vary by period displaced.

JLS can and do control for age, sex, initial industry and firm size, and local economic conditions (employment growth trend, deviation in employment growth from trend, and unemployment rate at the time of displacement, which varies across time and across 12 areas within Pennsylvania). Moreover, they allow the earnings loss to vary by these characteristics, which may lessen any bias that is introduced by the assumption that the effects of displacement do not vary across periods. Their approach is potentially more problematic in our data because we do not know age or sex of the workers or the geographic location of the firm or worker within California. Therefore, we investigate a more flexible specification by plotting the (median) earnings profile separately for workers displaced at each quarter over the sample period. We are able to employ this flexible procedure because of the large sample sizes in the California data.<sup>11</sup> In addition, because the data are longitudinal, we are able to examine the distribution of the earnings drop at the time of separation and the subsequent earnings recovery.

In addition to describing the pattern of earnings of displaced workers, we are interested in estimating what the displaced worker's earnings would have been if the events that led to the decline in firm employment and the worker's separation would not have occurred. We consider three different counterfactuals to address this issue. First, we assume that workers who were displaced would have received the same earnings growth as those workers who remained with the (declining) firm throughout the period. Of course, even workers who remained employed with declining firms may have experienced higher growth if their firm had not been faced with the problems that led to their downsizings. Therefore, our second counterfactual assumes that displaced workers' earnings would have grown at the rate experienced by workers who remained with their firm throughout the period and who were in healthy firms (i.e., firms whose employment expanded between the beginning and end of the period). This is perhaps an upper bound on the earnings growth that would have been experienced by displaced workers had they not been displaced.<sup>12</sup> For the third counterfactual, we assume that the worker's earnings would have continued to grow at the rate they were growing several quarters prior to displacement. Estimates from each counterfactual are compared below.

### Sample Selections

One limitation of the data is that if a worker stops receiving earnings in the California wage sector covered by UI, we do not know why. A worker could have retired, moved out of the state, withdrawn from the labor market, entered the non-covered sector, or become unemployed and not receiving UI (recall that we know if the worker is receiving UI in the state). As a result, we follow the same selection criterion that was used by JLS to overcome this problem; that is, we restrict to workers who had earnings in at least one quarter in each year of the study period. This selection leads to a sample of 531,612 out of the original 833,004, or 63.8 percent. Using the 1990 census, we estimated that, given the age distribution of durable goods manufacturing workers, eight to 12 percent would have been expected to retire between 1989:1 and 1993:4.<sup>13</sup> An additional eight to 15 percent would have been expected to leave the state during the period.<sup>14</sup> Another five

<sup>10</sup>Note that if there were no correlation among firms in the timing of their decline in employment, then across the economy at any point in time there would be some workers displaced early, i.e., less valued workers given their wage, and some workers displaced late, i.e., more valued workers given their wage. In this case, we would not expect there to be a period effect. However, firms' changes in employment are positively correlated, especially in our sample which contains workers in one large industry (i.e., durable manufacturing) in one state.

<sup>11</sup>The earnings profiles are precisely estimated; therefore, we do not report confidence intervals on the figures. To demonstrate the precision of the estimates, in Figure A.2 we display the path of mean earnings, which is similar to the path of median earnings but at a higher level, along with bands of plus and minus two standard errors around the mean for workers separating in 1991:3. This figure illustrates that even when workers are stratified by the quarter of separation, the profiles are precisely estimated. The estimates continue to be precise when the workers are simultaneously stratified by other factors that we consider below (e.g., industry, number of subsequent separations).

<sup>12</sup>In addition, both counterfactuals are likely to overstate earnings growth because firms may be more likely to release workers with lower expected earnings growth; however, there is little evidence in our data that supports differential earnings growth between separators and non-separators one to two years prior to separation.

<sup>13</sup>Recall that if a worker has any earnings in 1994 they will be included in our sample; therefore, we project retirement through the end of 1993. Based on the age distribution of workers in the 1990 census and assuming a stable population in 1990, we estimate that at least 8.04 percent of the durable goods workers in California would retire over a five-year period. For all durable goods workers over the age of 60, we calculated the difference between the number of workers age  $A$  and age  $A+5$ . The sum of these differences is the number of workers expected to retire in the subsequent five years, and the share is determined by dividing this number by the total number in the 1989 California durable goods work force. This is likely to be a lower bound because a substantial number of workers received early retirement packages in the 1990s. The likely range for the share retiring is perhaps 8 to 12 percent.

to ten percent of workers in California are not covered by the UI reporting system, so in total these three outcomes (i.e., retiring, leaving the state, and entering the uncovered sector in California) can account for almost all of the workers who left the sample.

We also drop workers in small firms (i.e., those firms with less than 50 employees in 1989:1, as did JLS) because it is more difficult to determine whether these firms are distressed, which reduces the number of workers to 478,901, or by an additional 9.9 percent. Workers whose 1989:1 firm had missing data on firm size in 1989:1 or 1994:3 are also excluded, which reduces the sample to 455,392. This selection was made because the size of the worker's 1989:1 firm in these two quarters is crucial for identifying distressed firms.<sup>15</sup>

A separation from a firm is identified by using the worker's firm's Federal Employer Identification Number (FEIN). A firm's FEIN may also change due to mergers, acquisitions, or spin-offs. To eliminate these types of separations, we exclude workers who ever experienced a firm separation in which at least 50 co-workers moved to the same firm, which reduces the sample by an additional 4.9 percent to 432,851. This selection is discussed in more detail in the appendix, and in Table 2 we present estimates of earnings loss when this selection is not made.

One of the short-comings of the data (as well as the data examined by JLS) is that we do not know why the separation occurred; it could be voluntary or involuntary, and if involuntary, it could be due to a plant closing, mass lay-off, or firing due to poor work performance by the individual worker. Given our focus on displaced workers, we are most interested in involuntary separations that were not related to poor performance. Workers whose firms are experiencing employment declines are more likely to separate involuntarily either because they were released or they anticipated being released in the near future. Therefore, we follow JLS by examining differences in earnings paths among workers whose firms experienced varying degrees of employment change. Our findings, which are discussed in the appendix, led us to select on those workers whose firm's employment shrank between 1989:1 and 1994:3. This excluded just 9.5 percent of all workers because, as noted below, California was entering a recession during this period.

Although selecting on workers separating from distressed firms is likely to provide a fairly accurate picture of the experience of displaced workers, even among these firms there may still be some workers who separated from their firm voluntarily. One group of workers separating from their firms who did not leave voluntarily are those workers who enrolled in UI after separation. Except in unusual circumstances, workers who voluntarily leave their jobs in California cannot collect UI benefits.<sup>16</sup> Therefore, we also examine the patterns of earnings for workers who received UI in the quarter they separated from their firm. However, estimated losses among these workers is likely to be a significant upper bound on the amount of earnings loss of all displaced workers because a substantial share of displaced workers do not enroll in UI, and the workers who do not enroll in UI experience smaller wage losses. Based on analyses of the 1986, 1988, 1990, and 1992 Displaced Worker Supplements (DWS), 48, 51, 51, and 49 percent of displaced workers did not receive UI benefits after being displaced. And the median wage change for displaced workers who received UI (did not receive UI) was -9.9 (-1.8), -12.1 (-3.9), -10.0 (-5.1), and -15.5 (-5.1) in the 1986, 1988, 1990, and 1992 DWSs, respectively.<sup>17</sup>

### **Firm-level Analysis**

Because we have information on a large number of workers in some firms (in fact, we have information on *all* workers within 1989:1 aerospace firms), we can investigate individual firms and determine whether the pattern of earnings loss observed across firms holds within firms. To demonstrate our within-firm findings we have chosen a large aircraft manufacturing company (SIC 3721) that had over 50,000 employees in 1989:1 (Figure 1). The firm experienced substantial downsizings over a short period of time, with an especially large decline in 1991:4, which is a period that we will examine particularly closely.<sup>18</sup> Because this downsizing was at the center of our study period, we can examine earnings several years before the large scale displacements, when employment in the firm was still growing and earnings were perhaps not being affected by the upcoming recession, and several years after the separation.

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<sup>14</sup>Out-migration rates are not available for our sample over the study period; therefore, we base our estimates on out-migration between 1985 and 1990 using the 1990 census. According to the 1990 census, there were 1,008,145 workers in the labor force outside California in 1990 who were residing in California in 1985. The estimated labor force in California in 1985 was 12,937,000. Therefore, approximately 7.8 percent of the labor force in 1985 was residing in another U.S. state on April 1, 1990. We do not know how many 1985 California workers left the U.S. We assume that the probability of leaving the state between 1989:1 and 1993:4 is the same as estimated by the census between 1985 and 1990. If anything, evidence suggests that out-migration has accelerated over time, suggesting that our estimate of 7.8 percent is low.)

<sup>15</sup>A firm may exist in 1994:3 but not have any of its 1989:1 workers in it at that time. If so, we would assume it had gone out of business. However, we assume that this did not happen often because we selected on firms with at least 50 employees in 1989:1. For the aerospace firms, we have all of the 1989:1 workers, so all 50 (at a minimum) would have to have left the firm by 1994:3 but the firm still be in business. For non-aerospace firms, we have a 20 percent random sample of all workers, so the expected number in our sample from a 50-employee firm would be 10, and all 10 would have had to leave that firm by the end of the period. Moreover, just 8.7 percent of the analytic sample were in firms in 1989:1 that were not found in 1994:3.

<sup>16</sup>The two most common examples of voluntary separators who do qualify for UI benefits are people who quit a job for a better offer and the offer falls through, or people who quit a job to follow a spouse to another region. (Source: correspondence with officials from the California Employment Development Department.) Estimates of the share of UI recipients who qualify because of these reasons are not available.

<sup>17</sup> The percent of displaced workers who received UI (did not receive UI) who were working at the time of the survey was 63 (64), 66 (66), 67 (69), and 58 (61) in the 1986, 1988, 1990, and 1992 DWSs, respectively.

<sup>18</sup>Not everyone in the firm in 1989:1 is in our analytic sample because we select on workers with positive earnings in each year. For example, some workers who were in the firm in 1989:1 retired during the period. However, workers in the analytic sample made up most of the workers in the firm by the end of the period, implying that relatively few new hires entered during the period.

It should be noted that the aerospace sector is unique in that it is highly dependent on government contracts, and its employment declines were associated with the reduction in defense procurement for military aircraft. Despite these differences, we did not find substantial differences in earnings losses between aerospace and non-aerospace workers or among other 2-digit industries, as described below.

## RESULTS

### Comparison with Pennsylvania in the early 1980s

To compare our California and JLS's Pennsylvania results, consider those workers who separated from their firm (for the first time) in 1991:3 in California and 1982:1 in Pennsylvania (Figure 3).<sup>19</sup> For the latter, this is the earnings profile depicted in Figure 1 of JLS. Separations in 1991:3 are chosen as the comparison because at this time California was in about the same stage of its early 1990s recession as was Pennsylvania in 1982:1 (Figure 2).<sup>20</sup>

JLS found that workers who eventually separated from their firm had earnings in the periods several years prior to separation that were somewhat lower than the earnings of workers who remained with the firm throughout the entire period (i.e., 1974 to 1986). Then, one to two years prior to separation, this gap in earnings began to increase. For separators, earnings dropped substantially in the quarter following separation, then it began to recover quickly in the subsequent quarters. Earnings growth eventually fell off about two to three years after the separation. Using as their counterfactual the earnings of stayers, JLS estimated that the long-run earnings loss of displaced workers was 25 percent.

The earnings pattern for California separators in the 1990s was remarkably similar. Earnings dropped steeply in the period of separation, and by about the same percentage as in Pennsylvania. In California, earnings recovered more quickly in the period following separation, but two to three years after separation the earnings levels relative to the earnings levels two to three years prior to separation were comparable to Pennsylvania. The similarities in the earnings patterns of displaced workers in Pennsylvania and California are remarkable given the different time periods, economies, types of government assistance programs available, severity of recessions, and types of workers in the two settings.

One important distinction between Pennsylvania and California is in the earnings of workers not separating from their firms, with a large gap in the earnings of California stayers and separators. Despite this difference, in California the gap between stayers and separators did not increase until one to two quarters prior to separation, which implies that their were not substantial earnings losses prior to separation. For example, the gap between stayers and separators was \$2,112 in 1989:1, and in 1991:1, just two quarters prior to separation, the gap was virtually unchanged (\$2,128). One potential explanation for this difference across studies is that JLS restrict to workers who had been employed with their firm at least six continuous years while the analyses for California did not make this selection. However, this is not likely to explain the differences because one would expect that longer tenure workers are less likely to experience a pre-separation wage decline because of union seniority rules.<sup>21</sup> The difference in the results for Pennsylvania and California is more likely to be explained by the fact that the majority of the pre-separation decline estimated by JLS was experienced by workers in the primary metals industry, and in California primary metals is a relatively small share of the durable goods workforce. In California in 1989, just 2.9 percent of the 1,406,000 workers in durable manufacturing were in primary metals (California Department of Finance, 1994), while in Pennsylvania in 1979, 23.9 percent of the 854,000 durable goods workers were employed in primary metals (U.S. Department of Labor, 1989).

