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## **Earnings Losses of Displaced Workers**

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## **Earnings Losses of Displaced Workers**

### Abstract

The 1990-1991 recession has intensified concerns about the consequences of workers' job losses. To estimate the magnitude and temporal pattern of displaced workers' earnings losses, we exploit an unusual administrative data set that includes both employees' quarterly earnings histories and information about their firms. We find that when high-tenure workers separate from distressed firms their long-term losses average 25 percent per year. Further, their losses mount even prior to separation, are not limited to workers in a few industrial sectors, and are substantial even for those who find new jobs in similar firms. This evidence suggests that displaced workers' earnings losses result largely from the loss of some unidentified attribute of the employment relationship.

# Earnings Losses of Displaced Workers

## 1. INTRODUCTION

The 1990-91 recession and recent trade and environmental debates have heightened policymakers' concerns about the repercussions associated with workers' job losses.<sup>1</sup> Those concerns follow from empirical and theoretical considerations indicating that either a significant part of workers' skills or some other firm-specific attribute is not easily transferred from one job to the next. Accordingly, job losses may be followed by prolonged unemployment and substantial earnings declines. By now many studies have found such adverse impacts, particularly for high-tenure workers.<sup>2</sup> The varied explanations for these losses turn on the existence of earnings premiums associated with displaced workers' former jobs. Such premiums have been explained by the presence of firm-specific human capital, "matching," efficiency wages, internal labor markets, and unions.<sup>3</sup>

This paper exploits the features of an unusual longitudinal data set to estimate the magnitude and temporal pattern of displaced workers' earnings losses. Because we merge administrative records covering 13 years of employees' quarterly earnings with information about their firms, our data have four advantages over the data used in other studies.<sup>4</sup> First, we have a large sample of high-tenure displaced workers. Second, we can determine whether workers' earnings losses are temporary or permanent. Third, we can compare displaced workers' earnings to similar workers who remained employed at their former firms. And finally, we can examine those losses' sensitivity to factors such as workers' former industry, the sector of their new jobs, and whether or not they separated during a mass layoff.

As other studies have found, we find that high-tenure workers incur large earnings short-term losses when they separate from their firms. However, we also find that these workers' earnings often substantially decline even prior to separation. In addition, these losses appear to be permanent when workers separate from firms that are experiencing substantial employment reductions. Moreover, this finding holds regardless of whether workers were formerly employed in the manufacturing or in the nonmanufacturing sectors. Finally, these losses are closely linked

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<sup>1</sup>For instance, Congress and the Bush administration have recently debated whether to and in what form to provide extended unemployment benefits to recipients who have exhausted their regular benefits. Concern about workers' jobs losses also arose in the Congressional debate over whether the Bush Administration should have "fast-track" authority when negotiating a free-trade agreement with Mexico, and in discussions about how to protect the spotted owls in Northwestern U.S. forests. The costs of preserving the spotted owls' habitat is borne disproportionately by workers in the lumber industry.

<sup>2</sup>Hamermesh (1989) summarizes a dozen of these studies. More recent studies include Addison and Portugal (1989), Kletzer (1989), Topel (1990), Swaim and Podgursky (1991) and Ruhm (1991).

<sup>3</sup>For example see Becker (1975), Jovanovic (1979), Stiglitz (1974), Lazear (1981), and Lewis (1986).

<sup>4</sup>For example, the Displaced Workers Survey. See Flaim and Seghal (1985).

to some unidentified attribute of the employment relationship. Even those workers who find new jobs in similar industries to their old jobs experience large earnings losses.

The remainder of this paper proceeds as follows: In section 2 we describe our longitudinal data and comment on some of their strengths and shortcomings. In section 3 we develop a statistical model to estimate the earnings losses incurred by displaced workers. In section 4 we present estimates of the earnings losses for “high-tenure” workers who separated from their firms during the early and mid-1980s. Some concluding remarks follow in section 5.

## **2. The Pennsylvania Data**

The statistical framework developed in this paper applies generally to the problem of estimating earnings losses for displaced workers. However, our empirical work is limited to the magnitude and pattern of those losses for displaced workers from Pennsylvania.<sup>5</sup> By combining different administrative records, we created a longitudinal earnings file for a 5 percent sample of the Pennsylvania wage and salary workforce.<sup>6</sup> These data have two principal advantages over others that have been used in the literature. First we have a large sample of quarterly earnings histories extending from 1974 through 1986 for both displaced and nondisplaced workers. Second, we have merged workers’ earnings histories with information about their firms. That information includes the firm’s employment levels and growth, geographical location, and “4-digit SIC” industry.

Besides covering only Pennsylvanian workers, our data set has three additional shortcomings. First, the only available worker characteristics are a person’s year of birth, sex, and tenure with the firm since 1974. Therefore, we only can learn to a limited extent how earnings losses vary across different demographic groups. Second, although we can identify separations from administrative records, we do not know for certain whether those separations result from quits, from discharges for cause, or from reduced labor demand. Accordingly, our displaced worker sample may include some workers who left their former jobs voluntarily or because of their own poor performance. Finally, about 20 percent of high-tenure workers who separate from their firms subsequently never have positive earnings in Pennsylvania. For the unemployed, those earnings are their actual earnings. But other groups such as those who retired,

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<sup>5</sup>Although our findings for these workers may not reflect the experiences of displaced workers generally, it is worth noting that Pennsylvania is a large state with a diverse industrial base. Further, during the 1980s—the period covered by this study—the economic performance of the eastern half of the state was considerably different from that of the western half of the state. The state’s eastern half shared in the growth experienced by the other middle Atlantic states and New England, whereas the western half was mired in double-digit unemployment rates. See Jacobson (1988).

<sup>6</sup>For details on how we constructed our data set see the data appendix.

moved out of the state, or became self-employed have or would have positive earnings.<sup>7</sup> Therefore, if our analysis included those groups, we would probably overstate the losses associated with displacement.

