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Estimates of Earnings Losses of Displaced Workers Using California Administrative Data

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USING CALIFORNIA ADMINISTRATIVE DATA

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Abstract

This study estimates earnings losses of displaced workers using administrative data which tracks 833,004 workers in California between 1989 and 1994. The study finds that earnings losses: i) are 17-25 percent 3-5 years after displacement, ii) are related to the economic conditions at the time of displacement, and iii) vary by firm size, change in industry of employment, and number of subsequent separations.

INTRODUCTION

Perhaps the most widely cited estimates of earnings losses of displaced workers are contained in a study by

Jacobson, LaLonde, and Sullivan (JLS, 1993a). That study found that earnings losses were large and persistent,

with losses of about 25 percent even several years after displacement. The study is widely referenced in part

because the data that were analyzed -- administrative files from Pennsylvania covering the period 1974-1986 –

were superior to existing data from population surveys. The administrative data allowed JLS to examine the

earnings of a relatively large number of displaced workers several years before and after being displaced. These

workers were also compared with workers who were not displaced over the same time period.

Despite its substantial impact, the study by JLS is the only one that has used administrative data to

estimate earnings losses of displaced workers. The central objective of this paper is to determine whether

estimates from administrative data from a different state – California – and a different time period – 1989-1994

– are similar to those of JLS. The study goes on to estimate the distribution of earnings losses across workers

and determine the extent to which these losses are related to changes in industry of employment, firm size, and

subsequent displacements.

The statistical approach and the data are described and then the sample selections are discussed. Using

the California data we replicate the basic earnings patterns found by JLS in Pennsylvania. We then examine the

variation in earnings losses among workers and relate this variation to various factors. A final section

summarizes.

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 dummy variables that indicate whether the worker was displaced in each

past, current, and future period k, D_{it}^{k}:

$$y_{it} = \alpha_i + \gamma_t + X_{it}\beta + \sum_{k \geq -m} D_{it}^{k}\delta_k + \varepsilon_{it}$$

where X_{it} are the control variables, α_i is an individual fixed effect, γ_t are period indicators, and ε_{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 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 initially release workers who have skills that are least valued (given their earnings), and if these workers are also have more difficulty finding new jobs with comparable wages (perhaps because their skills are becoming obsolete), then the assumption that earnings losses are common across all periods may be violated. 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 reduce 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. 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.[1] 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.

DATA

The analysis uses a unique data set that was constructed from administrative information collected as part of the California Unemployment Insurance (UI) system. 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, who were followed 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, industry (four-digit SIC code), and number of weeks they received UI payments. All earnings are reported in real terms for the fourth quarter of 1994 using the California Consumer Price Index. 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, which is available from the authors upon request.)

3

We use the changes in the worker's primary employer's identification number, defined as the firm from which the worker receives the greatest earnings within each quarter, to identify a separation from the firm. 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. This requirement was imposed to abstract from temporary layoffs of workers who are eventually recalled. Of the 13.8 percent of separators who returned to the same firm within one year, 77 percent returned within one quarter.

One advantage of these data is that the samples are far larger than in any other study. The California data include as many separators in *each* quarter as 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 workers experienced a displacement over the 18 year period 1969 to 1986 (Stevens, 1997).

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 (DWS) to the Current Population Survey. This allows us to determine whether earnings decline prior to separation, as found by JLS.[2] In addition, the administrative data on earnings presumably have very little measurement error, and they are not top-coded, as is the case with most survey data.

Despite these advantages, the data have limitations. Labor market earnings for some occupations is not reported to the UI system and, therefore, are not captured by our data.[3] However, in total these occupations account for at most five to ten percent of California employment. 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, p. 685), who do have information on age and sex, find that earnings losses "depend only slightly on their age and sex."

An additional limitation of the data is that they are restricted to durable manufacturing workers. We compared the losses of workers displaced from durable manufacturing with the losses of workers displaced from other industries using the DWS. In Table 1 we report that workers displaced from durable manufacturing

firms were slightly more likely to be re-employed than other workers (in the 1992 data, 61.2 percent of displaced durable manufacturing workers and 59.3 percent of other workers). However, among workers who were re-employed, durable manufacturing workers experienced larger wage reductions; this difference ranges from 3.9 to 1.6 percentage points.

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. 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.[4] An additional eight to 15 percent would have been expected to leave the state during the period.[5] Another five 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.

Similar to JLS, workers in small firms (i.e., those firms with less than 50 employees in 1989:1) are dropped because it is more difficult to determine whether these firms are distressed (which is necessary for making additional selections described below). This selection 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.

A separation from a firm is identified by using the worker's firm's identification number. A firm's identification number 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.