### Firm-Level Analysis

Firms adopt different policies regarding who and how to downsize, and, as a result, the workers they displace may have distinct post-displacement outcomes. We investigated the earnings paths within several large firms, and in Figure 5 we display results for one firm, described earlier, that was typical of the observed patterns. The results for this firm are consistent with the cross-firm estimates. Earnings do not fall significantly prior to separation nor does the gap between separators and stayers change much, earnings drop substantially in the period of separation, it takes two to three years before earnings growth levels off, and at that time the workers' new earnings are about 18 percent below the level they

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<sup>19</sup>JLS's earnings reports for each quarter were scaled up by the ratio of California to Pennsylvania earnings in the 11th quarter prior to separation (i.e., 1989:1 in California)

<sup>20</sup>Some workers experience multiple displacements. If there are previous separations, then which separation should be assigned the earnings losses? Of course, this depends on the question of interest. Here, the interest is in how workers are affected by a downturn in their firm or industry. California was heading into a recession at the beginning of the study period, and we select on workers in firms whose employment declined between 1989:1 and 1994:3. Therefore, we associate the costs of the economic downturn to the *first* separation experienced by a worker during the period, as did JLS. (In conversations with JLS, it was clarified that they only considered *first* separations.) This distinction is quite important because, for example, 65 percent of workers with any separation in 1991:3, not just their first, experienced at least one other separation between 1989:1 and 1991:2. Figure 4 displays the earnings profiles of workers experiencing a separation in 1991:3, not just their first separation, by the number of prior separations. Workers with separations before 1991:3 had lower quarterly earnings prior to separation, in part because they had more quarters (or hours within a quarter) without earnings. Workers with one additional separation prior to 1991:3, which included 28.9 percent of all workers separating in 1991:3, experienced an earnings drop and recovery of similar relative magnitude to workers whose first separation was in 1991:3. Workers with two or more previous separations had a relatively flat profile, with very low earnings prior to the 1991:3 separation, and then their earnings increased after separation almost to the level they were as early as 1989:1. However, the earnings in 1989:1 were probably low relative to these workers' historical earnings levels because they experienced several displacements between 1989:1 and 1991:3.

<sup>21</sup>The California panel is not long enough to replicate JLS's tenure selection.

were one year prior to separation.<sup>22</sup> We also continue to find that the earnings prior to the date of separation are higher for those workers remaining with the firm relative to those who eventually separate, although this gap is reduced substantially when comparing workers initially employed with the same firm.

### **Bounding the Effects on Hourly Wages**

Some of the loss in quarterly earnings is due to a decline in the number of hours and weeks worked within a given quarter. Unfortunately the administrative data do not have information on hours that allow us to make straightforward adjustments to determine how much of the decline in quarterly earnings is due to lower hourly wages. However, utilizing data on the number of weeks each worker spent on UI in each quarter, and with some assumptions, we are able to bound the effect on hourly wages.

First, we assume that workers without earnings in a given quarter could earn the same level of wages as workers who are in fact working in that quarter. This is likely to be an upper bound, as we will demonstrate. Second, we use information on the number of weeks each worker participated on UI in each quarter (and hence did not work) to adjust quarterly earnings.<sup>23</sup> This is likely to be a lower bound because some workers are not fully employed but are not receiving UI because, for example, they have exhausted their UI benefits.

Figure 6 displays the earnings of those workers whose first separation was in 1991:3, which is the same as Figure 3. In addition, we display the earnings if, instead of assuming zero earnings in quarters of no wages, we assume that these zero-earners could have earned the (median) earnings earned by those who did work (i.e., the profile labeled “assuming group median”). This imputation suggests that the drop in quarterly earnings at the time of separation is largely determined by changes in hours. This is re-enforced by the pattern of the employment rate in Figure 6, with almost 30 percent of workers having no wages in the quarter following separation.<sup>24</sup> This rate declines fairly rapidly, so that one year after separation less than 10 percent are without earnings within the quarter. However, the employment rate remains at 90 to 94 percent even two to three years after separation. As a result, the long-run decline, 14.3 percent, is lower than if no hours adjustment is made, i.e., 19.7 percent.<sup>25</sup>

This wage profile is likely to be an upper bound because people who are working are likely to be high wage workers. This claim is supported by the fact that the pre-separation wages of workers who never had a full quarter with zero earnings after separation are substantially higher than for workers who did (Figure 6). However, even individuals working within the quarter may not be working full time, which would suggest that this may not be an absolute upper bound on hourly wages. It is worth noting that with this imputation the earnings level is not much lower in the short-run than in the long-run, which is consistent with Ruhm’s (1991a) result that the long-run losses in weekly wages (14) are only slightly less than the short-run losses (16 percent). In sum, the evidence suggests that quarterly earnings decline substantially and then recover, but much of the initial decline, perhaps about one-half, is due to a reduction in hours. The remaining short-run decline is due to a decline in real hourly wages, and this loss is not recouped even two to three years after separation.

An alternative approach to determining the effects of wages instead of hours or weeks worked is to use information on the number of weeks enrolled on UI within each quarter. We inflate quarterly earnings by the share of weeks spent on UI, and this wage path is depicted in Figure 7.<sup>26</sup> There were a non-trivial number of workers who were on UI in every week within a quarter but also received wages in that quarter. This is probably due to severance payments or the fact that a small share of workers continue to work at a reduced level and receive UI at the same time, as discussed earlier (footnote 21). Because some workers who receive UI in every week within a given quarter also have some wages in those quarters, we calculated two “UI adjusted” wage rates if the worker was on UI the entire quarter; one does not adjust wages at all and the other multiplies wages by the number of weeks in the quarter (i.e., assuming that the worker was employed only one week within the quarter). The profile adjusting for UI weeks is fairly similar to the profile that uses the (median) wages of employed workers as an imputation, at least in the long-run, providing a fairly narrow bound on the long-run losses in hourly wages (Figure 7).<sup>27</sup> These estimates suggest that a substantial share of the short-run effect on quarterly wages is due to changes in hours or weeks worked, but that the majority of the long-run effect is on hourly wages.

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<sup>22</sup>The gap in earnings between separators and stayers in the first five quarters (i.e., 1989:1-1990:1) prior to separation for workers separating in 1990:3 is 17, 23, 18, 21, and 21 percent, respectively, implying that there is little change in relative pre-separation earnings.

<sup>23</sup>This estimate will not be a lower bound if there is a substantial number of displaced workers who receive zero earnings continuously for at least one year because these workers are not in our analytic sample. However, as discussed earlier, this is likely to be a small share of workers. In California, UI recipients can have some limited amount of earnings and still be eligible for UI, and this too would imply that our lower bound estimate may in fact not be a lower bound. However, only about 10 percent of UI recipients do in fact have labor market earnings at the time they receive their first UI payment (Correspondence with the Employment Development Department of the State of California). Of course, assuming zero earnings for those with no earnings is the lowest lower bound.

<sup>24</sup>We require a worker to be employed in the quarter of separation, as did JLS (1993b, page 57, footnote 8). It is also interesting to note that the pattern of employment rates that we estimate is very similar to that found by JLS (1993b, page 90).

<sup>25</sup>Here we measure the long-run decline as the percent change in the sum of median earnings from 1989:1-1989:4 and 1993:4-1994:3.

<sup>26</sup>Specifically, we inflate earnings by: (number of weeks in the quarter)/(number of weeks in the quarter-number of weeks on UI in the quarter).

<sup>27</sup>The earnings spike at the period of separation is not surprising given that many workers are given a severance payment when they are separated; adjusting for hours, the quarter of separation would then appear to be one with unusually high earnings.

### **Counterfactual Earnings Growth**

Thus far we have documented the earnings paths of workers separating and not separating from their firm. But one question of primary interest is what would have been the earnings of the displaced worker if the events that lead to their displacement would not have occurred. We investigated three counterfactuals to address this question. First, we assumed that the earnings growth of displaced workers would have been the same as the earnings growth of workers who remained with the firm throughout the period. Assuming that separators' earnings between 1989:1 and 1989:4 were not affected by the 1991:3 separation, we assume that workers who separated, had they not separated, would have received the growth rate in annual earnings actually experienced by stayers. The second counterfactual is similar to the first, but instead of assuming the growth rate of stayers in declining firms, we assume that the separators would have had the growth rate experienced by workers in firms whose employment grew. These two counterfactual earnings paths and the associated earnings loss due to displacement are depicted in Figure 8.

An alternate counterfactual is to use the earnings growth experienced by separators themselves one to two years prior to separation as a prediction of their future earnings growth had they remained with the firm. The growth rates using this approach are very similar to the growth rates experienced by stayers (in declining firms) in future periods; therefore, we do not display this counterfactual.

Based on the first counterfactual, we find that (median) earnings were 59.1 percent below their expected level in the first quarter after leaving the firm (Figure 8). Quarterly earnings then increased sharply, so that just one quarter later the gap was reduced to 34.9 percent. Another four quarters later, the gap shrank to 22.7 percent. The earnings gap stabilized two to three years after separation, with earnings 17.3 percent below expected levels. This gap is remarkably close to the long-run loss in *weekly wages* of 14 percent estimated by Ruhm (1991a) and 21 percent estimated by Topel (1990). It also suggests that the long-run effects on quarterly earnings are primarily effects on wage rates and not labor supply, which is consistent with the fact that only five to eight percent of workers are not working two to three years after separation (Figure 6). Ruhm also finds that the loss in weekly wages in the calendar year following displacement is only 16 percent, suggesting very little recovery after the first year. Our findings suggest that there is tremendous variation in earnings loss within the first year following displacement, although much of the gain is due to changes in hours, with the share who are working rising from 70 percent to close to 90 percent within the first four quarters.

The counterfactual earnings profile is somewhat higher when it is assumed that displaced workers would have experienced the earnings growth of stayers in healthy firms. As a result, the estimated earnings losses are greater. The long-run loss is 24.7 percent instead of 17.3 percent, which is remarkably close to JLS's estimated loss of 25 percent.

Earnings losses, including the pre-separation decline in earnings, have been found to vary by industry of initial employment (JLS, 1993a; Carrington and Zaman, 1994). Figure 9 displays the earnings loss in each quarter for workers displaced from the major two-digit industry groups (i.e., the percent difference in actual quarterly earnings and the quarterly earnings the displaced workers would have had had their earnings grown at the same rate experienced by people in their industry who remained employed for the same (declining) firm throughout the period). The patterns are fairly similar across industries, with little or no pre-separation decline in earnings, substantial short-run earnings losses of 30 to 60 percent, and long-run losses of 15 to 25 percent.

#### *Restricting to Workers Receiving UI in the Quarter of Separation*

The pattern of earnings for workers who were enrolled in UI in the quarter they separated from their firm (i.e., 1991:1) is also displayed in Figure 8. Prior to separation, the earnings of these workers were 10-11 percent lower than the earnings of all workers separating in 1991:1. As expected, these workers also experienced larger earnings losses; two to three years after separation, the earnings gap between workers enrolling in UI and all workers separating in 1991:1 increased to 22-23 percent. As discussed above, the experience of these workers provides an upper bound on the amount of earnings loss because a substantial share of displaced workers do not enroll in UI, and the workers who have not enrolled are more likely to have quickly found a new job with good wages. This upper bound suggests that the estimates of long run earnings loss of 17-24 percent, based on the sample of all workers separating from firms with declining employment, are at most about 10 percentage points too low.

### **Differences in Earnings Losses by Period Displaced**

Our approach has the advantage of allowing the effects of displacement to vary across time periods, and here we investigate the importance of this assumption. We plot the earnings path for workers experiencing their first separation in various quarters. Figure 10 demonstrates that the amount of earnings drop at the time of separation varies substantially by the date of displacement, with the largest declines among workers separating during the peak of the recession in 1992. This suggests that the data (without controlling for observable local labor market conditions, which JLS were able to do) violate one of the assumptions of JLS's approach. That is, the effects do vary by period of displacement. In addition, it appears that firms tended to release lower earnings workers first, which is consistent with anecdotal evidence for California.

The workers whose first separations are in later periods are likely to have accumulated greater years of tenure at the time of displacement, and these workers may have more difficulty finding new employment at comparable wages. Therefore, differential tenure could be hypothesized to account for the observed time pattern in Figure 10. However, the evidence is not consistent with this hypothesis. First, the changes in the earnings drop at the time of separation are discrete, with a large increase between workers laid-off just a few quarters apart. Second, we plotted earnings profiles similar to Figure 10, but instead of requiring that the worker be employed with the same firm since 1989:1, we required that the worker be employed with the same firm for the six quarters prior to separation, thereby reducing the tenure selection bias (Figure 11). Although tenure differences explain some of the pattern, there remains substantial variation in earnings loss across periods.

Carrington (1993) and JLS (1993a) find that the amount of earnings loss is associated with the local economic conditions at the time of displacement. The pattern of earnings losses in Figure 10 relate quite closely with California's economic conditions. In Figure 12 we demonstrate this relationship by plotting the quarterly unemployment rate in California (using the simple average of monthly rates estimated by the California Employment Development Department) against the earnings drop at the time of separation and the earnings recovery following separation. The earnings drop is the percentage change in the sum of quarterly earnings eight to five quarters prior to displacement and the sum of quarterly earnings in the first four quarters after displacement. Earnings recovery is defined as the percentage change in the sum of quarterly earnings in the first four quarters after displacement and the sum of quarterly earnings nine to 12 quarters after displacement.<sup>28</sup>

The evidence suggests that the size of the drop is closely related to economic conditions in the labor market at the time of separation, which is not surprising. What is somewhat surprising is that the size of the recovery also appears to be *positively* related to the economic conditions at the time of displacement. Perhaps this is due to the fact that earnings have a greater amount to recover for those experiencing large earnings drops. It also suggests that the negative effects of local economic conditions at the time of displacement may not be persistent, although additional analyses with longer panels should address this issue more fully.