In this study the foregoing problems are of less importance, because we focus on the earnings histories of prime-age high-tenure displaced workers. Each displaced and nondisplaced worker in our sample was born between 1930 and 1959 and had been employed at the same firm since at least 1974. Accordingly, because we studied separations between 1980 and 1986, the displaced workers in our sample had 6 or more years of tenure and most were in their 30s or 40s when they lost their jobs.<sup>8</sup> Further, we required every worker in our sample to have received wage or salary earnings in each calendar year.

To further minimize the ambiguities associated with quits and discharges for cause, we used the information about changes in firms' workforces to split our sample of separators into two groups. The "mass-layoff" sample includes separators whose firms experienced substantial reductions in employment. In this paper, such firms are those whose employment in the year following an employee's discharge was more than 30 percent below their maximum level during the late 1970s. The "nonmass-layoff" sample includes all other separators. Although some employees from that mass-layoff sample may have quit their jobs or been discharged for cause, the vast majority probably separated involuntarily from their firm for economic reasons.

Table 1 presents the mean age at separation and pre-displacement earnings for our sample of high-tenure workers who either separated or stayed with their firm between 1980 and 1986. As shown in panel A of the table, the median age of the 9,568 separators in our sample is 37, and 90 percent are between the ages of 26 and 48. Moreover, this group is on average approximately 5 years younger than the 14,028 nondisplaced workers.<sup>9</sup> Further, this characterization of separators' ages holds for several subgroups in our sample, namely, male and female workers, manufacturing and nonmanufacturing workers, workers from eastern and western Pennsylvania, and the mass-layoff and nonmass-layoff subsamples.

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<sup>7</sup>Tannery (1991) studied the rates that workers left the Pennsylvania wage and salary workforce between 1979 and 1987. Although his sample is not restricted to high-tenured workers, he found that among those who left for reasons other than retirement 60 percent had left the state. Among those who left the state by 1987, over one-half had 1979 earnings of less than \$3,000 and less than 8 percent had earnings greater than \$20,000.

<sup>8</sup>In related research Jacobson (1991) found that between 1977 and 1987, the rate of separations for workers from Allegheny County (Pittsburgh) was 80 percent for workers with less than 1 year of tenure, 43 percent for workers with one year of tenure, 24 percent for workers with two to three years of tenure, and 13 percent for workers with four or more years of tenure. For those with four or more years of tenure, he estimated that one-half were retirements and one-third were displacements. Thus the quit rate for that group would be about 2 percent per year.

<sup>9</sup>For the purposes of Table 1, the mean age of nonseparators is their age in 1983. Their mean earnings are their earnings in 1981.

As shown by panel B of Table 1, three years prior to separation, the median displaced worker earned \$23,084 (1987 dollars) annually. Approximately 90 percent of the sample earned between \$10,600 and \$35,196. The earnings of these workers are \$2,500 less than those of the workers who remained employed with their firms.<sup>10</sup> Further, with the exception of women, this characterization of separators' earnings holds for several subgroups, including workers from different industrial sectors, regions, and types of firms.<sup>11</sup>

Relatively simple tabulations indicate that displaced Pennsylvanian workers experienced substantial long-term earnings losses. For example, as shown by Figure 1, the earnings of workers who separated from their firms during the first quarter of 1982 fell sharply relative to the earnings of workers who remained with their firms through 1986.<sup>12</sup> But more importantly, four years after separation their earnings were nearly \$2,000 per quarter less than their nondisplaced counterparts.

There are at least two ways to interpret the stayers' and separators' earnings differences during the mid-1980s. One interpretation suggests that because the earnings of displaced and nondisplaced workers were nearly the same during the mid-1970s, their characteristics that determine earnings also must have been similar. Accordingly, earnings differences that emerge in the late 1970s between the two groups must result from the events that led to workers' displacements. Alternatively, the divergence between separators' and stayers' earnings starting at the end of the 1970s may indicate that employers select their less productive employees for displacement. Consequently, some of the post-displacement earnings gap between separators and stayers would have existed even if there had been no separation. One of our objectives in this paper is to determine which of these competing interpretations best explains the earnings differences observed in Figure 1.

### **3. Statistical Model of Earnings Losses**

In this section, we develop a statistical framework for estimating and summarizing the evidence on the magnitude and temporal pattern of displaced workers' earnings losses. We begin by more precisely specifying our definition of the earnings loss associated with worker displacement. Next we develop our basic statistical model. Finally, we discuss the circumstances that may lead to biases in our estimates.

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<sup>10</sup>That earnings difference of \$2,500 is consistent with the 5-year age gap between the groups of displaced and nondisplaced workers. See Topel (1991).

<sup>11</sup>The earnings of female separators are 57 percent of their male counterparts. That difference is similar to other estimates of the unadjusted earnings gap between males and females. See Blau and Ferber (1987), Table 1.

<sup>12</sup>Both the displaced and nondisplaced workers had 7 or more years of service with their firms in 1982:Q1.

## A. Definition of Earnings Losses

In this paper, we wish to compare displaced workers' actual earnings to the earnings they would have received had they not been displaced. However, when a firm's reduction in force actually occurs, its declining fortunes may have been at least partially evident for some time. Therefore, to capture the full effect of the events that lead to a worker's displacement, we must track a worker's earnings for several years prior to separation.

To make this definition more precise, we let  $y_{it}$  denote the earnings of worker  $i$  at date  $t$  and let  $D_{is} = 1$  if worker  $i$  was displaced at date  $s$  (and  $D_{is} = 0$  otherwise). Our definition of earnings loss would lead us to estimate the change in expected earnings if, at  $p$  years prior to date  $s$ , it was revealed that the worker would be displaced at date  $s$  rather than being able to keep his or her job indefinitely. More formally, we have

$$(1) \quad E(y_{it} | D_{it} = 1, I_{is-p}) - E(y_{it} | D_{it} = 0, I_{is-p}),$$

where  $I$  is the information available at date  $s-p$ , and  $p$  is sufficiently large that the events that eventually lead to displacement have not begun. This definition of workers' earnings losses allows the events that lead to a worker's displacement to affect earnings even prior to separation. In addition, because our definition requires that the alternative to displacement rule out displacement at date  $s$  and at any time in the future. It captures the potential importance of workers' job losses to their careers.<sup>13</sup> This alternative ensures that we compare job losers' earnings at different dates to a common standard, and simplifies the interpretation of several of our empirical results.