One of the shortcomings of the California data (as well as the Pennsylvania data examined by JLS) is that they do not report whether the separation was voluntary or involuntary. 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.[6] 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.[7]

6

RESULTS

Before comparing the California and Pennsylvania findings, it should be noted that the earnings profiles are precisely estimated; therefore, we do not report confidence intervals on all figures. To demonstrate the precision of the estimates, in Figure 1 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).

Comparison with Pennsylvania in the early 1980s

To compare the California and Pennsylvania results, consider those workers who separated from their firm (for the first time) in 1991:3 in California and 1982:1 in Pennsylvania. 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).

JLS found that several years prior to separation, workers who eventually separated from their firm had earnings that were similar to the earnings of workers who remained with the firm throughout the entire period (Figure 3). Then, one to two years prior to separation, earnings of separators began to fall slightly relatively to stayers. For separators, earnings then dropped substantially in the quarter of separation. Earnings recovered quickly in subsequent quarters. Earnings growth eventually fell off about two to three years after separation. Using as their counterfactual the earnings of stayers, JLS estimated that the long-run earnings loss of displaced workers was 25 percent per year.

The earnings pattern for California separators in the 1990s was remarkably similar (Figure 3). 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

7

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 prior to separation. 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 there 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). The difference in the results between Pennsylvania and California is 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. The share of durable manufacturing employment within primary metals was 23.9 percent in Pennsylvania in 1979 (U.S. Department of Labor, 1989) but just 2.9 percent in California in 1989 (California Department of Finance, 1994).

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 did not occur. 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 we assume that the separators would have had the growth rate experienced by workers in firms whose employment grew. A third counterfactual is based on the earnings growth experienced by separators themselves one to two years prior to separation. 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 estimates based on 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 4). 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 (1991) and 21 percent estimated by Topel (1990). It also suggests that the long-run effects on quarterly earnings are primarily on wage rates and not labor supply. In fact, only five to eight percent of workers are not working two to three years after separation. Similarly, JLS (1993b, p. 90) find that employment rates are just three to four percent lower than predicted levels (i.e., relative to non-displaced controls) following the first year of displacement.

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.

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 4. 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 are at most 10 percentage points too low.

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* by quarter of 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.[10] In all periods at least 25 percent of workers separating experienced an earnings drop of at least 50 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. The median rebound was 10 to 20 percent, with 25 percent of the workers experiencing a recovery of more than 50 percent.

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 5). 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. The earnings of these workers 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 more severe, and the long-run losses were substantially higher. The pre-separation earnings of the top two quartiles were quite similar to each other, but they followed distinct paths following displacement. 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. 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.

What Explains the Variation in Earnings Paths?

Subsequent Separations. One cost of displacement is a high likelihood of subsequent job loss. In addition, subsequent separations are closely related to the path of post-separation earnings, which is consistent with

evidence reported by Stevens (1997) using the PSID. Figure 6 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 pre-separation 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. In all cases 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.

Labor Market Conditions. What causes workers to have additional separations or lower quarterly earnings? One important factor is labor market conditions. The patterns of earnings losses are closely related to economic conditions at the time of displacement. As demonstrated in Figure 7, the median drop increased substantially as California's recession deepened. At the same time, the recovery in earnings was larger when the unemployment rate was higher.

Change in Industry. Workers who remained in the manufacturing sector after separation had higher earnings prior to separating relative to those who left manufacturing (Figure 8). 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 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 9). 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 in the 1990s 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 long-run earnings losses appear to be 17 to 25 percent. 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 are generally consistent with Jacobsen, LaLonde, and Sullivan (1993a), which is the only other study to examine administrative data.

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.