### **Distribution of Losses**

The average earnings loss, which has been discussed thus far, masks substantial differences among workers. In Table 2 we report the earnings drop and recovery, as defined above, for each period that has the requisite number of future or past earnings quarters available. As demonstrated in Figure 12, the median drop increased substantially as California's recession deepened. In addition, within each time period there was a wide variation in earnings losses. In all periods, at least 25 percent of workers separating experienced an earnings drop of at least 50 percent, and in the most difficult period the worst 25 percent had an earnings loss of at least 92 percent. At the same time, another one-fourth of the workers experienced no more than a very small earnings loss, and many in fact had earnings gains. Earnings recovery also varied substantially among workers, with a median rebound of 10 to 20 percent and greater growth in the more recent period.

To further illustrate the variation in earnings losses, we plotted the earnings paths for those workers separating in 1991:3 by the quartile of their earnings drop (Figure 13). The bottom 25 percent experienced dramatic earnings declines, and in fact the median quarterly earnings in the first three quarters after separation was zero for these workers. Their earnings then increased quickly, but even in the long-run they had large earnings losses. Even though workers in the lowest quartile had similar pre-separation earnings as those in the second lowest quartile, their earnings drop was much less severe, and the long-run losses were substantially lower. The pre-separation earnings of the top two quartiles were quite similar to each other, but they followed distinct paths following their displacements. The top quartile experienced earnings growth even in the immediate quarter after displacement, and in less than one year after separation their earnings were about 25 percent greater than the earnings of workers in the second highest quartile; this 25 percent gap persisted throughout the rest of the study period.<sup>29</sup> Moreover, the gap in quarterly earnings between the workers who experienced the highest and lowest earnings drops increased from about \$1,500 two years prior to separation to about \$7,500 three years after separation.

One of the sample selections was to drop workers who moved to a new firm with 50 or more co-workers in order to exclude workers experiencing a merger or spin-off. (See the discussion in the appendix for details of this selection.) In the final columns of Table 2 we report the median earnings drop and recovery if we would not have made this selection. In most quarters this selection does not alter the results substantially, but in some quarters (e.g., 1992:3 and 1992:4) there were large mergers, and these workers' earnings did not decline nearly as much as the earnings of other workers.

### **What Explains the Variation in Earnings Paths?**

#### *Subsequent Separations*

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<sup>28</sup>For some workers, the sum of quarterly earnings in the first four quarters after displacement is zero. In this case, the percentage earnings recovery is not defined, and it is therefore assumed to be 100.

<sup>29</sup>Because we cannot determine definitively whether separations were involuntary, it may be that the share of workers separating voluntarily is higher among the workers with smaller earnings declines, which may explain some of the disparities in earnings loss. However, all workers separated from firms whose employment was falling, and most workers' firm's employment declined substantially, as discussed in the appendix.

One cost of being displaced is high rates of subsequent job loss, which is quite common. In addition, subsequent separations are closely related to the path of post-separation earnings, which is consistent with new evidence reported by Stevens (1995) using the PSID. Figure 14 depicts the earnings for workers who had zero, one, two or more, and any number of additional separations after separating in 1991:3. In no case was there a substantial decline in pre-separation earnings except in the one or two quarters prior to separation. It is somewhat surprising that earnings did not decline more for the workers who eventually separated frequently; if firms reduce the hours and the wages paid to workers prior to releasing them, then it is perhaps most likely to occur among these “high turnover” workers. In addition, workers with fewer separations had higher pre-separation earnings, and they had a much smaller earnings drop than workers with a large number of separations, as one would expect simply because of the effects of changing jobs on the hours and weeks worked. In all cases the earnings rebounded substantially after separation, although even two to three years after the first separation, the pre-separation earnings gap that existed among these workers had increased. However, the earnings of workers with several additional separations were still growing at the end of the period, so data after 1994:3 would be needed to assess the long-run earnings loss of these workers.

#### *Change in Industry*

But what causes workers to have additional separations or lower quarterly earnings? One important factor is changes in industry of employment. Workers who remained in the manufacturing sector after separation had higher earnings prior to separating relative to those who left manufacturing (Figure 15). Moreover, the long-run earnings losses for workers not finding new employment within manufacturing were substantially larger, and in the long-run the gap in earnings between these workers and workers who remained in the same 2-, 3-, or 4-digit industry almost doubled relative to the pre-separation gap. This finding is consistent with JLS and suggests that there is substantial industry-specific capital or that rents are associated with these industries, which are perhaps more highly unionized than non-manufacturing industries.

#### *Firm Size*

Consistent with the literature (e.g., Brown, Hamilton, and Medoff, 1990), workers in larger firms earn substantially higher wages, with earnings being especially low in firms with fewer than 500 employees (Figure 16). However, in general, the long-run earnings losses are greater for workers in larger firms. Workers in firms with 50 to 500 employees had earnings that were 12 percent lower two to three years after displacement relative to their earnings two to three years prior to displacement; the decline for workers in the largest firms was 18 percent.

#### **SUMMARY**

The (presumably) increasing trend of downsizing has renewed interest in the earnings losses of displaced workers. Using administrative data from California that allow us to examine an unusually large number of worker-firm separations, we find that the long-run earnings loss appears to be 17 to 25 percent relative to what displaced workers would have earned had the events that led to their displacement not occurred. In the short-run, there are substantial declines of approximately 60 percent, but this is largely due to reductions in weeks and hours worked. These findings, which are consistent with previous studies that have examined earlier periods and different regions and industries, continue to hold in firm-specific analyses.

Contrary to previous findings, quarterly earnings are not found to decline substantially prior to displacement. In addition, we find tremendous heterogeneity in workers’ earnings losses following displacement, and this variation is associated with the economic conditions at the time of displacement, whether workers change industry of employment, the size of the worker’s firm, and the number of subsequent separations.

## APPENDIX

### CONSTRUCTION OF DATA FILES, COMPARISON OF WAGE DATA WITH EXTERNAL SOURCES, IDENTIFICATION OF MERGERS/ACQUISITIONS/SPIN-OFFS, AND SELECTION ON DECLINING FIRMS

#### Construction of Data Files

The data that we examine are drawn from two files: the base wage file and the single claimant, or UI file. In each quarter, all employers covered by the UI system are required to report the total wages that they paid to each employee. The state maintains a data file that contains the earnings information as well as Federal Employer Identification Number (FEIN), Social Security Number (SSN) of the worker, four-digit SIC of the employer, and the number of employees of the firm. The UI file contains, for each quarter and each SSN, the number of weeks that benefits were received, and the SSN. In addition, UI claimants are asked to voluntarily report their age, sex, and ethnicity.

Using these two files, we first drew the SSN for all workers in an aerospace industry (i.e., SIC codes 366, 372, 376, 381, and 382) and a random sample (based on the last digit of the workers' SSN) of 20 percent of all non-aerospace workers as of 1989:1. For these two groups of workers, which consisted of 517,148 aerospace and 315,856 other durable workers, a file was created that contained the FEIN, SIC, SSN. Then, for each quarter, from 1989:1 through 1994:3, the base wage record and UI record (if they existed) for each of the workers was selected using the workers' SSNs. Workers who held jobs in more than one firm would have multiple records. This file contains all of the information available on the base wage file (for each employer of each SSN) and UI files for each quarter. Base wage information includes SSN, quarter, wages, FEIN, four digit SIC, number of employees in the firm. Information from the UI file for each quarter includes SSN, quarter, and the number of weeks benefits were received. The SSN and FEIN were then scrambled to ensure that individual workers and firms could not be identified.

#### Comparison of Administrative Earnings Reports with the 1990 Census

The 1990 census estimate of annual wage and salary income for aerospace workers in California is \$37,566 in 1989 dollars. Inflating to 1994 dollars using the CPI, this amounts to \$44,462 ( $=37566 * (151.5/128)$ ). For non-aerospace durable manufacturing, average earnings are \$27,656 in 1989 dollars. Inflating leads to an estimate of \$32,733 in 1994 dollars. The estimates from the administrative data from California are comparable; the mean earnings for aerospace workers in the first quarter of 1989:1 (in 1994 dollars) is \$11,674, which is \$46,696 in annual terms. For non-aerospace durable manufacturing, the average earnings in 1989:1 is \$8,134 or \$32,536 annually. The estimates from the census and the administrative data are extraordinarily close. One reason why the administrative estimates are higher, at least for aerospace workers, is that the census has a top code for earnings of \$140,000 while the administrative data has no top-code.

#### Number of Weeks on Unemployment Insurance

The number of weeks on UI, which was computed by the Employment Development Department in California, is calculated by adding up the "weekly action payment records." These include "paid" and "unpaid" weeks, where "paid" weeks are simply the weeks that benefits were paid.<sup>30</sup> The following reasons are counted as unpaid weeks:

- |                          |                       |
|--------------------------|-----------------------|
| 1. Waiting periods       | 6. Disqualifications  |
| 2. Under appeal          | 7. Desk certification |
| 3. Waiting period credit | 8. False statement    |
| 4. Refused suitable work | 9. Overpayment offset |
| 5. From PH2 record       |                       |

#### Changes in the Employer Identification Number

Changes in a worker's FEIN are used to identify changes in a worker's firm. The reasons a firm's FEIN may change include, for example, business failure, the sale of the business to another entity, merger with another firm, or incorporation of the firm. In the case of mergers, acquisitions, and splits, the guiding principal in determining whether a new FEIN is established (or two FEINs are merged) is "continuity of control," as defined by the California Unemployment Insurance Code (Division 1, Part 1, Chapter 1, Article 2, 135).

We estimated the number of workers who appeared to have experienced a merger or an acquisition as opposed to a "true" firm separation, and in Table 2 we present earnings losses including and excluding workers who appeared to experience the former. Recall that we have the population of aerospace workers in 1989, not a sample, which allows us to examine the movement of *all* 1989:1 co-workers. We first calculated the number of each worker's co-workers in quarter  $t$  who were also their co-workers in period  $t-1$ , when the FEIN for the workers' employer at  $t$  and  $t-1$  were different. Among all aerospace workers, 15.3 percent experienced the same employer change between adjacent quarters as at least one co-worker sometime during the study period. However, in most cases the number of co-workers who made the same change

<sup>30</sup>Note that adjustment payments are not included as a week of benefits.

was very small; 39 percent were moves of 10 or fewer co-workers. On the other hand, 30 percent of the workers moved with at least 100 co-workers.

It is quite likely that co-workers separating from one firm were hired by the same new firm in the subsequent quarter without a merger or acquisition, although this is not as likely to explain the cases in which a large number of co-workers moved simultaneously. However, it may be that small firms are being purchased or spun-off. Therefore, we also examined the *share* of co-workers at time  $t$  who were co-workers at time  $t+1$ . Of those making the same employer change with at least one co-worker in adjacent quarters sometime between 1989:1 and 1994:3, 48.6, 10.1, 13.2, 5.5, 15.3, and 15.1 percent of the workers made the same employer move as 1-10, 11-30, 31-50, 51-70, 71-90, and 90-100 percent of their co-workers at time  $t$ .<sup>31</sup> As a last step we calculated the share of workers who had at least 50 co-workers or 50 percent of the firm's work force make the same FEIN change. Among those workers experiencing the same change in FEIN with at least one co-worker, 59 percent fell into this category. Based on these estimates, we excluded the workers who at any time during the period moved with at least 50 co-workers to the same new firm. Among the workers who did not satisfy this 50 co-worker-selection, very few moved to a new firm with a substantial *share* of their co-workers. Therefore, our selection is likely to have eliminated most all workers experiencing a merger or spin-off. The change in earnings with and without this selection are depicted in Figure A.1. In most periods the median earnings drop and earnings recovery with and without the selection are similar. However, in some periods the selection does alter the estimates substantially. In the periods where the wage drop differs in these two samples, the wage drop for the sample that excludes the workers experiencing a move with 50 or more co-workers is larger, which is consistent with these changes in FEIN representing mergers or spin-offs and not true separations.

### Employment Levels

In some quarters firms fail to report their employment levels, and in our analytic sample 64.2 percent of the workers had missing data for their firms employment in at least one quarter during the six year period. However, quite often a firm's employment level would be missing in only one quarter and available in the adjacent quarters, presumably due to lack of reporting on the part of the firm. We did the following to impute these missing quarters. First, if a worker was employed with the same firm on both quarters surrounding the quarter for which the employment level was missing, and the employment levels for the surrounding quarters were not missing, then we assumed that the employment levels for the current quarter was the average of the two surrounding quarters. After making this imputation, only 18.2 percent of workers had at least one quarter with missing employment levels. Next, if the worker was not employed with the same firm in both the preceding and subsequent quarters, but the worker was with the same employer in the subsequent quarter, and the firm's employment level in that subsequent quarter was not missing, we assumed the missing employment level was equal to employment in that subsequent quarter. This reduced the percent of workers with missing employment levels in at least one quarter to 10.5 percent.<sup>32</sup> Finally, if the worker was with the same firm in the quarter preceding the quarter with missing employment level, and the employment levels in the preceding quarter was not missing, we assumed that the current quarter's employment level was equal to the employment level in the preceding quarter. After this imputation, just 4.9 percent of workers had at least one quarter with missing employment level data.