The magnitude and interpretations of workers' earnings losses depend crucially on the variables in the information set  $I_{is-p}$ . Clearly, to the extent that we can, we want to control for the standard demographic variables that influence earnings. In addition, our data set allows us to condition on the industry and even the displaced worker's former firm. However, the danger in using a measure of earnings losses that conditions on a worker's firm is that even the workers who are fortunate enough to retain their jobs (in firms that permanently lay off other workers) may themselves experience some earnings losses. If such a loss actually occurs, this latter measure would not capture the full impact of the events that led to workers' displacement. Instead it would capture only the effects specifically associated with workers' job losses.

In attempting to understand the importance of a worker's attachment to a particular firm, we need to see variation in outcomes to similar workers in different firms. Thus, our preferred definition of displaced workers' earnings losses conditions on general firm and worker characteristics at date  $s-p$  that we expect would affect earnings. Nevertheless, we also report estimates that condition explicitly on workers' firms, because the difference between the two

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<sup>13</sup>Because our data end after 1986, we have no way of knowing whether some nondisplaced workers were displaced in 1987 or beyond. Therefore, our alternative rules out displacement at date  $s$ , and at any time through 1986.



measures serves as an indicator of the losses imposed by structural change on workers who retain their jobs.

## B. The Statistical Model

To estimate the earnings losses corresponding to our definition we must specify a statistical model to represent workers' earnings histories and identify the displacement effect with some subset of the model's parameters. In addition, that specification should exploit the principal strengths of our data set—its large sample size and the fact that it covers a long period of time—so as to obtain a very detailed picture of the magnitude and pattern of earnings losses both across time and across workers.

In order to allow for variation of the estimates across both time and worker characteristics, we pool information for workers displaced between 1980 and 1986. A convenient way to do this is to introduce a series of dummy variables for the number of quarters before or after a worker's separation. Accordingly, we let  $D_{it}^k = 1$  if, in period  $t$ , worker  $i$  had been displaced  $k$  quarters earlier.<sup>14</sup> By restricting attention to these dummy variables, we formalize the idea that, say, a worker displaced in 1982 was in much the same position in 1985 as a worker displaced in 1981 was in 1984.

Our first statistical specification assumes that a worker's earnings at a given date depend on displacement through the set of previously defined dummy variables and on some controls for fixed and time varying characteristics:

$$(2) \quad y_{it} = \alpha_i + \gamma_t + X_{it}\beta + \sum_{k=-m}^n D_{it}^k \delta_k + \epsilon_{it}$$

In (2), the complete set of dummy variables,  $D_{it}^k = -m, -(m-1), \dots, 0, 1, 2, \dots, n$  represent the event of displacement. In particular,  $\delta_k$  is the effect of displacement on a worker's earnings  $k$  quarters following (or prior to) its occurrence.<sup>15</sup> The vector  $X_{it}$  consists of the observed, time varying characteristics of the worker, which in this paper are limited to the interactions among sex, age, and age squared. The  $\gamma_t$ 's are the coefficients on a set of dummy variables for each quarter in the sample period that capture the general time pattern of earnings in the economy. The impact of permanent differences across workers in observed and unobserved characteristics is summarized by the "fixed effect"  $\alpha_i$ . Finally, the error term,  $\epsilon_{it}$ , is assumed to have constant variance and to be uncorrelated across individuals and time.

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<sup>14</sup>Alternatively,  $D_{it}^k = 1$  if worker  $i$  was displaced in quarter  $t-k$ .

<sup>15</sup>Our statistical model is similar to those used to evaluate the earnings impact of public sector training programs. See Heckman and Robb (1985), Ashenfelter (1978), and LaLonde (1986).

As the discussion surrounding Figure 1 indicated, one potential problem with the foregoing specification is that it does not allow for the possibility that workers' earnings may grow at different rates. If workers with lower than average rates of earnings growth are more likely to be displaced than those with higher rates of growth, estimates of the  $\delta_k$ 's based on (2) overstate the effects of displacement. Accordingly, our second specification differs from our previous specification by including a set of worker-specific time trends,  $w_{it}$ .<sup>16</sup> By adding these trends to (3), we allow workers' earnings to depend on both their fixed characteristics and individual-specific rates of earnings growth.

$$(3) \quad y_{it} = \alpha_i + w_{it} + \gamma_t + X_{it}\beta + \sum_{k=m}^n D_{it}^k \delta_k + \epsilon_{it}$$

To identify the parameters of either (2) or (3) we must observe the earnings of at least some displaced workers more than  $m$  quarters prior to their displacement. We have chosen to let  $m$  be 20 quarters or 5 years. This choice of  $m$  amounts to imposing the restriction that there are no displacement effects prior to five years before separation. This choice presents us with no problems of identification, for even our first cohort of displaced workers who separated from their firms in the first quarter of 1980 have 6 years of pre-displacement data from the same firm. We have also estimated versions of (2) with  $m$  set equal to values of up to 10 years. In no case did we see evidence of an effect of displacement prior to three or four years before the actual separation.<sup>17</sup>

The identification restrictions discussed in the previous paragraph point up another advantage of the long time series provided by the Pennsylvania data. Because of the long panel, we can identify estimates of displacement's effects on workers' earnings well before separation. Moreover, as long as the events that lead to workers' separations do not cause their earnings to depart from their expected levels five years before their job losses, our model is over identified. Consequently, estimates of the displacement effect in the pre-displacement period may be used to form an informal specification test of our model. Evidence that displacement significantly affects workers' earnings four to five years before separation would lead us to reject our specification.