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Figure 1
Mean Versus Median Earnings Profile of Workers Displaced for First Time in 1991:3
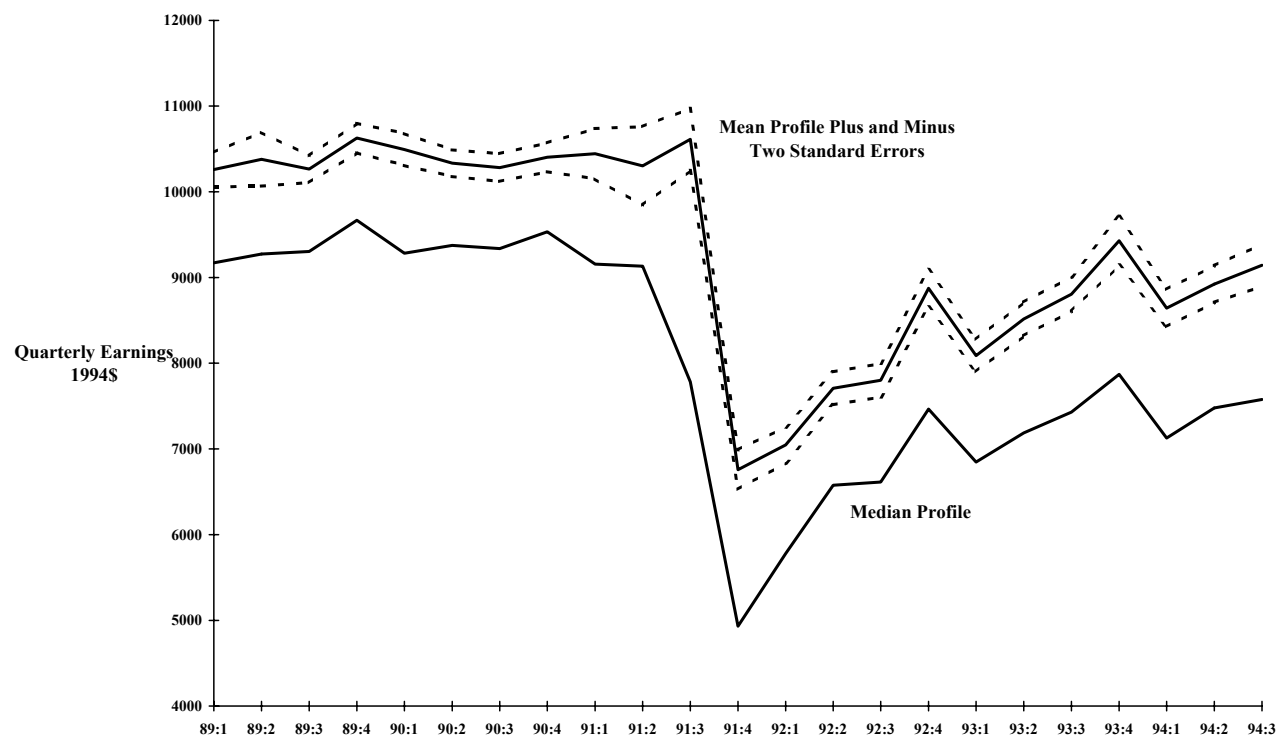
Figure 2
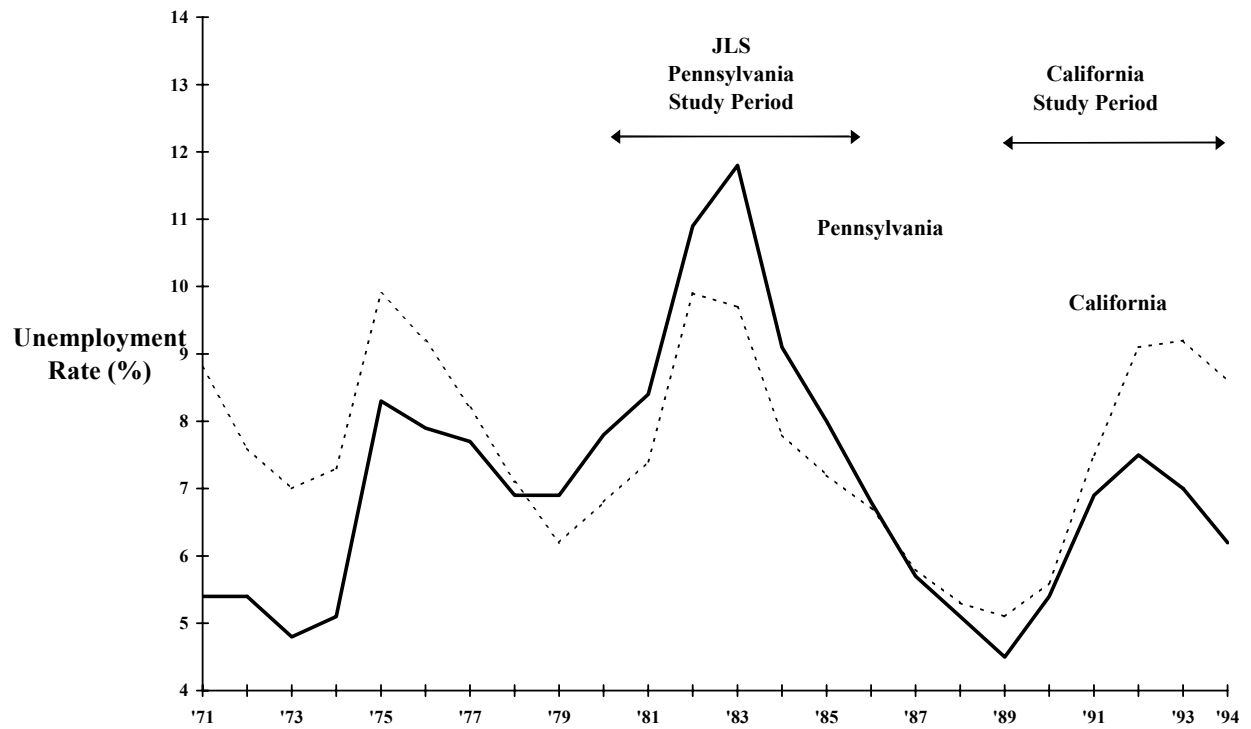**Unemployment Rates in California and Pennsylvania, 1971 to 1994.**