### Selection on Declining Firms

To abstract from voluntary separations, we restrict the sample to workers in firms whose employment declined between 1989:1 and 1994:3. This eliminates only 9.5 percent of the sample because California was entering a recession at the beginning of the period and had not fully recovered by the end of the period (Table A.1).

This selection was based on analyses of the earnings path of workers by the amount of employment change experienced by their 1989:1-firm between 1989:1 and 1994:3, which is summarized in Figure A.2. In Figure A.2 we depict the earnings of workers who separated in 1991:3 by the quartile of the change in their initial firm's employment between 1989:1 and 1994:3. (The range of employment change for the first, second, third, and fourth quartiles are: less than -86.8 percent, -86.8 to -49.0 percent, -48.9 to -33.7 percent, and greater than -33.7 percent.) We also display the earnings of workers who separated from firms that grew during the period.

As expected, workers in the second and third quartile experienced greater losses than workers in the fourth quartile or workers in growing firms (i.e., the earnings gap between these groups of workers shrank following separation). Workers in firms that experienced the greatest employment declines (i.e., workers in the first quartile) did not have greater earnings losses. This pattern may be explained by the fact that these workers are the most likely to have been displaced

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<sup>31</sup>If a worker had more than one employer move that they shared in common with a co-worker, the one which that worker shared with the greatest number of co-workers was chosen for calculation of these rates. Also, because new workers entered the industry after 1989:1, the worker may have had more co-workers make the same employment change than is estimated with these data. Technically, we estimate the number of co-workers making the same change between  $t$  and  $t+1$  among those who were working in aerospace in 1989:1.

<sup>32</sup>We iterated this imputation for all adjacent quarters. For example, if a worker was employed with the same firm in quarters  $t$  through  $t+n$ , and the firm's employment level was available in period  $t$  but no other period, then the level for  $t$  would be assigned to all periods  $t+1$  to  $t+n$ . However, assignment of firm size more than three quarters away from the assigning quarter was rare.

in a plant closing, and as found by Gibbons and Katz (1991), workers displaced due to plant closings experience smaller earnings losses relative to workers displaced for other reasons.

JLS emphasize results from their “mass layoff” sample, which consists of those workers whose firms experienced a 30 percent decline in employment.<sup>33</sup> In the California sample, only 27 percent of the workers would not satisfy this selection. Moreover, when we restrict to declining firms, just 18 percent of the workers were in firms whose employment declined by less than 30 percent. In addition, in our firm-specific analysis we focus on one large firm that clearly had a substantial downsizing in the quarter under consideration, and our results for workers in this firm are consistent with the cross-firm analysis. Therefore, any differences between JLS’s findings and ours are not due to this sample selection.

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<sup>33</sup>JLS define employment change as the difference between the worker’s firm’s employment in the quarter of displacement and employment in the quarter in which the worker’s firm’s employment peaked during the late 1970s.

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Figure 1  
Total Quarterly Employment for Aerospace Manufacturing Firm  
and Number of Workers from This Firm in the Analytic Sample

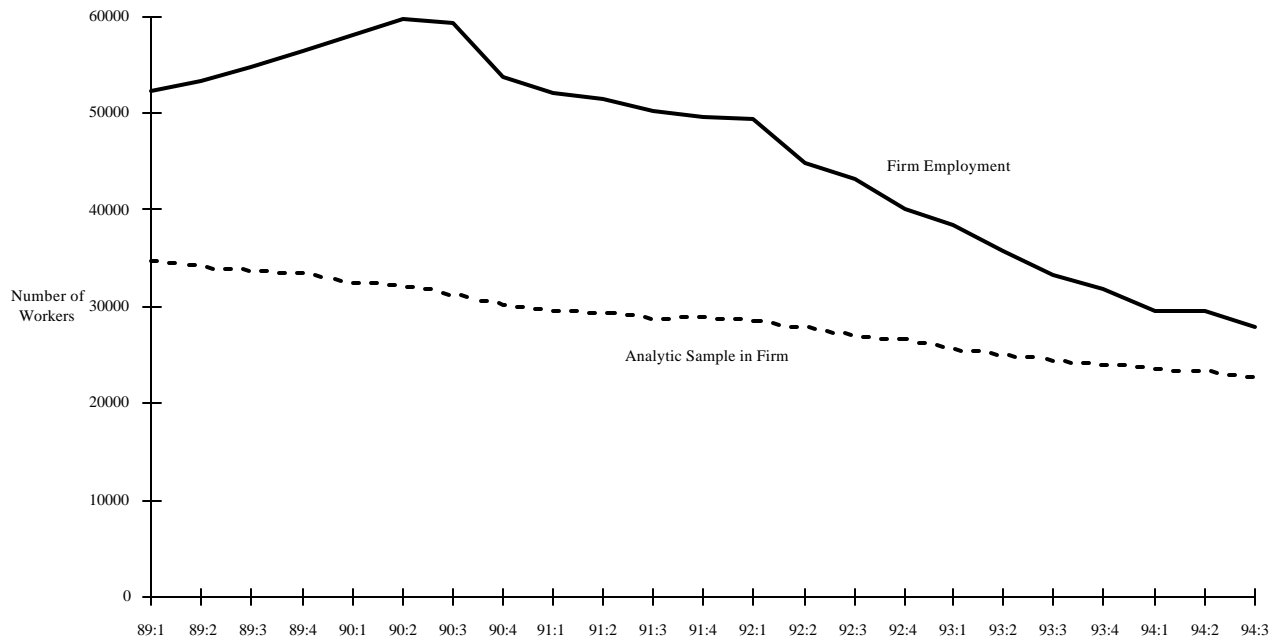


Figure 2  
Unemployment Rates in California and Pennsylvania, 1971 to 1994.

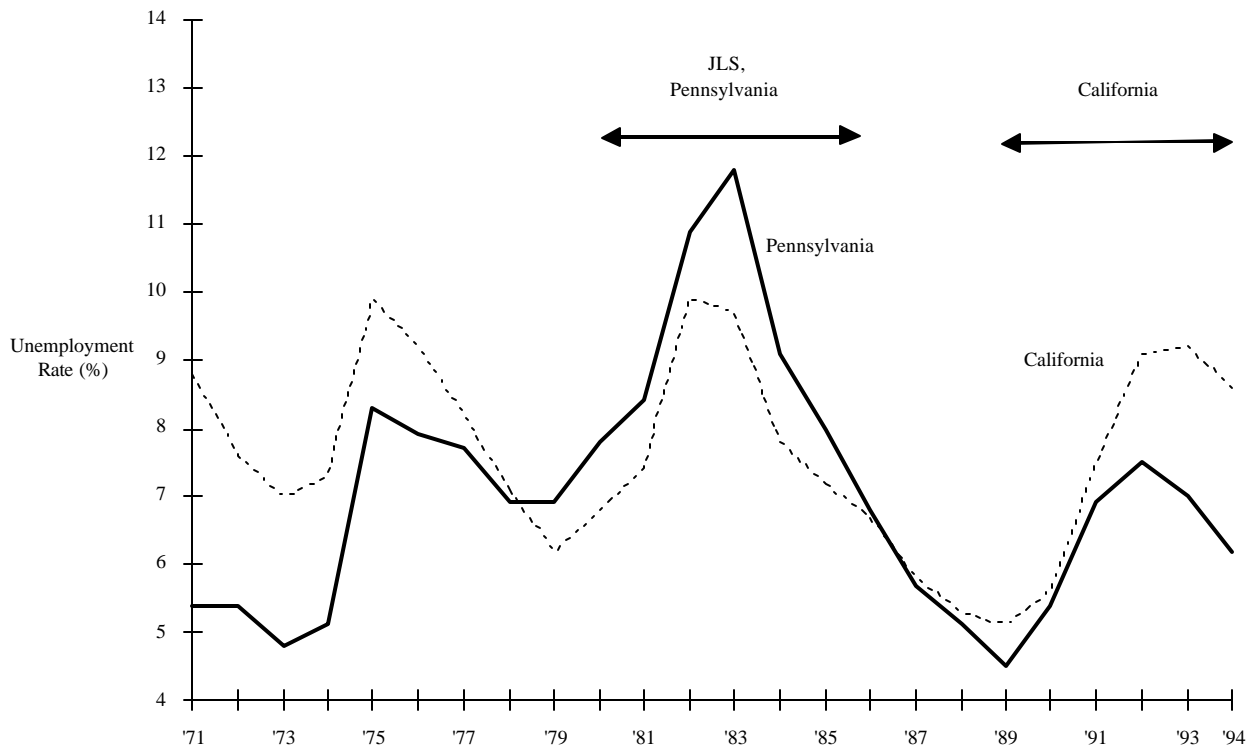


Figure 3  
 Comparison of Pennsylvania and California Earnings Profiles of Displaced Workers  
 Quarter of Separation for Pennsylvania Workers is 1982:1

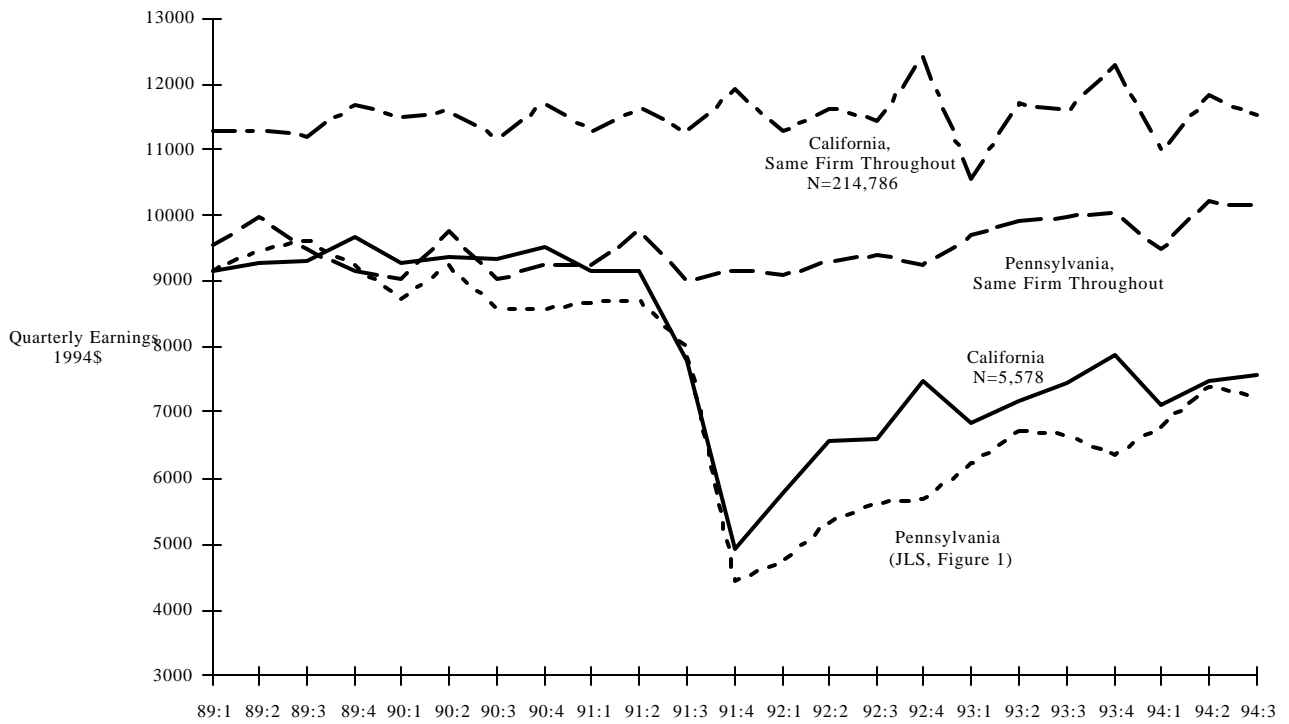


Figure 4  
 Earnings Profiles of Displaced Workers By Number of Separations Prior to 1991:3