### C. Potential Biases

The principal sources of bias in our model arise if firms select for displacement employees whose performance was unusually poor in the quarters prior to separation. In terms of our model (2), that behavior implies that employers displace workers partly on the basis of the realizations of the error term,  $\epsilon_{it}$ . The importance of any resulting biases depends critically on the time series

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<sup>16</sup>In the program evaluation literature this specification has fit the earnings data of program and nonprogram participants more successfully than the simpler fixed effects specification. See Ashenfelter and Card (1985), and Heckman and Hotz (1990).

<sup>17</sup>We estimate the parameters of (2) and (3), including the  $\alpha$ 's and  $\gamma$ 's, by least squares.

properties of that error. For example, when—as we assumed above—those errors are independent across time, such behavior biases only the displacement effect associated with workers’ date of separation. Unfortunately, when the errors are correlated over time, other estimators,  $\delta_k$ , besides the one associated with workers’ date of separation are likely to be biased.

This source of biased estimates is less serious when the serially correlated errors are covariance stationary. When the errors are stationary, the spurious effects of displacement are symmetric about the date of displacement.<sup>18</sup> For example, if it turns out that the estimated displacement effects are zero, say more than 3 years before workers lose their jobs, the spurious effects of displacement must also be zero 3 years after workers’ separations. Accordingly, when firms displace workers partially on the basis of the error, the realized displacement estimates will “regress to the mean” following workers’ separations. Consequently, such biases are likely to be unimportant for measuring the long-term effect of displacement.

A more serious problem for estimating earnings losses arises when the error is nonstationary. In this case, when firms discharge recent poor performers there is no reason to expect their earnings to recover. In fact, these employees’ earnings would have remained low even if they had not separated from their former firms. However, we substantially diminish the importance of this source of bias by restricting our analysis to workers who separate from a firm that closes all or a large part of its operations. These workers are not likely to be leaving their job as a result of their own poor performance. Therefore, in the empirical work that follows we distinguish between the estimated earnings losses for workers in our mass-layoff sample and those in our nonmass-layoff samples.

#### **4. Empirical Findings**

According to the model developed in the previous section, we define displaced workers’ earnings losses as the difference between their quarterly earnings and their expected earnings had they remained with their former employer. We report that difference below for each quarter beginning with the 20th quarter prior to and ending with the 26th quarter after their separation. To facilitate the exposition we plot these estimated differences against the quarters before and after workers’ separations.

##### **A. Earnings Losses and Mass Layoffs**

As shown in Figure 2, our study indicates that high-tenure, prime-age workers endure substantial and permanent earnings declines when they are displaced during mass layoffs. Even six years after their separations, their quarterly earnings remain \$1,500 below their expected

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<sup>18</sup>See Heckman and Robb (1985).

levels.<sup>19</sup> This earnings loss represents 25 percent of workers' predisplacement earnings. Moreover, because the estimated loss is even larger when we control for individual-specific rates of earnings growth, this loss does not result from employers systematically displacing workers with more slowly growing earnings. Further, because the estimated losses do not decline significantly after the third year following their separations, there is little evidence that displaced workers' earnings will ever return to their expected levels.<sup>20</sup>

We also find evidence that the events that lead to workers' separations cause their earnings to depart from their expected levels even before they leave their firms.<sup>21</sup> As shown in Figure 2, three years prior to separation, these workers' quarterly earnings diverged from their expected levels. That divergence accelerated during the quarters immediately prior to separation. In the quarter prior to displacement, these workers' earnings are approximately \$1,000 below their expected levels. Although we cannot determine from our data whether these pre-displacement declines result from real wages and weekly hours cuts, we do find that the incidence of temporary layoffs increased. During the two years prior to separation, workers receive more unemployment insurance benefits than their counterparts who remained employed.<sup>22</sup>

Our confidence in these findings—that earnings losses are large and long-term and appear even before workers permanently lose their jobs—is enhanced by the results of the specification test described in the previous section. Displaced workers' earnings should equal their expected earnings several years prior to separation. As shown in Figure 2, when we use (2) to estimate the impact of displacement, we find some small earnings effects 5 years prior to workers' separations. However, when we turn to (3) and include individual-specific time trends in our model, these effects disappear. Nevertheless, even though the model with individual-specific time trends performs better, the small difference between the two sets of estimates suggests that any biases that result from ignoring these time trends also are small.

A different pattern of earnings losses emerges from the nonmass-layoff sample. First, as shown by Figure 3, depending on which model we used to estimate the earnings losses, this

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<sup>19</sup>Although not shown, the quarterly employment rates of the displaced workers in our sample depart only slightly from their expected levels except for the year following separation. This behavior for displaced workers' employment rates is not surprising because our sample excludes workers with extremely long spells without wage and salary earnings. Thus the substantial earnings losses observed in Figure 2 are largely due to lower earnings for those who work, rather than an increase in the number of workers without quarterly earnings.

<sup>20</sup>Because our sample is large, the estimated standard errors are relatively small. For example between the fifth year prior to workers' separations and the second quarter after their job losses the standard errors associated with the displacement effects average \$30 per quarter. After the quarter, the standard errors increase so that by the 20th quarter following their separations, the standard errors have risen to \$60.

<sup>21</sup>Ruhm (1991), using the Panel Study of Income Dynamics (see p. 322) and Blanchflower (1991), using data from Great Britain (see p. 489), each found that displaced workers' earnings declined prior to separation.

<sup>22</sup>See Jacobson, LaLonde, and Sullivan (1991).

group's earnings recover within three to five years following separation. Second, prior to separation, their earnings depart only slightly from their expected levels, and following separation they drop by only one-half as much as workers in the mass-layoff sample. This pattern of earnings losses for the nonmass-layoff sample is not surprising, considering that this sample probably includes larger fractions of workers who quit their jobs or who had fewer firm-specific skills. Because workers in the nonmass-layoff sample adjust more easily to separation, our confidence is increased in the finding that workers displaced during mass layoffs experience large earnings losses.

