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**LONG-TERM EFFECTS OF JOB
DISPLACEMENT: EVIDENCE FROM THE
PANEL STUDY OF INCOME DYNAMICS**

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ABSTRACT

This paper measures the long-term wage and earnings losses of workers who lose jobs due to plant closings and layoffs, using a fixed-effects estimator to control for unobserved worker characteristics and longitudinal data from the Panel Study of Income Dynamics. The results show large and persistent effects of displacement on average, with earnings and wages falling by 25 and 12 percent in the year after job loss. Six or more years later, earnings and wages remain reduced by approximately nine percent. Multiple job losses are responsible for much of this persistence. Those workers who avoid subsequent displacements experience more rapid recovery, with earnings and wage reductions of one and four percent six or more years after displacement. These multiple job losses are not heavily concentrated among any identifiable group of workers, but instead affect the recovery patterns of workers with a variety of characteristics.

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The effects of involuntary job separations on future employment and earnings have been the subject of numerous empirical studies. Until recently, most studies had focused on the consequences of displacement¹ in the period immediately following job loss. Now, however, an emerging body of evidence on the longer-term effects of displacement suggests much of the impact of displacement on earnings and wages is permanent (Topel, 1990, Ruhm, 1991, Jacobson, LaLonde and Sullivan, 1993).

The persistence of wage changes after job loss has important implications for public policy. Evidence of large short-term costs of displacement has led many to argue the importance of providing assistance to displaced workers. If the costs of displacement persist this may motivate still more concern over the long-term prospects of these workers. Further, differences across workers in their recovery paths may be an important factor in developing and targeting future assistance programs.

This paper measures the long-term impact of displacement on annual earnings and wages, using longitudinal data from the Panel Study of Income Dynamics (PSID) to follow displaced workers over time. Specifically, this study adds to the growing literature on the long-term effects of displacement in several ways. First, I estimate a fixed-effects model with longitudinal data from the PSID to control for unobservable differences between displaced and not displaced workers that may bias estimates of displacement costs. This methodology was utilized by

¹ The terms "displaced" workers or "displacement" are sometimes used to refer to specific groups of workers who lose their jobs, particularly those from certain industries or in certain high job tenure groups. For the purposes of this study the term displacement is used to refer to any involuntary termination of a position, with the exception of the ending of an explicitly temporary job.

Jacobson, LaLonde and Sullivan (JLS, 1993a, 1993b), but has not been applied to a national sample of displaced workers. Second, I separate the effects of subsequent job losses that follow an initial displacement, and show that these explain much of the persistence of observed earnings and wage losses. Finally, by making use of information on worker characteristics available in the PSID, I investigate differences in recovery prospects for different worker groups, and examine whether multiple displacements are particularly common among certain subsets of displaced workers.

Some have noted that substantial wage recovery might be expected in the years following displacement.² If earnings and wage reductions primarily reflect losses of firm-specific capital and job tenure, and if workers can reinvest in such capital following displacement, then recovery may result. On the other hand, if other factors are behind displacement costs,³ or if there are barriers to re-investment in specific capital following displacement, relatively little recovery may occur. To resolve this question, several recent empirical studies have examined wage and earnings patterns in the years after job loss.

Jacobson, LaLonde, and Sullivan (1993a, 1993b) use statistical techniques similar to those used here to estimate earnings losses from a large administrative dataset from the state of Pennsylvania. They find reductions in quarterly earnings of approximately 25 percent six years after the separation for a sample of high tenure Pennsylvania workers. Their dataset offers important advantages in terms of the very large sample size and detailed information on workers'

² Topel (1990b, p. 16) argues that the large wage growth associated with tenure accumulation in the early years of a job implies that "initial wage losses would vastly overstate changes in lifetime wealth caused by a job termination." Hamermesh (1989) cites the large gains made by women re-entering the labor market as suggestive of possible recovery for displaced workers.

³ Union or industry-level rents, for example, may be lost with displacement. Carrington (1993) provides evidence that poor local labor market conditions explain a portion of observed displacement costs.

pre-displacement employers. On the other hand, this dataset is not nationally representative and lacks information on important worker characteristics, such as education and union status.