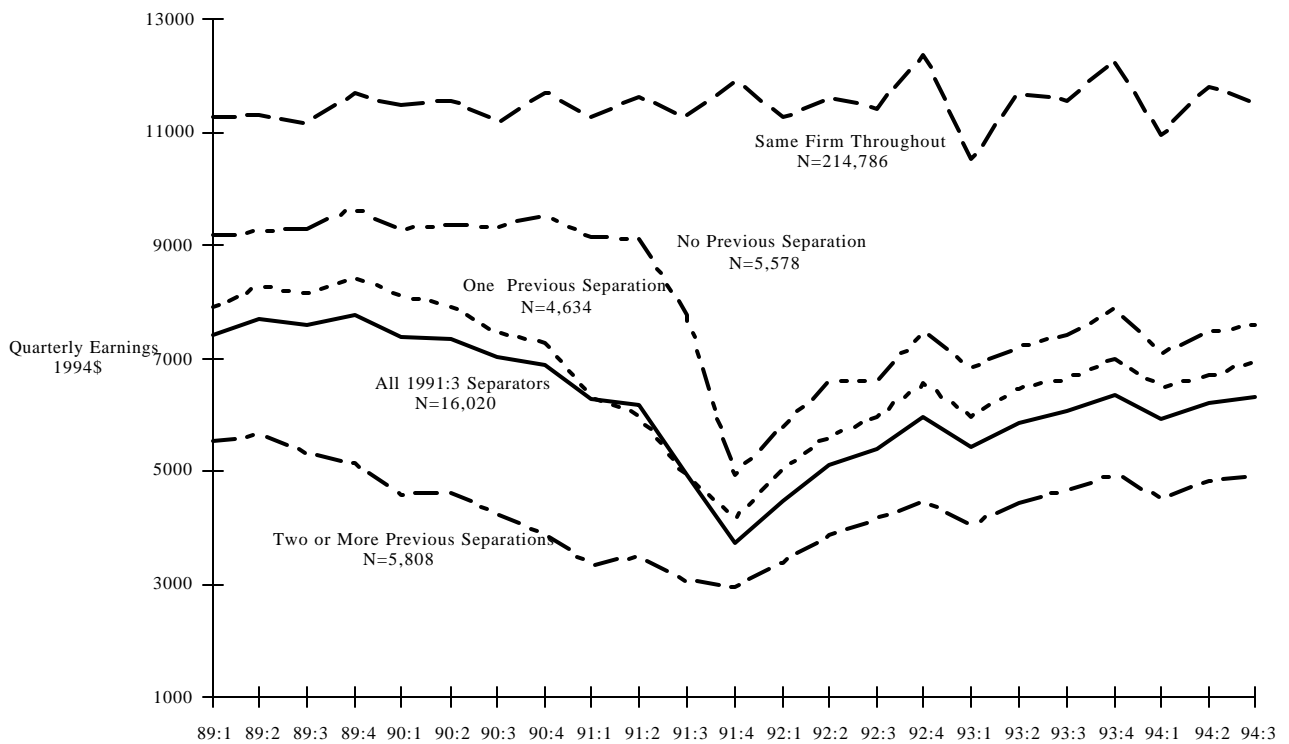


Figure 5  
 Quarterly Earnings of Workers Who Were Employed in a Large Aircraft Manufacturing Firm in 1989:1

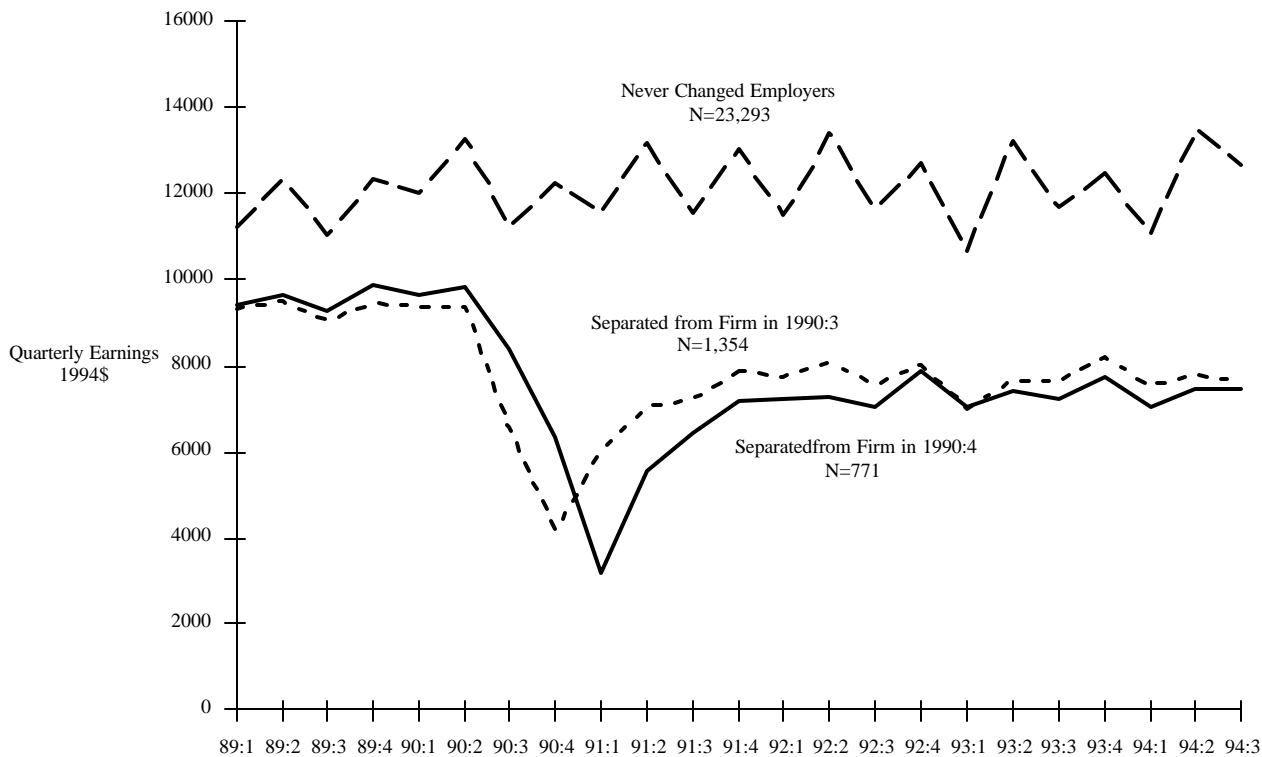


Figure 6  
 Earnings and Employment Profiles of Displaced Workers Whose First Separation Was 1991:3  
 Assuming Zero Earnings and Assuming Group Median When Earnings are Zero (N=5,578)

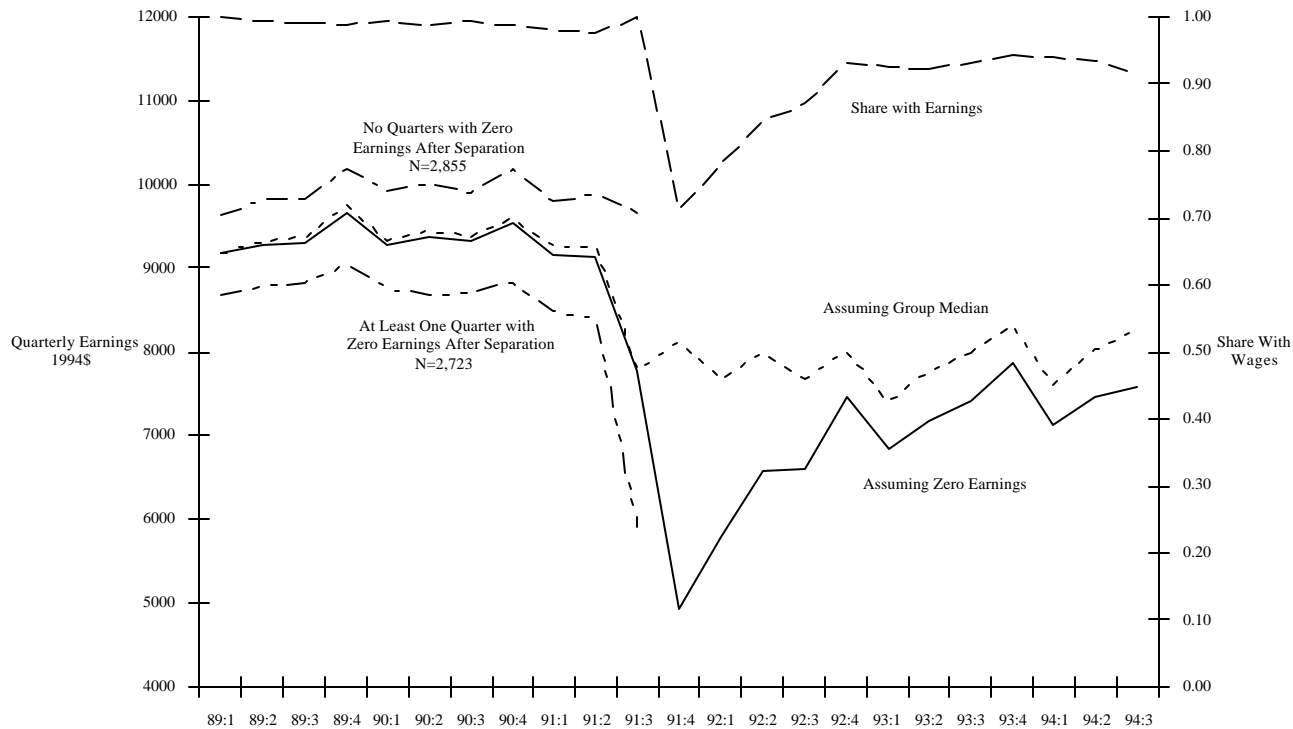


Figure 7  
Earnings Profiles of Workers First Separating in 191:3  
Adjusting for Weeks on UI