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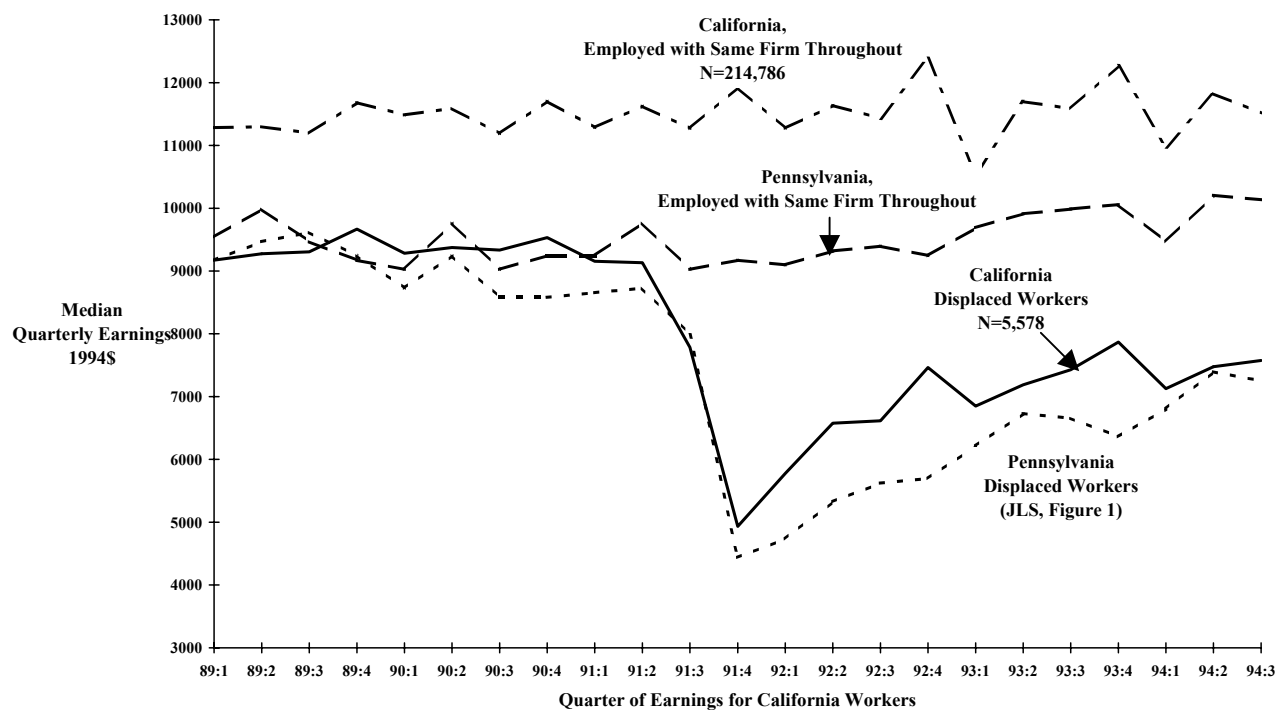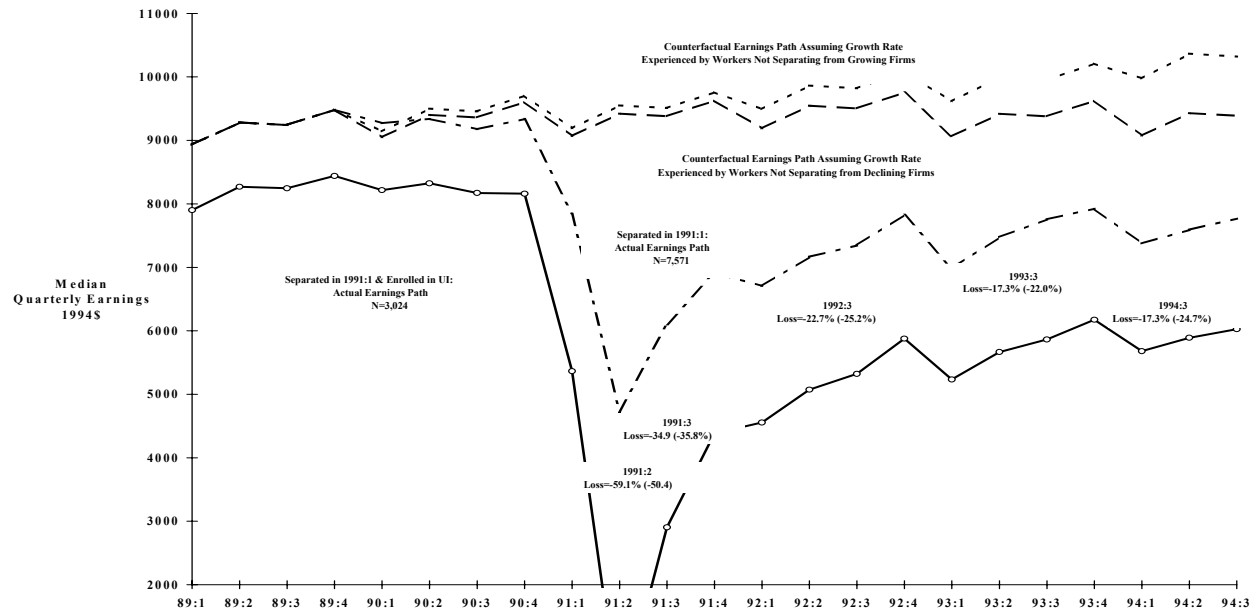**Quarter of Separation for Pennsylvania Workers is 1982:1**