The foregoing findings demonstrate that when estimating the effects of displacement it is important to have long time-series on workers' earnings histories and information about their firms. Studies that use data lacking these features, such as the Displaced Workers Survey, have likely underestimated the earnings losses associated with worker displacement. For example, as shown by Figure 2, displaced workers' earnings are abnormally low in the year prior to separation. As a result, if we had only one year of pre-separation earnings data to rely on, our earnings loss estimates would have been nearly 50 percent smaller than the estimate based on workers' long-term earnings histories. Likewise, we would have underestimated workers' earnings losses if we had to rely on displaced workers' assessments of their firms' economic well-being rather than the firms' administrative records. As indicated by Figure 3, if people who separated from "normal" firms report that they were laid off from distressed firms, we would understate the long-term losses associated with displacement.

## B. Earnings Losses for Stayers

In the foregoing analysis, similarly tenured workers who did not separate from their firms between 1980 and 1986 identified the influence of macroeconomic factors,  $\gamma_t$ , and of age and sex,  $\beta$ , on earnings. With that identification assumption, we effectively compared displaced workers' earnings to those of the typical nondisplaced worker in Pennsylvania. Alternatively, we might prefer to compare displaced workers' earnings to those of nondisplaced workers in the same industry or even firm.<sup>23</sup> The estimated earnings losses based on this alternative estimator should be smaller as long as nondisplaced workers in distressed industries or firms have earnings that grow more slowly than those of other nondisplaced workers. Such a finding would suggest that nondisplaced workers' earnings are adversely affected by the events that lead to mass layoffs in their industry or firm.

As shown by Figure 4, when we use the nondisplaced in displaced workers' former firms to identify the influence of macroeconomic factors, the estimated earnings losses fall by about 20 percent. For example, five years after separation, displaced workers quarterly earnings are \$1,200 below their expected levels compared to \$1,500 when we use all nondisplaced workers

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<sup>23</sup>To compute these estimates we interact the time dummies,  $\gamma_t$ , in (2) with a worker's 1979 industry or firm.

to identify the influence of macroeconomic factors.<sup>24</sup> The gap between these two sets of estimates indicates that employees who remain employed during mass layoffs experience modest declines in earnings relative to other nondisplaced workers.

It is also apparent from Figure 4 that, because the gap between the two sets of estimates becomes large only after the mass layoffs, nondisplaced workers in distressed firms fall behind other nondisplaced workers only after their firms lay off large numbers of workers. Before the mass layoffs, the displaced workers' earnings fall substantially relative to either comparison group of nondisplaced workers. That finding indicates that the displaced workers' pre-displacement earnings losses result from losses relative to nondisplaced workers from the same firm. Therefore, when firms seem likely to dramatically reduce their workforces, it is probably apparent that those employees who have experienced temporary layoffs in the past are subsequently more likely to be permanently laid off.

Turning to the nonmass-layoff sample, we find that our earnings loss estimates do not depend on the comparison group. As shown in Figure 5, the estimated earnings losses are the same whether or not we condition on a displaced worker's firm. This finding should not be surprising for when few employees separate from their firms, it is unlikely that those separations would be associated with earnings losses for those who remain employed at the firm. Because nondisplaced workers in relatively healthy firms are unaffected by the separations of other workers, the findings from the nonmass-layoff sample are consistent with our contention that nondisplaced workers in distressed firms experience significant earnings declines.

### C. Earnings Losses by Sector

Our findings indicate that workers separating from firms during mass layoffs usually experience large earnings losses. In this section, we show that this result generally holds among workers in different sectors of the economy. As shown by Figure 6, employees displaced from distressed nonmanufacturing and manufacturing firms experienced nearly the same earnings losses. Although before and during the quarter of separation, displaced nonmanufacturing workers experienced smaller earnings declines than their manufacturing counterparts, five years after separation, their quarterly earnings were still \$1,200 below their expected levels. As was shown in Table 1, because the pre-displacement earnings of these two broadly defined groups are similar, their percentage losses are also nearly the same.

Although Figure 6 indicates that workers displaced from different sectors experience similar earnings losses, within each sector losses vary to some extent depending on workers' former industry. Five years after separation, the annual earnings losses of displaced primary

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<sup>24</sup>The two sets of estimates in Figure 4 are based on the fixed effects estimator described in (2). The sample of displaced workers used in Figure 4 differs from that used in Figure 2, because there is no corresponding comparison group for workers displaced during plant closings. Accordingly, in Figure 4 we use only workers displaced during mass layoffs where the firm continued its operations.

metals workers and of transportation, communication, and public utility workers amounted to \$11,200 and \$9,060, respectively. Five-year losses for workers displaced from the motor vehicle and from the wholesale and retail trade industries each averaged approximately \$6,500. Workers displaced from the nonelectrical and electrical machinery industries and from the financial and services industries experienced smaller, but still substantial, five-year losses amounting to \$4,420 and \$2,530 respectively.<sup>25</sup>

Besides the sector of their old jobs, another potential determinant of displaced workers' earnings losses is the sector of their new job. For example, workers displaced from distressed manufacturing firms may fare better if they find new jobs in manufacturing.<sup>26</sup> To pursue this point, we examined the earnings losses among workers whose new jobs were (i) in the same 4-digit SIC industry as their old job, (ii) in the same sector (manufacturing vs. nonmanufacturing) but in a different 4-digit industry, or (iii) in a different sector. By characterizing displaced workers' new jobs in this fashion, we implicitly assume that new jobs in the same 4-digit SIC industry are similar to workers' old jobs. Therefore, those displaced workers should experience smaller earnings losses than those whose new jobs lie outside their old industry.