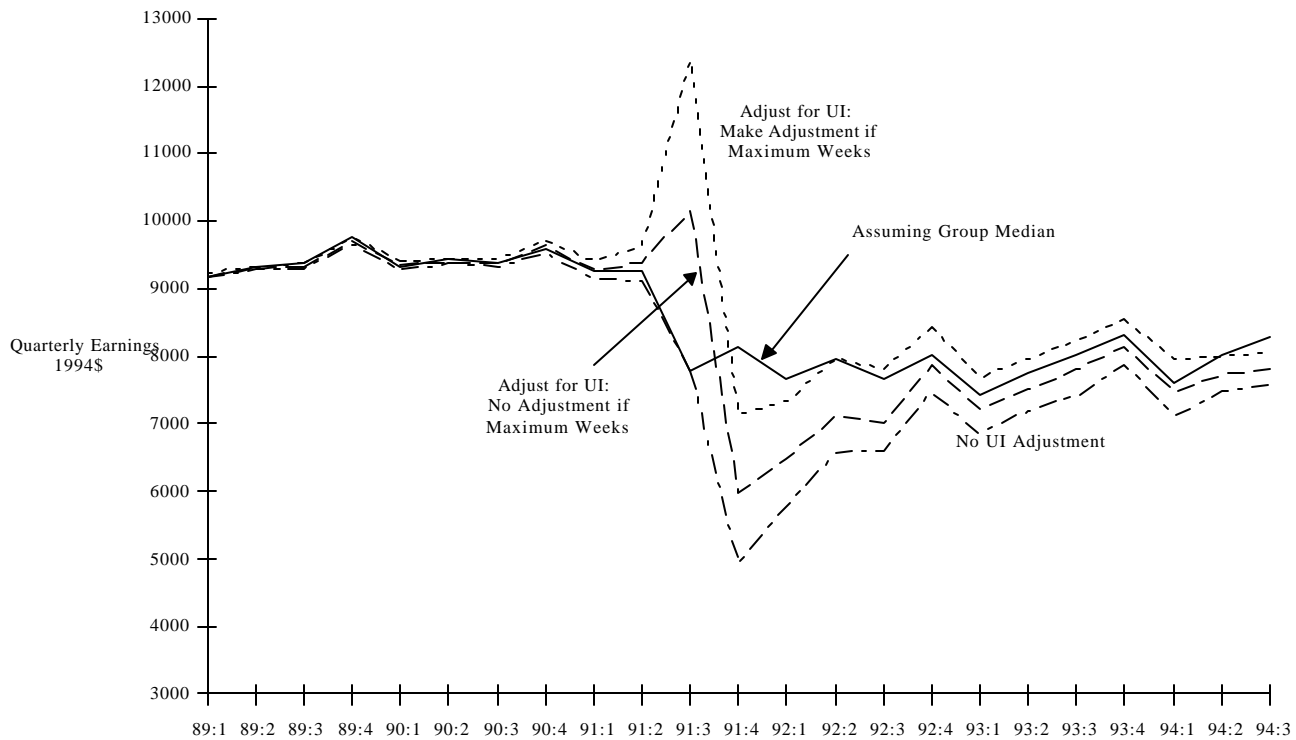


Figure 8  
Counterfactual Earnings Growth of Displaced Workers

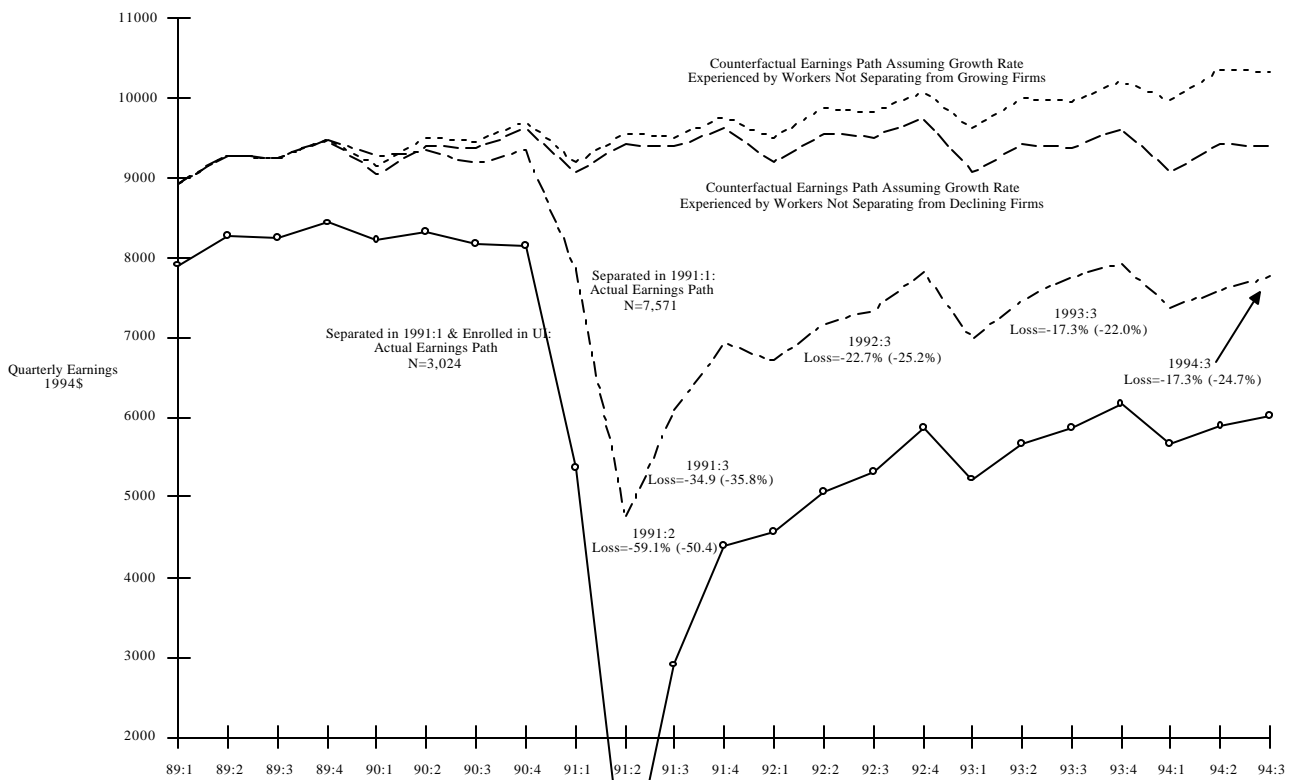


Figure 9  
Earnings Loss Relative to Earnings in 1989:1 by Industry of Employment in 1989:1  
(N=Number of Stayers/Number of Separators in 1991:3)

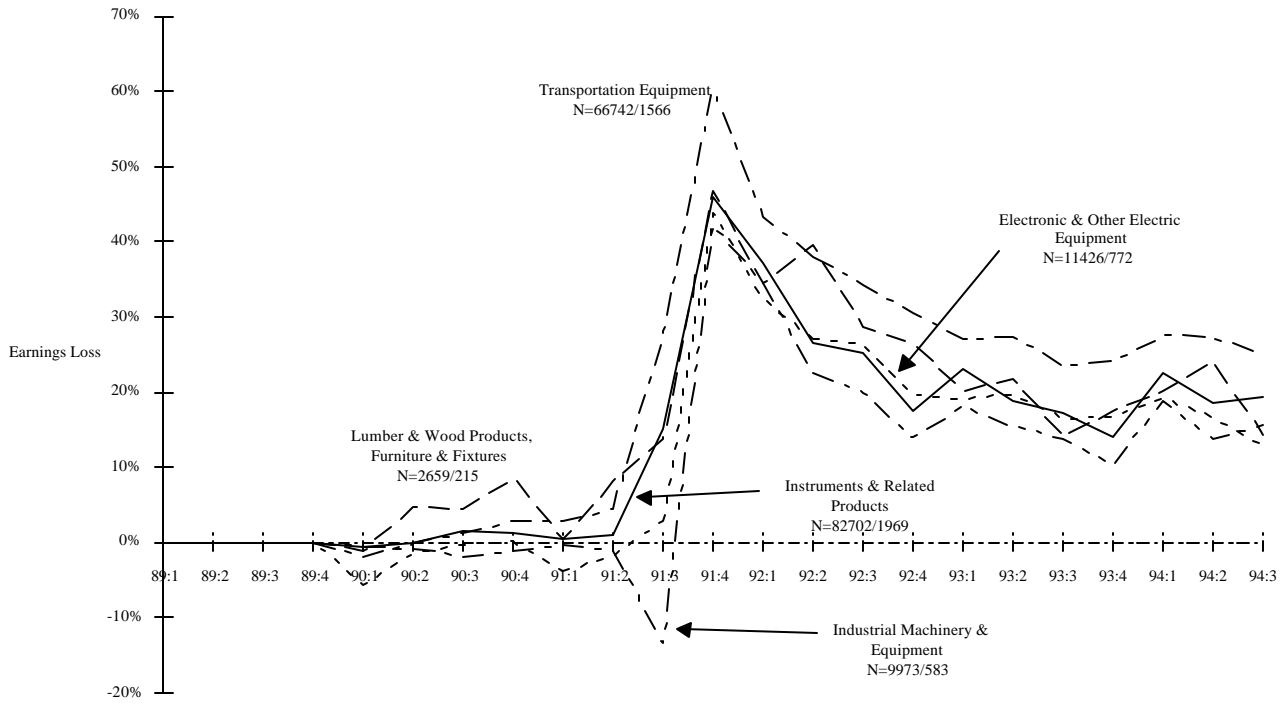


Figure 10  
Earnings Pattern by Quarter of First Separation

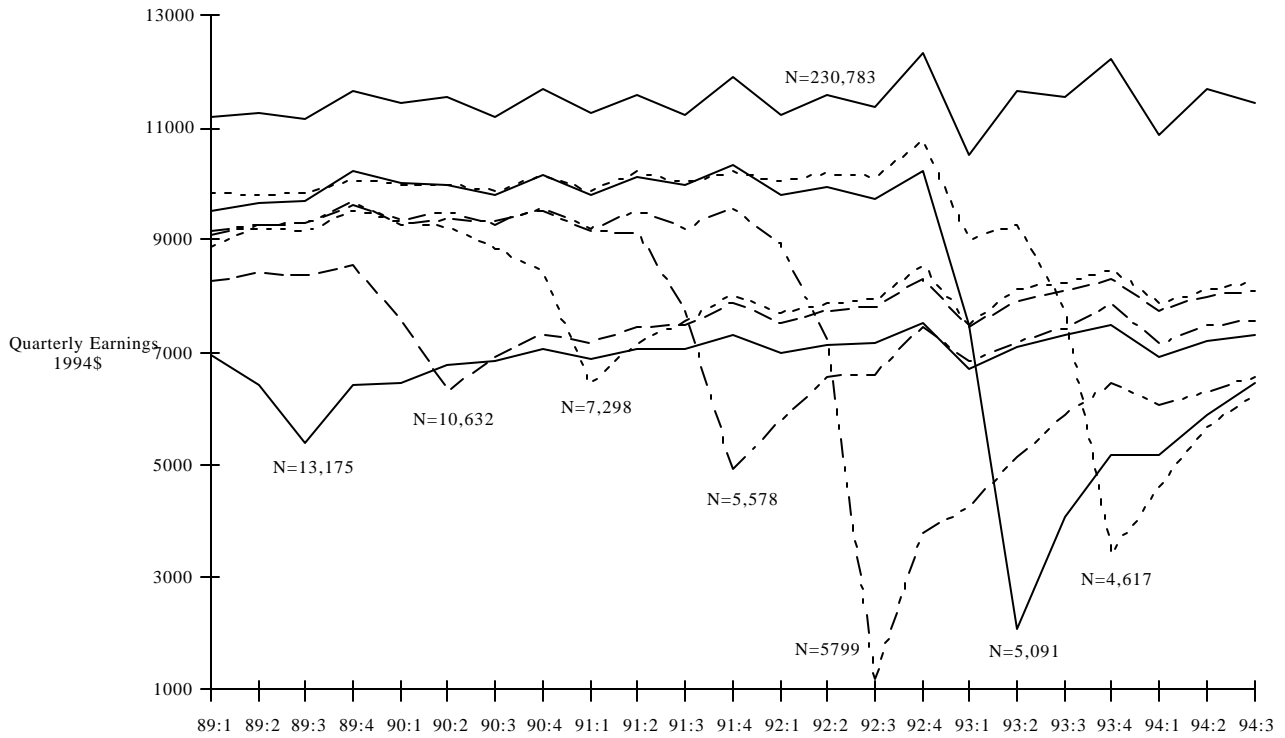


Figure 11  
 With and Without Controlling for Tenure of At least Six Quarters  
 Solid Lines Do Not Control for Tenure

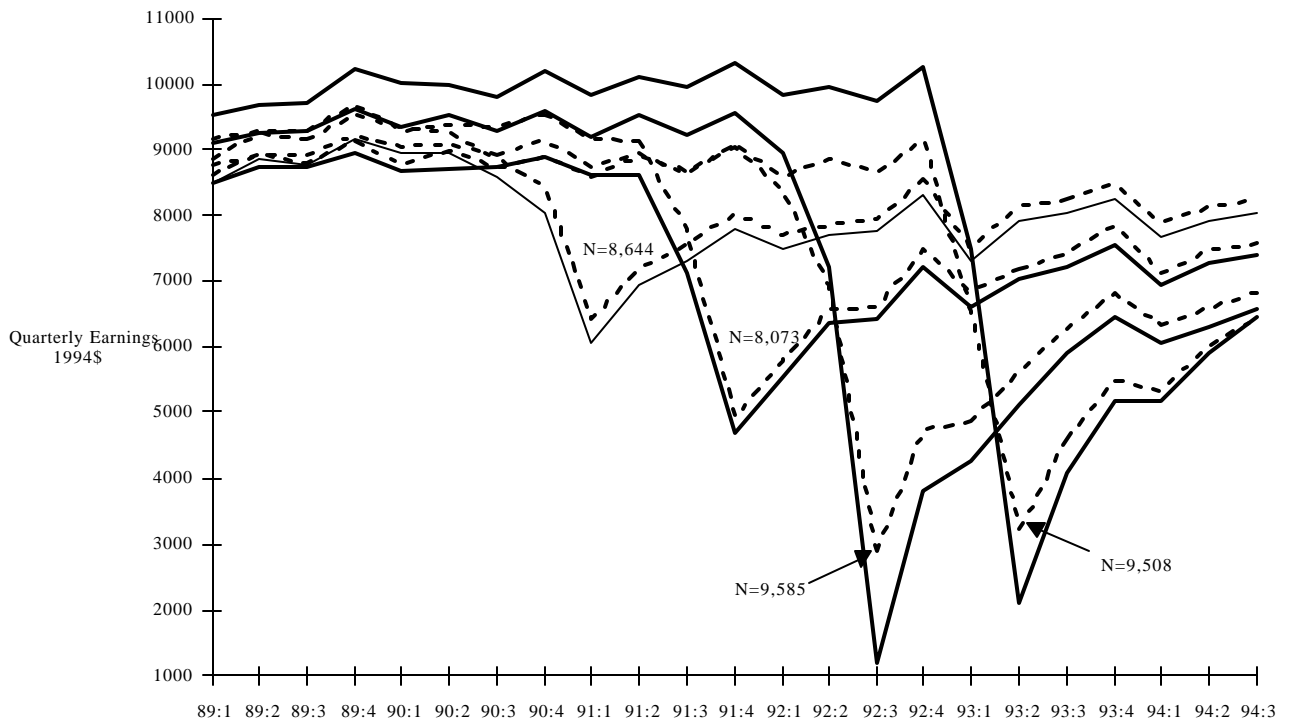


Figure 12  
 Unemployment Rate and Median Earnings Drop and Wage Recovery by Quarter of First Separation

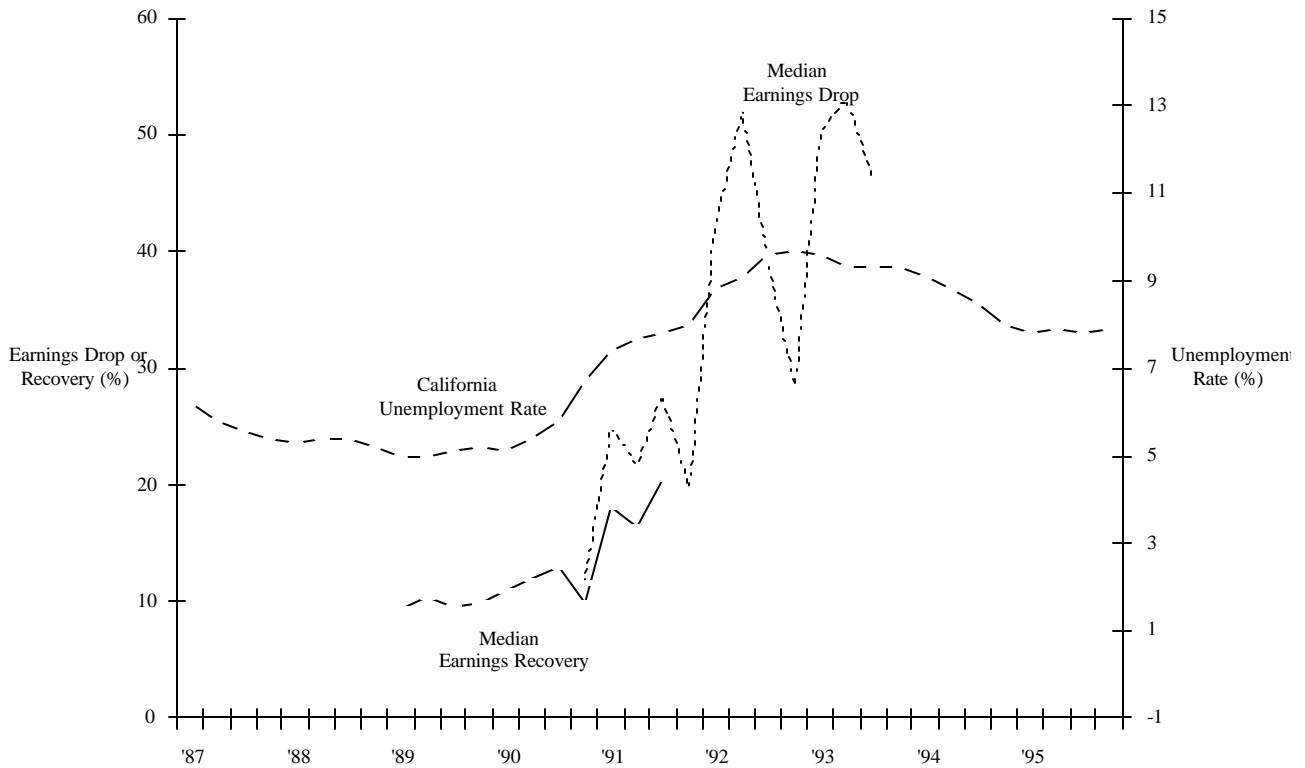


Figure 13  
Earnings Path by Quartile of Earnings Drop For Workers with First Separation in 1991:1  
N=7,571