Ruhm (1991a, 1991b) provides estimates of the lasting effects of displacement based on PSID data and using a comparison group of yet-to-be displaced workers to control for unobservable characteristics associated with displacement. This method is troubling, however, particularly given evidence below on the frequency of multiple job displacements. It seems likely that his sample of workers to be displaced five years in the future may also contain workers displaced in the intervening period. This makes it unclear how to interpret the estimated coefficient for displacements in a future year. In addition, this approach to controlling for unobserved differences is only applicable to Ruhm's results for the initial year or two after displacement. Several previous studies, including JLS, have found that wages and earnings begin to deteriorate as many as three years prior to a job loss. As a result, Ruhm's control group of workers who will lose jobs five years after the base year may begin to experience their own wage reductions in years two or three.

Finally, Topel (1990a) uses PSID data and data from the Displaced Workers Survey (DWS) to study this issue. Topel does not control for normal life-cycle wage growth that occurs for all workers over time, and so his estimates of recovery reflect all earnings or wage growth after displacement. More relevant to the issue of recovery, however, is whether workers have higher than average wage growth following displacement, not whether they have any wage growth at all. Despite this difference in the definition of displacement effects between Topel's work and that of others discussed here, he also finds quite persistent effects. Individuals are

found not to return to their pre-displacement earnings and wage levels for many years; this implies even larger long-term reductions relative to experience-adjusted earnings and wages.

One issue not addressed in any previous studies is the significance of additional job losses that follow an initial displacement. Topel (1990a) explicitly selects the displacement following the longest job held to follow in his study. This is done to avoid counting subsequent job losses as separate events. While it is true that these additional displacements are not independent events, I show that subsequent displacements are an important part of workers' post-displacement experiences. I find that multiple displacements for a given worker are common and that controlling for time since a worker's most recent displacement, as opposed to time since a worker's first displacement, results in substantially more recovery in earnings and wages. These multiple displacements occur for workers with a variety of characteristics. This identifies intervening job separations as an important factor behind the persistence of displacement induced earnings reductions.

I. Econometric approach

To measure the long-term costs of displacement I use an econometric approach that closely follows that of JLS (1993a, 1993b). The basic approach is to use a fixed-effects estimator to control for unobserved worker characteristics that may be correlated with displacement probabilities, using data from workers who are displaced at some point in the sample frame and a comparison group of workers who are not displaced at any point in the sample period.⁴

⁴ See JLS (1993a) for a thorough discussion of the intuition behind and importance of utilizing both a fixed-effects model and a comparison group of never displaced workers.

More specifically, given longitudinal data on workers' wage and employment histories, the effects of an involuntary job separation for worker i on wages and earnings in year t can be modeled in the following way:

$$(1) \quad \ln W_{it} = X_{it}\beta + D_{it}\delta + \alpha_i + \gamma_t + u_{it}$$

W_{it} is person i 's real wage or earnings in year t ; X_{it} is a vector of variables influencing a worker's human capital and earnings potential; and D_{it} is a vector of dummy variables indicating a job displacement in a future, current, or previous year.

Note that the error term in the above equation contains a time invariant effect, α_i . If less able or less motivated workers are more susceptible to layoffs, estimates of displacement effects that fail to control for α_i will be biased towards finding larger losses. To control for such unobserved worker characteristics, I utilize a standard fixed-effects model. In estimating the fixed-effects model, many of the terms in X , such as education, sex, and race have also been eliminated from the equation, since they do not vary with time. In the basic model I estimate, only experience terms and experience-sex interactions remain in X . Other influences that are not necessarily constant over time, such as union status, industry, or occupation, are initially omitted since changes in these variables may be the result of job displacement. By omitting these factors that may change as a result of job loss, the terms in δ will capture the full effect of the job loss. Equation (1) also includes a vector of calendar-year dummy variables (γ_t). These variables will control for economy-wide wage and earnings changes over time, including both business cycle effects and trends in earnings and wages over the 1970s and 1980s.