Manufacturing workers' earnings losses depend crucially on whether their new jobs are in the same sector as their old jobs. As shown by Table 2, those displaced workers who leave the manufacturing sector incurred a 38 percent drop in earnings from their expected levels.<sup>27</sup> However, for those who found new jobs in the manufacturing sector it does not appear to matter whether they found a job in their old 4-digit industry. As shown in Panel A, those who found new jobs in the same 4-digit industry had earnings 20 percent below their expected levels 24 quarters after their separations. But those who found new manufacturing jobs in different 4-digit industries experienced losses of only 18 percent.

The findings for displaced nonmanufacturing workers, although less conclusive, are similar to those for their manufacturing counterparts. When displaced nonmanufacturing workers find new jobs in the same 4-digit industry their long-term earnings losses amount to 18 percent. That percentage rises to 22 percent when their new jobs are in a new 4-digit industry, but still in the same sector. Finally, those losses rise to 34 percent for those who find new jobs in the manufacturing sector. Unfortunately, the standard error associated with that estimate is relatively

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<sup>25</sup>See Jacobson, LaLonde, and Sullivan (1991).

<sup>26</sup>In keeping with this study's focus on displacement's long-term impact, we want to assess the relationship between earnings losses and the industry of workers' new jobs several years following separation. For workers displaced in 1985 and 1986 such an assessment is impossible because we have only a few quarters of post-separation data. Accordingly, we examined the relationship between earnings losses and new job's industry for workers displaced from distressed firms between 1980 and 1983. The new job's industry was the workers' primary employer in 1986 which was 3-6 years following displacement

<sup>27</sup>This finding showing greater losses when displaced workers switch sectors does not result because workers with jobs in the nonmanufacturing sector have been displaced for a shorter period of time. The mean quarter of separation for those who switch sectors is the same as for those who remain in the manufacturing sector.

large as few displaced nonmanufacturing workers found jobs in manufacturing. Nevertheless, the findings for displaced manufacturing and nonmanufacturing workers indicate that a substantial portion of their earnings losses result from the loss of some firm-specific component of earnings. Even those who found jobs in similar industries experienced large and seemingly permanent losses.

#### D. Earnings Losses and Local Demand Conditions

Until now we have ignored the possibility that displaced workers' earnings losses result from generally poor labor market conditions. Depressed local labor market conditions might explain why both displaced manufacturing and nonmanufacturing workers experience tough times when they lose their jobs. The varied economic performance of the 1980s Pennsylvania economy enables us to examine this hypothesis more closely. Although the Pennsylvania economy experienced a severe recession during 1982-83, the effects were much more severe in the western part of the state than in the state's eastern half.<sup>28</sup> Even within those broadly defined regions, economic performance was varied. For example, in eastern Pennsylvania, unemployment rates were substantially higher in Wilkes Barre-Scranton than in Lancaster.

Accordingly, using this variation in economic performance we can identify the potential importance of local demand conditions in explaining the magnitude of our earnings loss estimates. To examine how our estimates depend on such conditions we interacted our displacement indicators,  $D_{it}^k$ , with the area's unemployment rate when workers separated from their firms. This specification allows our earnings loss estimates to vary according to the labor market conditions that prevailed when workers were displaced.

Our findings indicate that workers' earnings losses were generally larger when they were displaced in depressed regions or during adverse economic conditions. For example, even after controlling for a worker's former industry, those displaced in the Pittsburgh region had long-term quarterly losses that averaged \$700 more than those in the Philadelphia region.<sup>29</sup> Further, within areas the prevailing unemployment rate at the time of the layoff modestly increased the initial loss and the rates of recovery. As a result, we conclude that local labor market conditions have a significant effect on both the short- and long-term effects of displacement. However, despite these significant effects, even if Pennsylvania's labor market had been stronger, say as strong as the Philadelphia market during the period, we estimate that the average long-term earnings losses would have fallen by only 30 percent. Consequently, our findings still indicate that displaced high-tenure workers experience substantial earnings losses even in relatively strong labor markets.

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<sup>28</sup>For example, although the two cities had similar rates of unemployment during the 1970s, during 1982 and 1983 the unemployment rate in Pittsburgh averaged 13.5 percent compared with 8.5 percent in Philadelphia.

<sup>29</sup>For a similar result see Beaudry and DiNardo (1989).



## 5. Conclusion

As we have shown in this paper, high-tenure workers experience substantial long-term earnings losses when they leave their jobs. Of course, many studies have found short-term losses of similar magnitude using other data sets. But we also find for workers displaced from distressed firms that these losses are (i) long term, with little evidence of substantial recovery after the third year; (ii) arise even prior to workers' separations; (iii) are not limited to workers in just a few industrial sectors; and (iv) are substantial even for those who find jobs in similar firms.

These results are significant because a large number of workers experienced these losses during the first half of the 1980s. Because we had a five percent sample of Pennsylvania's workers, we estimate that approximately 200,000 high-tenure workers were laid off from distressed firms. Although we have no way of knowing how common their experience was outside of Pennsylvania, simple extrapolation would suggest that, nationwide, 3.8 million workers found themselves in similar circumstances.<sup>30</sup>

Accordingly, our findings confirm the view that for a significant segment of the workforce, workers' job loss is associated with substantial and persistent earnings losses. Our findings do not allow us to determine which of the several competing theories best explain why such job losses should be so costly. But two points are clear: First, a substantial portion of these losses result because some attribute of the employment relationship is lost. Further, since these firm-specific losses arise generally for displaced workers, this finding works against the contention that these losses simply reflect union wage premiums or efficiency wages in particular industries. Alternatively, that lost attribute might be some form of specific human capital or result from a "tilted" tenure profile characteristic of internal labor markets. But our second point works against these contentions as well. We find that after their job losses, workers' earnings do not grow at a faster rate than the rate their earnings would have grown had they remained with their former firms. That finding is not consistent with the contention that earnings rise at a decreasing rate with tenure. These conclusions are, of course, only tentative, and reflect considerations beyond the scope of this paper. Their proper consideration is left for future research.