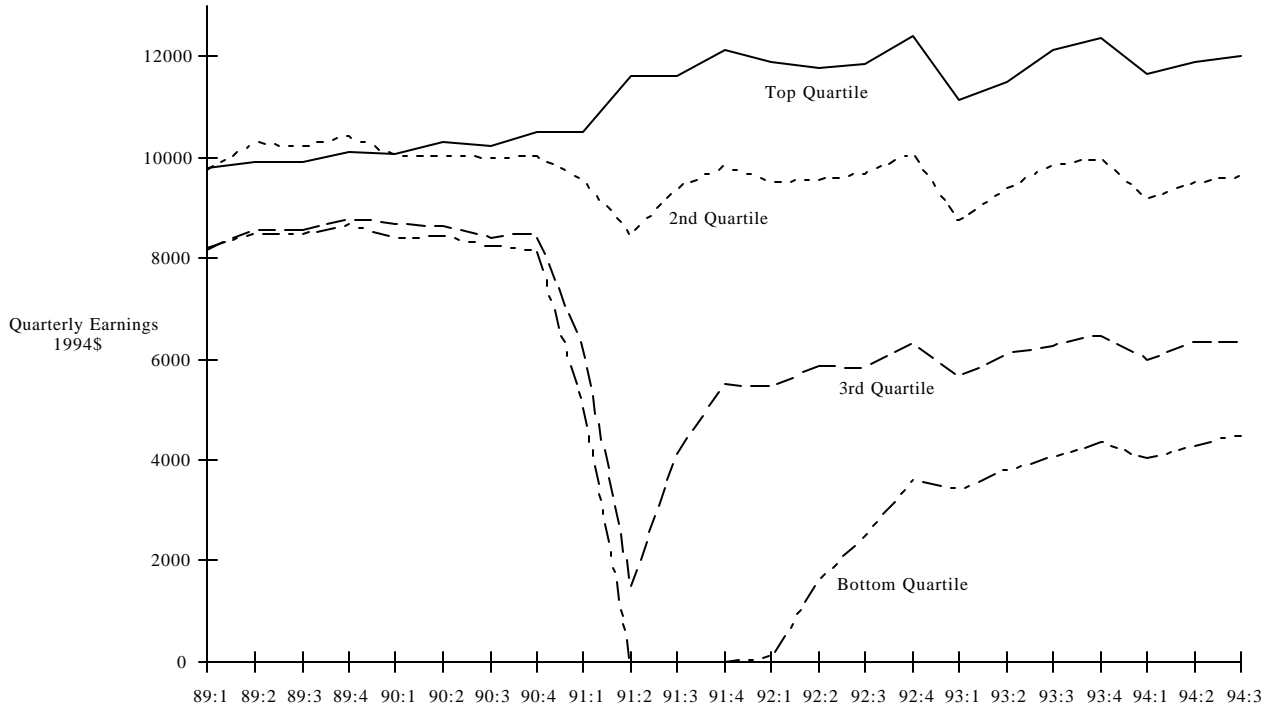


Figure 14  
Earnings Profiles of Workers First Displaced in 1991:3 by Number of Subsequent Separations

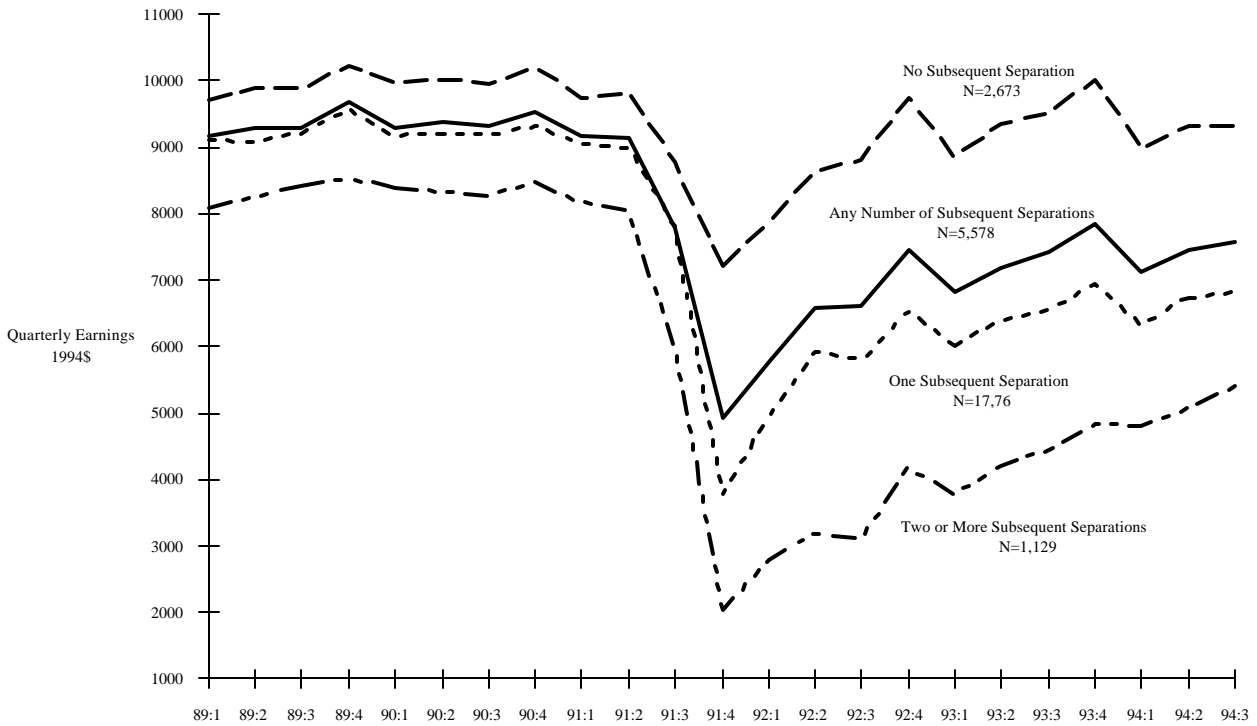


Figure 15  
Earnings Profiles of Displaced Workers By First New Industry of Employment Following Separation

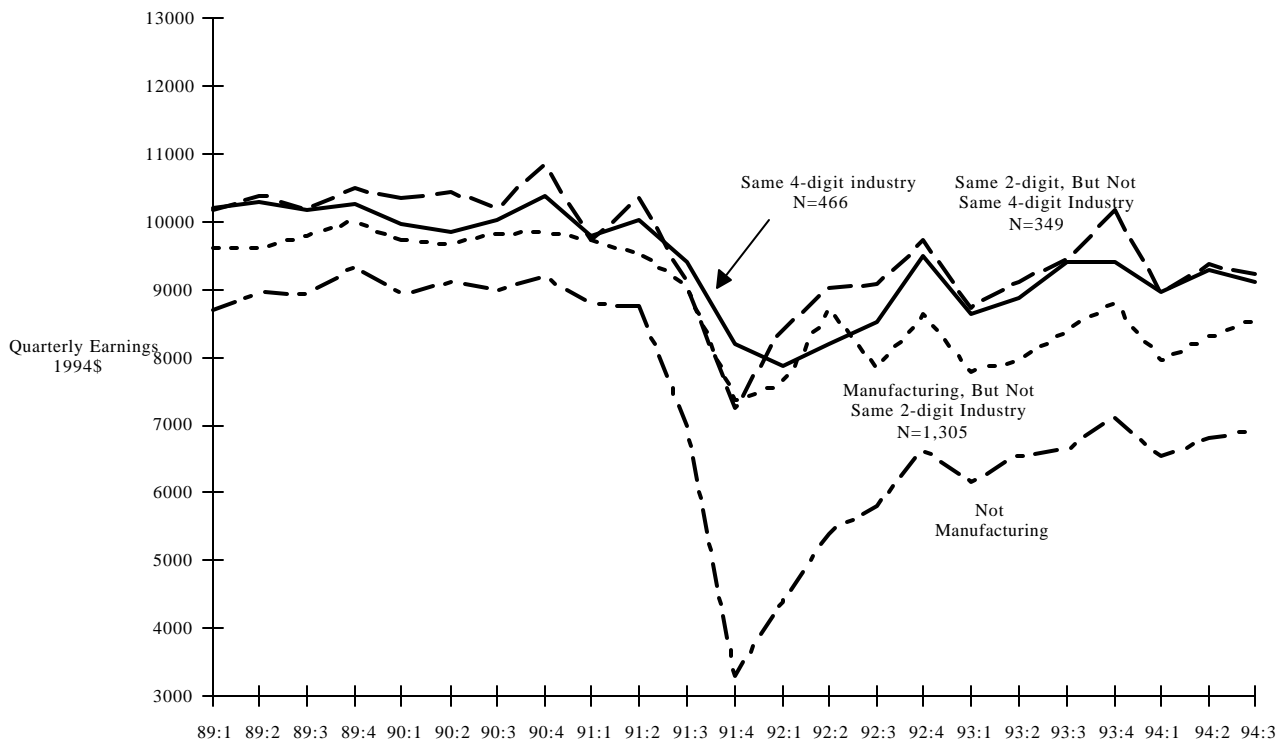


Figure 16  
Earnings Profiles of Workers Displaced in 1991:3 By Initial Firm Size

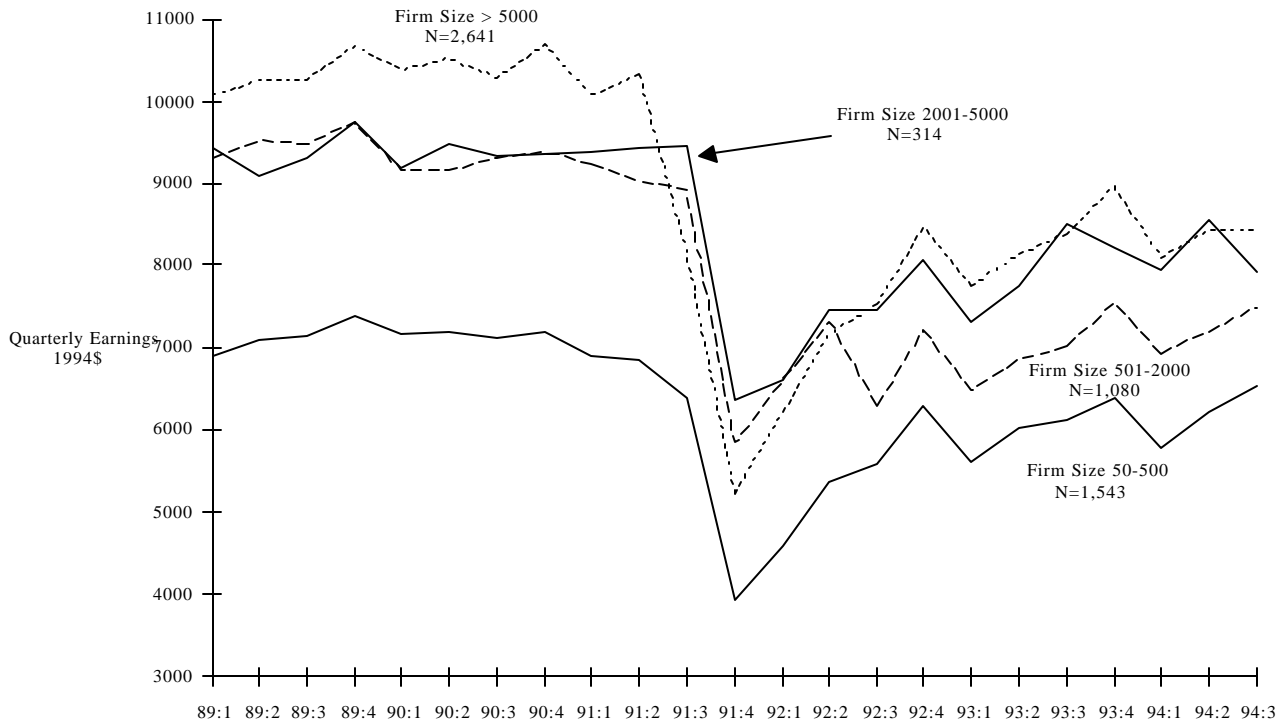


Figure A.1  
Earnings Pattern by Quarter of First Separation With and Without Dropping Workers  
Who Ever Moved with 50 or More Co-Workers