Figure 4
Counterfactual Earnings Growth of Displaced Workers

Median Quarterly Earnings 1994$

Counterfactual Earnings Path Assuming Growth Rate Experienced by Workers Not Separating from Growing Firms

Counterfactual Earnings Path Assuming Growth Rate Experienced by Workers Not Separating from Declining Firms

Separated in 1991:1 & Enrolled in UI: Actual Earnings Path N=3,024

Separated in 1991:1: Actual Earnings Path N=7,571

1991:3 Loss=-34.9 (-35.8%)

1991:2 Loss=-59.1% (-50.4)

1992:3 Loss=-22.7% (-25.2%)

1993:3 Loss=-17.3% (-22.0%)

1994:3 Loss=-17.3% (-24.7%)
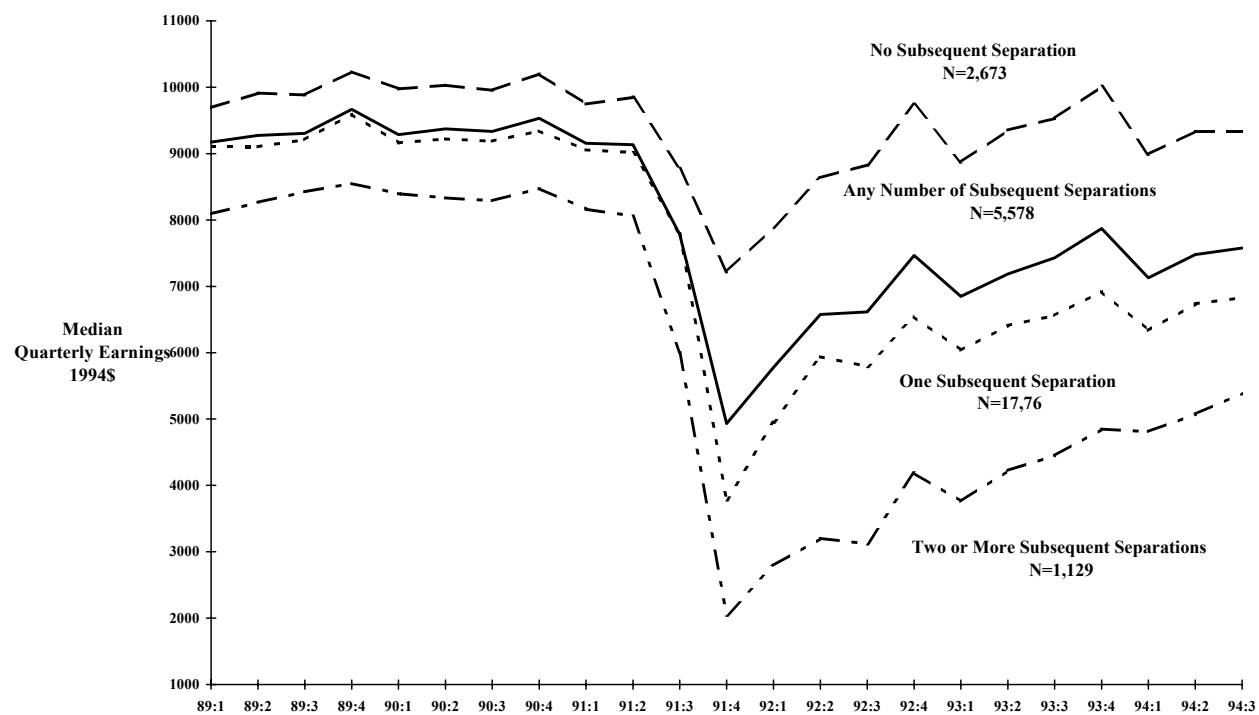
Earnings loss reported in parentheses is the loss for workers who enrolled in UI.