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<sup>30</sup>To arrive at this figure we simply divided 200,000 by 0.053, the fraction of the 1980 U.S. nonagricultural workforce employed in Pennsylvania. We expect this estimate to be too large because the 1982-83 recession was more severe in Pennsylvania than for the U.S. as a whole. Interestingly, however, the Displaced Worker Survey suggests that this figure is reasonable. Flaim and Seghal (1985) report that 5.1 million workers with three or more years of tenure separated from their employer between 1981 and 1985.

## DATA APPENDIX

### A. Constructing the Data

We constructed our longitudinal earnings data from Pennsylvania Unemployment Insurance (UI) tax reports, UI claims data, and ES202 reports. The UI tax records report the quarterly wage and salary earnings for each employee.<sup>31</sup> Since the state requires accurate and timely information to calculate firms' unemployment insurance taxes and workers' benefits, it cross-checks these earnings records against earlier reports and federal corporate tax returns. The ES202 reports provide information about firms' employment effectively at the county-SIC level. The Bureau of Labor Statistics uses this information when compiling its reports on employment and earnings. We created our longitudinal file by merging UI tax reports and ES202 records with the same Employer Identification Number (EIN). Thus for each worker in the sample, we had information on their quarterly earnings and for the corresponding calendar year their firms' EIN, SIC industry, location, and average employment during the last, current, and following years. Using that information we were also able to construct employees' years of service at the firm.

### B. Dating Workers' Separations

In order to estimate the costs of worker dislocation we also had to identify the quarters between 1980 and 1986 in which employees separated from their firms. Our Pennsylvania data had two pieces of information to identify who separated and when those separations occurred. First, the EIN reported annually referred to the firm (the principle employer) in which the worker received the most earnings during the year. A change from one year to the next in employees' EINs indicated that they separated from their incumbent firm. Second, the percentage of total quarterly earnings received from that year's principal employer signaled whether a job transition might have occurred during the quarter.

A key element of our analysis is accurately tracking workers' separations from individual firms. The Pennsylvania wage and ES202 data include each firm's Employer Identification Number (EIN) and separate files detailing EIN changes. In several years, well over 5% of total employment was affected by EIN changes. Thus, failure to correct for EIN changes would result in bogus job change due to bogus closing being greater than genuine job change due to closings. Indeed, had we not eliminated bogus changes, such change would be the primary source of movement of workers between employers with the same 4-digit SIC but different EINs.

To date the quarter of separation, we estimated the last quarter that the employee received earnings from the old principal employer. When this quarter was in the last year in which the

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<sup>31</sup>Employers report their employees' total earnings. Unlike Social Security earnings data, these data are not topcoded.

old employer was still the principal employer, the quarter of separation was the last quarter of positive earnings from that employer.<sup>32</sup> However, when the employee had positive earnings in the fourth quarter with the incumbent firm, the separation date was the last quarter of the following year in which the employee received earnings from sources other than the new principal employer.<sup>33</sup>

In most instances the foregoing procedure precisely dates the separation. But there appear to be two exceptions: First, when the employee has another wage or salary job besides the job with the incumbent; second, when the incumbent grants the employee severance pay after displacement. Both of those exceptions may cause us to date the separation after it actually occurred. As a result of our dating procedure, displaced workers' earnings may decline slightly during the quarters prior to displacement. However our finding reported in the text, showing that pre-displacement earnings losses are small in the nonmass-layoff sample, would imply that if there was a problem with our dating of separations, it would only occur when workers separate from distressed firms. We know of no reason why that should be the case in these data.

### C. Sample Restrictions

We restricted our sample in order to avoid the difficulties associated with quits and discharges for cause, early retirement, and lack of attachment to Pennsylvania's wage and salary workforce. To reduce the problem associated with quits, our sample includes only those workers hired by their firms prior to 1974. Thus our study is one of the effects of displacement on "high-tenure" workers. To reduce the problem associated with early retirement, our sample includes only workers born between 1930 and 1959. Although some workers in our sample are as old as 56 when they separate, as shown below in Table 1, most separators are under 50. Hence, for all practical purposes few separators are likely to retire following their separations. Finally, to avoid the difficulties associated with persons who never have quarterly earnings following separation, we required displaced workers to have positive wage or salary earnings in each calendar year after losing their job.

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<sup>32</sup>For example, if the worker has earnings from the old employer in the third but not the fourth quarter of the last year the old employer was the principal employer, we declare the separation to have occurred in the third quarter of that year.

<sup>33</sup>For example, if the worker receives all of his earnings from the new employer in the second but not the first quarter of the first year the new employer is the principal employer, we declare the separation to have occurred in the first quarter of that year.

## References

- Addison, John, and Portugal, Pedro (1989), "Job Displacement, Relative Wage Changes, and Duration of Unemployment," *Journal of Labor Economics*, 7:3, 281-302.
- Ashenfelter, Orley (1978), "Estimating the Effect of Training Programs on Earnings," *Review of Economics and Statistics* 60 (February 1978), 47-57.
- Ashenfelter, Orley, and Card, David (1985), "Using the Longitudinal Structure of Earnings to Estimate the Effect of Training Programs," *Review of Economics and Statistics*, November 1985, Vol. LXVII, No. 4, 648-660.
- Beaudry, Paul, and DiNardo, John (1989), "Long-Term Contracts and Equilibrium Models of the Labor Market: Some Favorable Evidence," Industrial Relations Section Working Paper No. 252, Princeton University, May 1989.
- Becker, Gary (1975), *Human Capital*, National Bureau of Economic Research, 2nd ed.
- Blanchflower, David, "Fear, Unemployment, and Pay Flexibility," *The Economic Journal*, May 1991, Vol. CI, 483-96.
- Blau, Francine D., and Ferber, Marianne A., "Discrimination: Empirical Evidence From the United States," *American Economic Review, papers and Proceedings*, May 1987, 77:2, 316-320.
- Flaim, Paul and Seghal, Ellen (1985), "Displaced Workers of 1979-83: How Well Have They Fared?" U.S. Department of Labor, Bureau of Labor Statistics, Bulletin 2240, Washington, D.C.
- Jacobson, Louis (1988), "Structural Change in the Pennsylvania Economy." The W. E. Upjohn Institute for Employment Research Report, Kalamazoo.
- \_\_\_\_\_ (1991), "The Dynamics of the Pittsburgh Labor Market," W. E. Upjohn Institute for Employment Research Report, Kalamazoo.
- Jovanovic, Boyan (1979), "Job Matching and the Theory of Turnover," *Journal of Political Economy* 87:5, 972-90.
- Hamermesh, Daniel S. (1989), "What Do We Know About Worker Displacement in the U.S.?" *Industrial Relations*, Winter 1989, 28, 51-9.