The vector of displacement indicators (D_{it}) contains three types of variables. First are dummy variables that equal one in the years prior to the job loss. These will capture the fact that

earnings or wages may begin to deteriorate prior to the actual displacement, as a firm's demand conditions worsen. Second, there is a dummy variable indicating the year of the reported displacement, to capture the immediate effect of job loss in the year that the job loss occurs. Finally, a series of variables indicate that a displacement has occurred in some previous year. These coefficients will reflect the persistence of the displacement effects over time. Two methods are used to define these post-displacement effects. Initially, these variables refer to years elapsed since a worker's first identified displacement. Later, I define these variables with respect to years since a worker's most recent job displacement.

It is possible that the effects of displacement estimated with equation (1) will be biased if displaced workers have unobserved characteristics that lower not only their wage levels, but that also lower their rates of wage growth. Suppose the correct model is:

$$(2) \quad \ln W_{it} = X_{it}\beta + D_{it}\delta + \alpha_i + \lambda_i t + \gamma_t + u_{it}$$

In this case, to avoid bias on the estimated displacement effects, the equation should be estimated including an individual specific intercept (α_i), as well as an individual specific time trend ($\lambda_i t$). This specification will be tested as well, to evaluate potential bias from unobservable heterogeneity related to levels of wage growth.

II. Data

The data used for this study come from the 1968 through 1987 waves of the Panel Study of Income Dynamics. To be included in the analysis sample, persons must be household heads, present throughout the length of the survey, and have positive earnings in a given year from 1968 through 1986. Given my requirements that workers be in the survey from 1968 on, and that they have earnings in each year they are included, the sample contains 1606 workers, 441 of whom

experience at least one displacement at some point in the sample period. The restriction to household heads using PSID data makes the sample largely male (84%), since the male is the default head of two-adult households in the survey.⁵ The dependent variables used are the natural log of the real hourly wage over the relevant year, measured as total labor income divided by total hours of work, and the log of real annual earnings, in 1982 dollars. Economists are often interested in the effects of displacement on wages, largely because of implications of specific human capital theories. From workers' and policy makers' perspectives, however, annual earnings may be of more interest. Both earnings and wage effects are estimated throughout.

The definition and identification of job displacements were as follows. The PSID survey asks respondents if their current job began after January of the previous survey year; if so, they are asked what happened to the previous job. A displacement is defined as leaving due to a plant or business closing or due to being laid off or fired. This definition of displacement is somewhat broad in that it includes virtually all involuntary job separations, with the exception of temporary layoffs and the ending of temporary jobs. This definition is consistent with previous work on job displacement using the PSID, and so will allow for comparison with earlier results.

There are two potential difficulties with identifying displacements in the PSID. First, as Topel (1990) points out, workers may have had multiple job changes between survey dates. This will cause some displacements to be missed if they are frequently followed by other job changes, since the survey asks workers only about their most recent job change. Secondly, the timing of the displacement is not precisely identified in all years of the survey. For example, consider a

⁵ Only heads have been selected for the analysis because wives and other household members do not have the necessary data available over the course of the panel. Unfortunately, this results in a small and selected sample of females. The estimated long-term effects of displacement do not differ substantially when the sample is restricted to male heads only.

worker who is displaced, according to the above definition, in 1986. This means that a displacement occurred for that worker at some time between January, 1985, and the survey date in 1986. As an extreme case, suppose the displacement occurred on January 1, 1985. The model summarized by equation (2) looks for the initial displacement effect in the deviation of average hourly wages in 1986 from the individual's mean wage over 1968 through 1986. If, however, the displacement occurred early in 1985, the 1985 wage will be the appropriate measure of the initial displacement impact. If this timing issue is a significant problem, my estimates of the initial impact of displacement will be biased towards zero. However, by including a displacement variable equal to one in the year prior to the displacement, I can capture the effects of displacements that occurred at the beginning of the previous year. Similarly, the variable for displacement effects one year following displacement will capture the effects of job separations that occur just prior to the survey period.