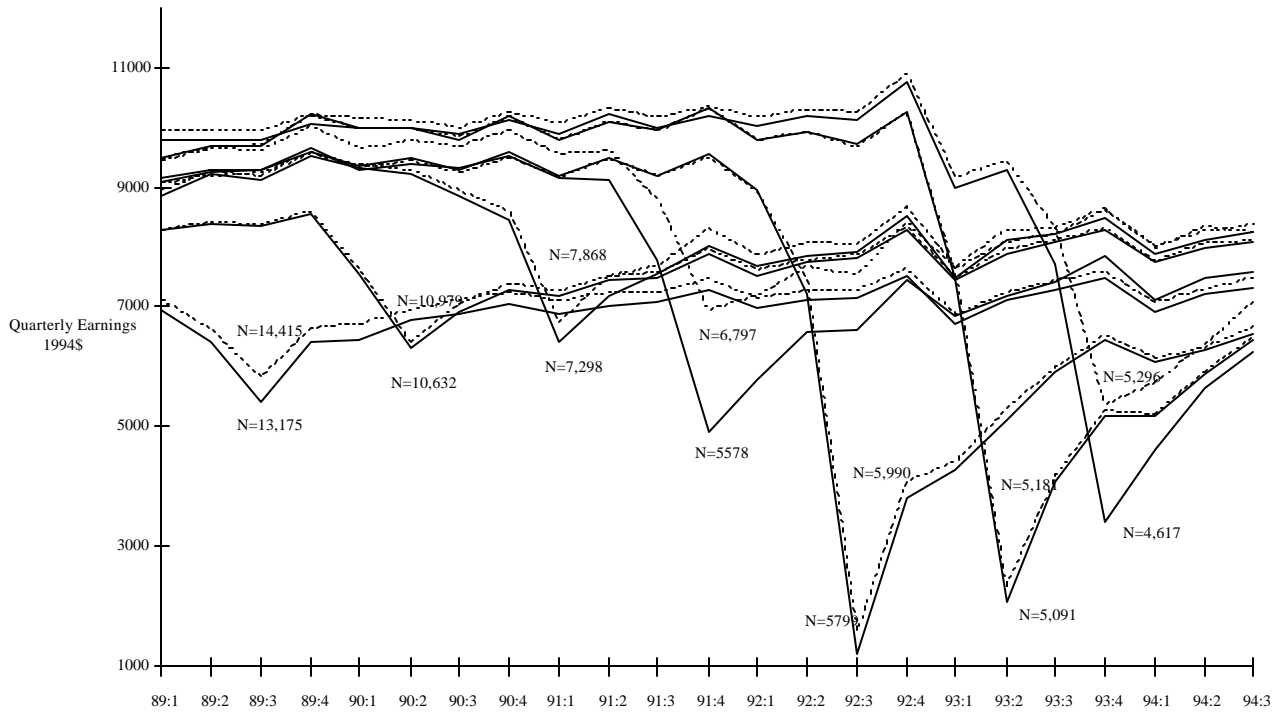


Figure A.2  
Earnings Profile By Quartile of Change in Firm Size

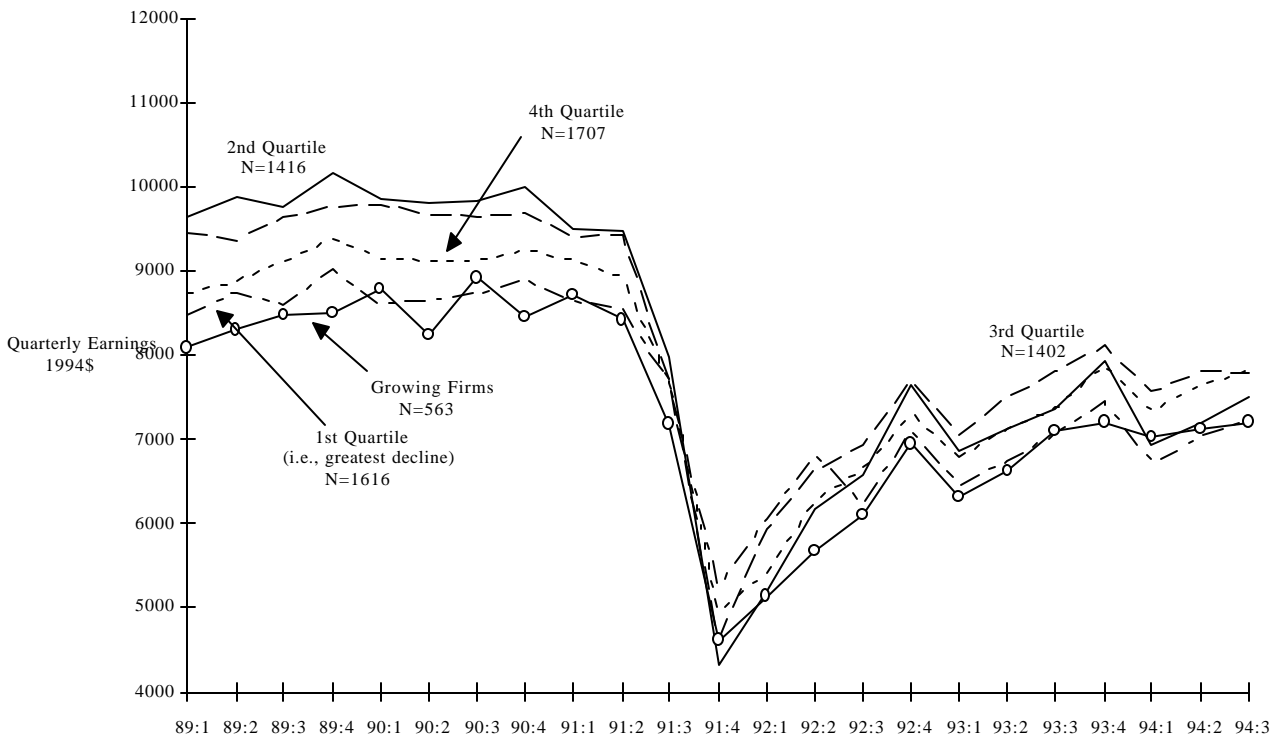
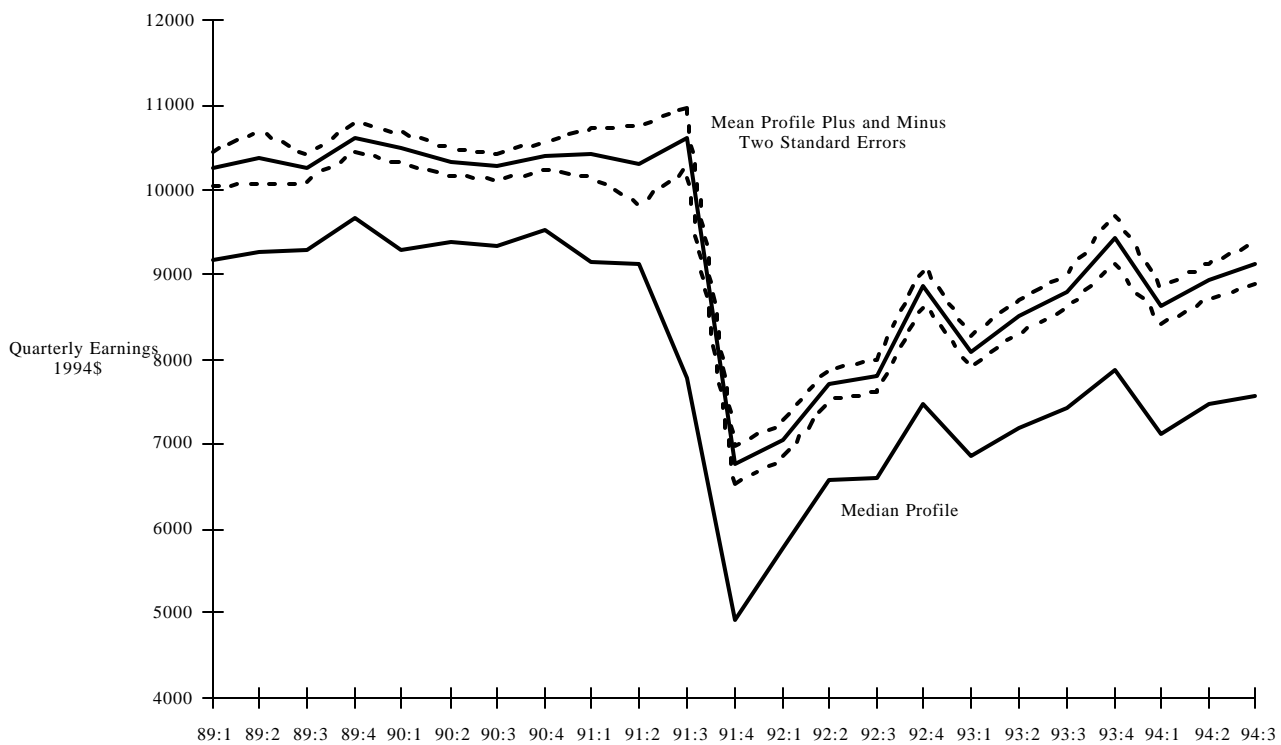


Figure A.3  
 Mean Versus Median Earnings Profile of Workers Displaced for First Time in 1991:3



**Table 1**  
**Cost of Displacement by Whether Displaced from Durable Manufacturing Firm**  
**Source: 1986, 1988, 1990, & 1992 Displaced Worker Supplements**

Survey Year	Percent Employed at Time of Survey		Median Percent Wage Change*	
	Durable Manufacturing	Any Other Industry	Durable Manufacturing	Any Other Industry
1986	64.6 <i>N=1981</i>	62.8 <i>N=6108</i>	-9.1	-5.2
1988	69.2 <i>N=1319</i>	64.9 <i>N=5956</i>	-8.6	-7.0
1990	70.4 <i>N=1142</i>	67.8 <i>N=5693</i>	-9.5	-6.8
1992	61.2 <i>N=1372</i>	59.3 <i>N=7316</i>	-11.7	-9.0

\*Wage change is for those workers employed at the time of the survey, and it is the change between the wages earned on the job from which the worker was displaced and the wages earned on the job held at the time of the survey. *N* refers to the total number of workers in the sample who were displaced from the given industry grouping.

**Table 2**  
**Percent Drop and Recovery in Earnings by Quarter of Separation**

Period of Separation	N	Percent Earnings Drop			Percent Earnings Recovery			Don't Exclude 50+ Co-Movers		
		25th %tile	50th %tile	75th %tile	25th %tile	50th %tile	75th %tile	Median Drop	Median Recovery	N
89:1	19902				-9.9	9.4	47.8		8.9	20376
89:2	13175				-9.5	10.3	52.0		8.6	14415
89:3	12775				-8.1	9.5	45.8		8.6	13424
89:4	9618				-7.9	9.8	43.6		7.9	11901
90:1	10632				-5.9	10.9	55.2		10.2	10979
90:2	9729				-5.8	11.8	60.8		9.2	10968
90:3	8592				-5.0	12.9	66.6		11.4	9164
90:4	7298	-53.2	-11.6	7.9	-7.0	9.8	50.4	-9.1	8.5	7868
91:1	7571	-71.7	-25.0	2.7	-2.9	18.0	100.0	-22.8	15.4	7916
91:2	7859	-70.0	-21.7	6.7	-3.5	16.4	100.0	-13.1	12.6	9076
91:3	5578	-71.7	-27.7	2.3	-3.2	20.4	100.0	-17.6	12.9	6797
91:4	5856	-65.3	-19.7	5.3				-6.6		7921
92:1	6617	-90.5	-42.3	-1.2				-39.6		6772
92:2	5799	-91.4	-52.4	-6.4				-49.5		5990
92:3	5352	-84.0	-39.2	-1.5				-6.1		10645
92:4	7152	-75.5	-28.5	0.4				-9.0		10420
93:1	5091	-92.8	-50.2	-3.7				-49.3		5181
93:2	5298	-88.7	-53.1	-4.4				-43.1		5816
93:3	4617	-81.4	-46.3	0.1				-33.2		5296

Earnings drop is the percentage change in the sum of quarterly earnings between eight and five quarters prior to displacement and the sum of quarterly earnings between one to four quarters after displacement. Earnings recovery is the percentage change in the sum of quarterly earnings between one and four quarters after displacement and nine to 12 quarters after displacement. If the sum of quarterly earnings in the first four quarters after displacement is zero, then the percent recovery is assumed to be 100.

**Table A.1**  
**Distribution of Change in Employment Between 1989:1 and 1994:3 for 1989:1 Firm**  
**N=432,851 Workers**

Percentile	Percent Change in Firm Size	Percentile	Percent Change in Firm Size
5th (lowest)	-100	55th	-46
10th	-93	60th	-40
15th	-68	65	-34
20th	-61	70	-34
25th	-54	75	-26
30	-54	80	-13
35	-50	85	-12
40	-49	90	0
45	-48	95 (highest)	+27
50	-46		