- Heckman, James, and Hotz, V. Joseph (1989), "Choosing Among Alternative Nonexperimental Methods for Estimating the Impact of Social Programs: The Case of Manpower Training," *Journal of American Statistical Association*
- Heckman, James, and Robb, Richard (1985), "Alternative Methods for Evaluating the Impact of Interventions." In *longitudinal Analysis of the Labor Market Data*, ed., J.J. Heckman and B. Singer. Cambridge: Cambridge University Press.
- Kletzer, Lori (1989), "Returns to Seniority After a Permanent Job Loss," *American Economic Review*, 79:3.
- LaLonde, Robert (1986), "Evaluating the Econometric Evaluations of Training Programs with Experimental Data." *American Economic Review*, 76:4, 604-620.
- Lazear, Edward (1981), "Agency, Earnings Profiles, Productivity, and Hours Restrictions," *American Economic Review*, 71:4, 606-20.
- Lewis, H. Gregg (1986), *Union Relative Wage Effects: A Survey*, Chicago: University of Chicago Press.
- Podgursky, Michael and Swaim, Paul (1987), "Job Displacement and Earnings Loss: Evidence from the Displaced Worker Survey," *Industrial and Labor Relations Review* 41:17-29.
- Ruhm, Christopher (1991), "Are Workers Permanently Scarred by Job Displacements?" *American Economic Review*, 81:1, 319-323.
- Stiglitz, Joseph (1974), "Alternative Theories of Wage Determination and Unemployment in LDC's: The Labor Turnover Model," *Quarterly Journal of Economics*, 88, 194-227.
- Swaim, Paul, and Podgursky, Michael (1991), "The Distribution of Economic Losses Among Displaced Workers: A Replication," *Journal of Human Resources*, 26:4, 742-755.
- Tannery, Frederick J. (1991), "Labor Market Adjustments to Structural Change: Comparisons Between Allegheny County and the Rest of Pennsylvania 1979-87." Unpublished Working Paper, Economic Policy Institute, University of Pittsburgh.
- Topel, Robert (1990), "Specific Capital and Unemployment: Measuring the Costs and Consequences of Worker Displacement." *Carnegie-Rochester Series on public Policy* 33, 181-214.
- \_\_\_\_\_ (1991), "Specific Capital, Mobility, and Wages: Wages Rise with job Seniority," *Journal of Political Economy*, 99:1, 145-176.

**PLEASE NOTE: FIGURES 1-6 ARE AVAILABLE IN HARD COPY ONLY**

Table 1  
Age and Earnings of Displaced Workers

	Mean	Std Dev	Median	10th Pctle	90th Pctle
A: Age at Separation					
All	36.9	7.9	37	26	48
Males	36.8	7.8	37	26	47
Females	37.1	8.2	37	26	48
Nonmanufacturing	36.4	7.7	36	26	47
Manufacturing	37.0	7.9	37	26	49
Western PA	36.7	7.9	36	26	47
Eastern PA	37.0	7.9	37	26	48
Nonmass-Layoff	36.9	7.8	37	27	47
Mass Layoff	36.9	7.9	37	26	48
Age of Nonseparators*	41.7	7.0	42	32	51
B: Earnings Three Years Prior to Separation					
All	\$23,084	\$13,500	\$21,718	\$10,601	\$35,196
Males	25,867	14,090	24,334	14,380	37,311
Females	14,929	6,736	14,157	7,314	23,416
Nonmanufacturing	24,586	18,491	22,024	9,925	38,866
Manufacturing	22,438	10,594	21,625	10,797	33,586
Western PA	22,934	12,122	22,044	10,572	34,442
Eastern PA	23,184	14,348	21,474	10,620	35,672
Nonmass-Layoff	23,560	17,122	21,125	10,711	36,111
Mass Layoff	22,857	11,365	21,970	10,473	34,795
Earnings of Nonseparators*	25,331	12,779	23,766	12,990	37,745

Note: Earnings figures are in 1987 dollars.

Table 2  
Earnings Losses by Sector of New Jobs

[Deviation between Actual and Expected Quarterly Earnings]

Quarters Since Separation	New Job in Same Sector		New Job in Different Sector
	Same 4-digit SIC	Different 4-digit SIC	
A: Displaced Manufacturing Workers			
-8	-\$379 (82) [-7]	-\$117 (67) [-2]	-\$237 (73) [-4]
12	-1,044 (82) [-19]	-1,117 (67) [-21]	-2,616 (73) [-44]
24	-1,103 (197) [-20]	-958 (137) [-18]	-2,221 (150) [-38]
B: Displaced Nonmanufacturing Workers			
-8	-229 (132) [-4]	-26 (128) [0]	-151 (231) [-3]
12	-1,129 (132) [-18]	-1,305 (128) [-23]	-1,498 (231) [-26]
24	-1,103 315 [-18]	-1,276 (241) [-22]	-1,949 (476) [-33]

Notes -- The numbers in parentheses are the standard errors. The numbers in square brackets express the estimated earnings losses as a percentage of pre-displacement earnings.