A final step in constructing the analysis sample was to eliminate those workers who reported being displaced prior to 1969. In 1968, the survey asked workers whether they had lost a job in the past ten years, and for what reason. For people who were displaced during this period, however, it is unclear exactly when the displacement occurred. They are eliminated from the sample because, for example, in 1969, I cannot distinguish between persons displaced four years ago and nine years ago. The final sample thus consists of workers who are displaced from 1969 through 1986 and a comparison group of workers who report no displacements from 1968 (and in the previous ten years) through 1986.

The PSID does have several shortcomings with respect to the study of displacement.⁶ One disadvantage is the small sample size of displaced workers. Given my other sample

⁶ A discussion of many of these issues can be found in Topel (1990a).

requirements, I observe approximately 440 displaced workers, only a fraction of those available in a more specialized survey such as the DWS. This is balanced, however, by the longitudinal nature of the PSID that allows me to control fully for individual-specific effects and for both pre- and long-term post-displacement effects. Another potential disadvantage is that I cannot distinguish between workers who are fired and those who are laid off (presumably for demand-related reasons). While it might be desirable to eliminate workers who were fired for cause from my sample of displaced workers, that is not possible given the data.⁷ This is likely to affect a relatively small number of cases, however. Boisjoly, Duncan and Smeeding (1994) have examined the specific types of job separations included in the laid off or fired category. They find that approximately 16 percent of these workers report having been fired.⁸ Finally, it is possible that attrition in the PSID may be related to negative events, such as a job loss. Topel (1990) notes that this will result in a downward bias in the costs of displacement estimated from the PSID if those hardest hit from displacement are most likely to leave the survey. While these limitations should be kept in mind in interpreting the results that follow, the advantages of a national sample and the long time period over which to observe workers before and after job loss make the PSID a useful source for this study of long-term effects of displacement.

III. Long-term costs of displacement

Table 1 shows the numbers of displaced workers in the sample by year. An important feature of Table 1 is the sizable difference between the columns indicating all job displacements and first job displacements. Many individuals experience multiple job displacements during the

⁷ JLS also cannot precisely identify the type of separation experienced by their sample of workers. They thus use a sample of high-tenure workers leaving firms experiencing severe employment reductions, in order to minimize the likelihood of workers leaving voluntarily or for individual-specific reasons.

⁸ Boisjoly, Duncan and Smeeding (1994) returned to the original copy of the survey questionnaire in order to distinguish layoffs from firings in their sample.

sample period. This suggests that a significant portion of the wage costs may be related to the increased likelihood of additional job separations. In the regression results below, I report results using only the first displacement as well as using all displacements. To implement this, the current and lagged displacement variables refer to the time elapsed since a worker's most recent displacement. The pre-displacement controls always refer to years before the first observed displacement.

It is not surprising that workers, once displaced the first time, are likely to suffer additional job losses. Additional displacements may follow an initial job loss either because persistent worker characteristics result in a correlation of displacement probabilities across time, or because the first displacement causes additional separations through reduced job-match quality or tenure. I do not attempt to distinguish between these two explanations in the current study. Table 2 shows that approximately 41 percent of workers for whom I observe one job loss experience two or more displacements within the sample period. These multiple displacements are most likely to occur within a few years of the initial job loss, with 80 percent of second or later displacements occurring within five years of the first. The bottom portion of Table 2 reports the probabilities that a displaced worker will lose another job, conditional on years since the first job loss. The denominator for each row is all displaced workers observed the given number of years after job loss. The risk of a subsequent job loss is 10 to 12 percent in the first two years after a displacement, and remains between six and nine percent in the following three years. This can be compared with overall rates of displacement in a given year, shown in Table 1, of two to four percent.