18

Figure 5
Earnings Path by Quartile of Earnings Drop For Workers with First Separation in 1991:1
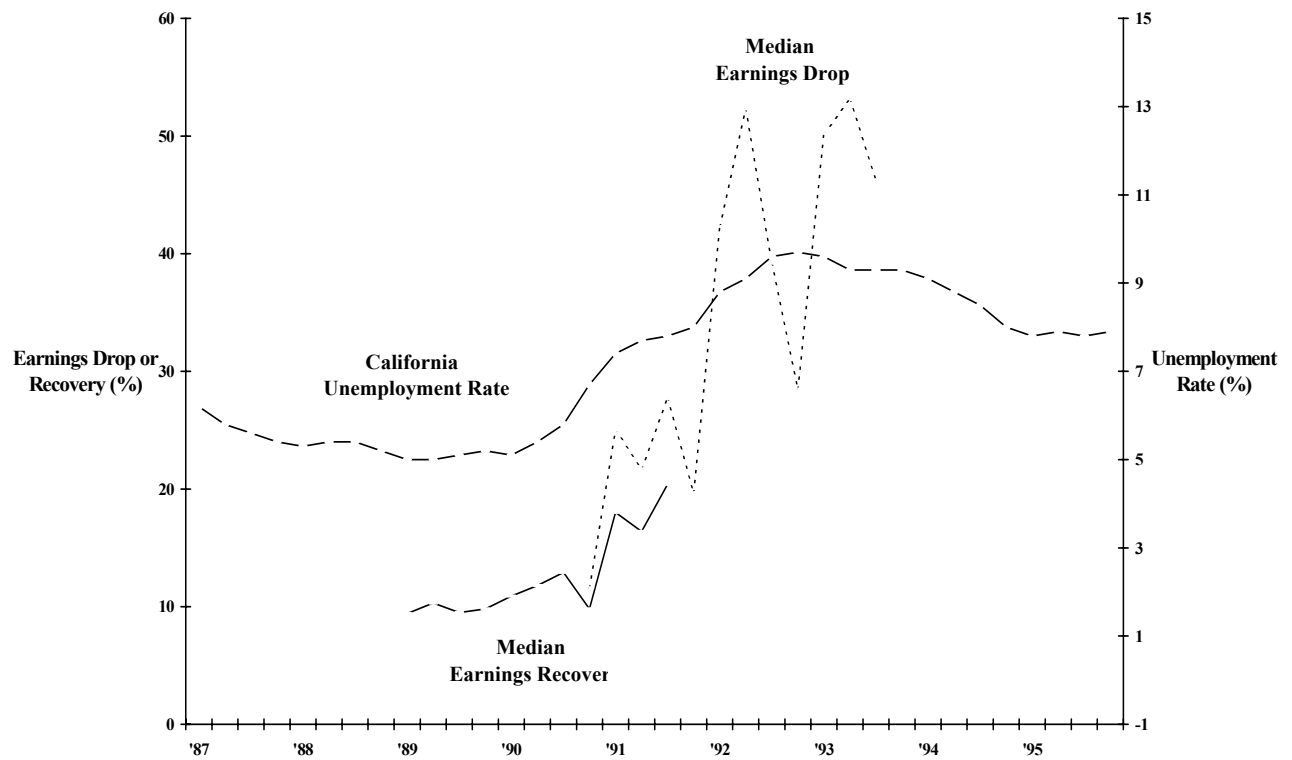**N=7,571**

Figure 7
Unemployment Rate and Median Earnings Drop and Wage Recovery by Quarter of First Separation

21

Figure 8
Earnings Profiles of Displaced Workers By First New Industry of Employment Following Separation
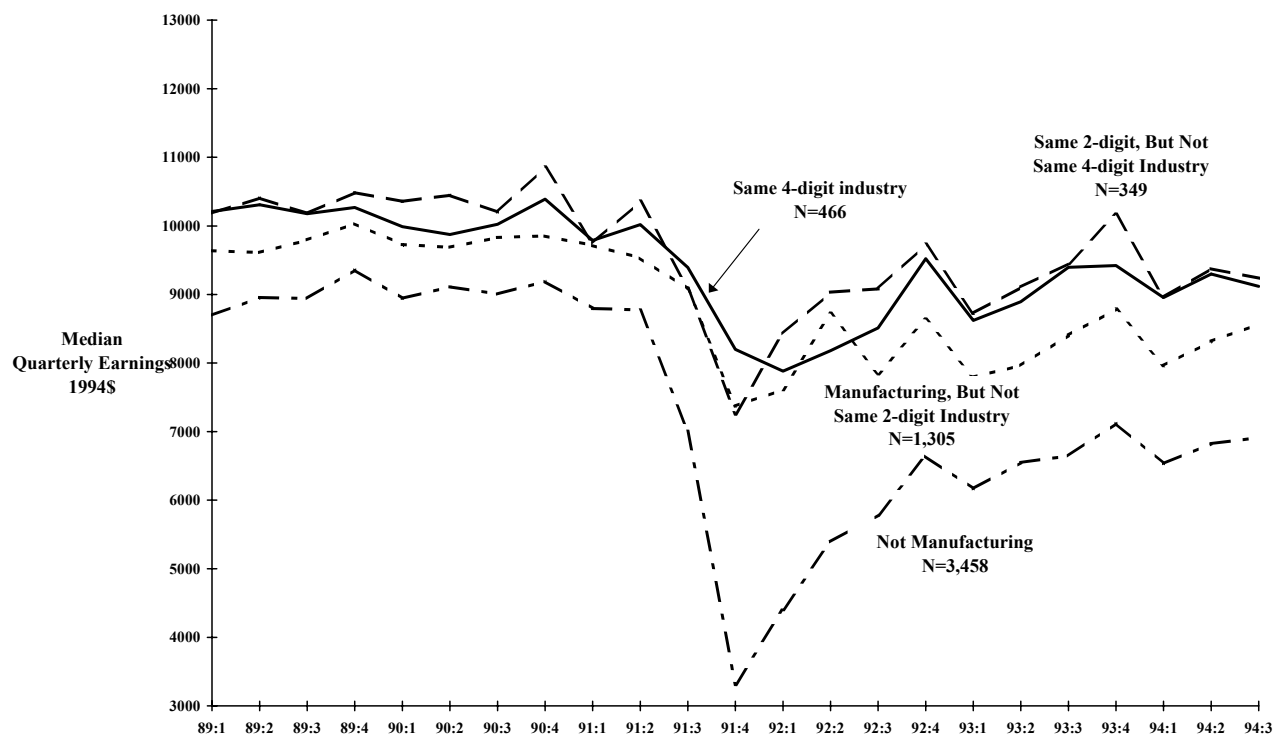
Figure 9
Earnings Profiles of Workers Displaced in 1991:3 By Initial Firm Size

Firm Size > 5000
N=2,641

Firm Size 2001-5000
N=314

Firm Size 501-2000
N=1,080

Firm Size 50-500
N=1,543

Median
Quarterly Earnings
1994$

11000
10000
9000
8000
7000
6000
5000
4000
3000

89:1 89:2 89:3 89:4 90:1 90:2 90:3 90:4 91:1 91:2 91:3 91:4 92:1 92:2 92:3 92:4 93:1 93:2 93:3 93:4 94:1 94:2 94:3

23
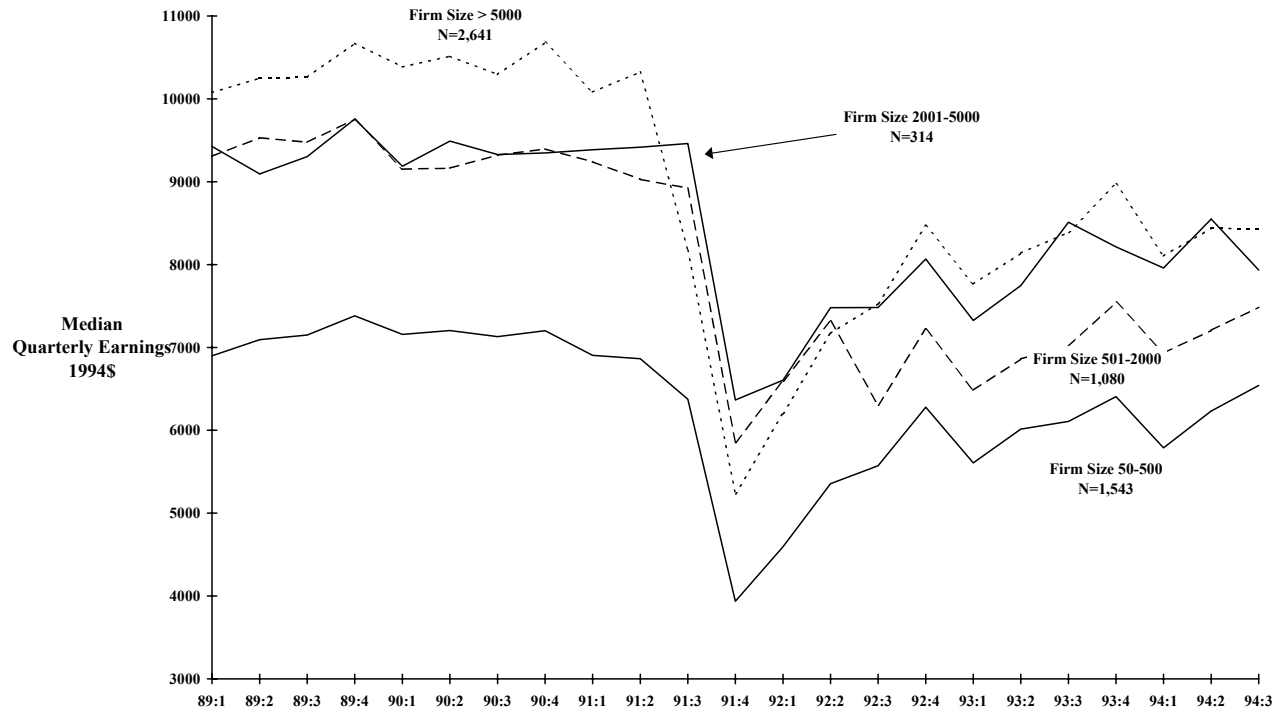
Table 1. Cost of Displacement by Whether Displaced from Durable Manufacturing Firm
Source: 1986, 1988, 1990, & 1992 Displaced Worker Supplements

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	62.8	-9.1	-5.2
	N=1981	*N=6108*		
1988	69.2	64.9	-8.6	-7.0
	N=1319	*N=5956*		
1990	70.4	67.8	-9.5	-6.8
	N=1142	*N=5693*		
1992	61.2	59.3	-11.7	-9.0
	N=1372	*N=7316*		

*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 displacement 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

		Percent Earnings Drop			Percent Earnings Recovery		
Quarter of Separation	N	25th %tile	50th %tile	75th %tile	25th %tile	50th %tile	75th %tile
89:1	19902				-9.9	9.4	47.8
89:2	13175				-9.5	10.3	52.0
89:3	12775				-8.1	9.5	45.8
89:4	9618				-7.9	9.8	43.6
90:1	10632				-5.9	10.9	55.2
90:2	9729				-5.8	11.8	60.8
90:3	8592				-5.0	12.9	66.6
90:4	7298	-53.2	-11.6	7.9	-7.0	9.8	50.4
91:1	7571	-71.7	-25.0	2.7	-2.9	18.0	100.0
91:2	7859	-70.0	-21.7	6.7	-3.5	16.4	100.0
91:3	5578	-71.7	-27.7	2.3	-3.2	20.4	100.0
91:4	5856	-65.3	-19.7	5.3			
92:1	6617	-90.5	-42.3	-1.2			
92:2	5799	-91.4	-52.4	-6.4			
92:3	5352	-84.0	-39.2	-1.5			
92:4	7152	-75.5	-28.5	0.4			
93:1	5091	-92.8	-50.2	-3.7			
93:2	5298	-88.7	-53.1	-4.4			
93:3	4617	-81.4	-46.3	0.1			

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.

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[1] 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.

[2] A decline in pre-separation earnings is interesting in its own right, but it also suggests that estimates of earnings loss using the DWS may be biased (de la Rica, 1995). If one attributes the pre-separation earnings loss to the displacement, then calculating the earnings loss associated with displacement as the difference in earnings in the year prior to displacement and the earnings after displacement (as estimated using the DWS) would lead to an underestimate of earnings loss. Estimates based on the DWS may also be problematic because 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. 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).

[3] 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 colleges or universities are not covered by the data.

[4] 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.

[5] 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 12,937,00. 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, implying that our estimate of 7.8 percent is low.

[6] 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.

[7] 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.

[8]Some workers experience multiple displacements. If there are previous separations, then which separation should be assigned the earnings losses? Our 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. 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.

[9]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)

[10]For some workers, the sum of quarterly earnings in the first four quarter after displacement is zero. In this case, the percentage earnings recovery is not defined, and it is therefore assumed to be 100.