Earnings and wage patterns of displaced workers around the date of the displacement are shown in Table 3. Real mean earnings and hourly wages (in 1982 dollars) are shown for the periods from five years prior to displacement to the period ten or more years after displacement. Comparable figures for non-displaced workers are shown for three different calendar years as well. The immediate drop in earnings at the time of displacement is obvious in Table 3. The first column of the table shows that average earnings fall from over \$20,000 three or more years before displacement to less than \$16,000 during the year of the job loss; hourly wages decline from around \$9.80 to \$8.77 over the same time period. The first and second columns show that earnings and wages do increase with time since the first displacement. Six years after the displacement, annual earnings have increased to almost \$19,000 and wages to \$9.63. The final two columns in Table 3 show the pattern of earnings and wages around the time since a worker's last displacement.⁹ Specifying time since displacement in this way does suggest a stronger pattern of recovery in both wages and earnings after job loss. Five years after the last displacement, for example, annual earnings are more than \$5000 above their level in the year of displacement. What this table does not show is how much wage growth these workers might have had over time, regardless of their displacement status. I next turn to regression results on the long-term costs of displacement.

Table 4 shows the regression results on earnings and wage losses for displaced workers based on the specification in equation (1). The estimation is by ordinary least squares, using a mean-differenced form to control for individual-specific effects. Additional controls include year effects, experience, and an experience-sex interaction. Here I report the effects of job loss on

⁹ The figures prior to displacement are the same since these always refer to the period prior to a worker's first displacement.

annual earnings and hourly wages, following both the first observed displacement and the most recent displacement. The effects of displacement on annual earnings are shown in the first column of this table. Significant earnings reductions begin in the year prior to the displacement.¹⁰ In the year of displacement earnings are reduced by approximately 25 percent.¹¹ In the year immediately after job loss earnings recover substantially as workers are re-employed. In subsequent years, however, earnings remain extremely variable, ranging from an estimated loss of ten percent four years after displacement, to under three percent in the next year, and falling again to seven percent in the sixth year. During the period ten or more years after the job loss, annual earnings remain more than six percent below their expected levels.

The fourth column shows the persistent wage reductions associated with job loss. Wage reductions begin prior to the job loss as evidenced by the significant coefficient on the dummy for one year prior to displacement. In the initial year of the job loss, wages are reduced by more than 12 percent. Over the five years following displacement wages recover very slightly, and are highly variable. Notably, in the period nine years after displacement, hourly wages are estimated to fall to 19 percent below their expected levels, although this temporary drop is largely eradicated during the period ten or more years after displacement.¹²

The second and fifth columns of Table 4 show how much of these lasting earnings and wage reductions are the result of subsequent job losses. The years since displacement variables now reflect years since a worker's most recent displacement. Subsequent displacements are an important part of persistence in annual earnings losses. Controlling for a worker's most recent

¹⁰ Given the timing problems noted above, this effect is a combination of the displacement effect and earnings reductions prior to displacement.

¹¹ The percentage effect on earnings and wages is computed as $e^{\delta} - 1$.

¹² Further investigation revealed that this is not the result of a few outliers, but does seem to reflect genuine variability in wages and some repeated job losses during this post-displacement period.

job loss, earnings are initially reduced by around 26 percent, and rebound by 12 percentage points in the initial year after displacement. Earnings then increase steadily until they are around three to four percent below their expected values eight and nine years after displacement. In the periods five or more years following the most recent job loss, earnings losses are small (four percent or less) and not statistically significant.

For hourly wages there are smaller differences in the displacement effects when controls for subsequent displacements are included. This is not too surprising, since a substantial portion of the annual earnings costs of displacement comes from the immediate period of unemployment. The wage effects over the first five years after displacement are virtually identical to the estimates following only the first displacement, with larger differences in the later years. These results indicate more long-term wage recovery if subsequent displacements can be avoided, although it is not until ten or more years after displacement that the effects are substantially diminished.

I next estimated the wage and earnings equations using the specification given by equation (2) including worker-specific time trends. These results are also shown Table 4. Inclusion of an individual specific trend makes relatively little difference to the results. For hourly wages, including the worker-specific trends leads to no systematic difference in the estimates. For annual earnings, the estimates based on equation (2) show uniformly larger losses. This is somewhat surprising since the expected bias was in the other direction, but the differences in the individual coefficients are small relative to the estimated standard errors.¹³ In the remainder of the paper I

¹³ JLS also implemented this approach on each of their two samples: workers separated in mass layoffs and those not separated in this way. For the non-mass layoff sample, this specification resulted in a much stronger pattern of recovery. For the mass layoff sample used by JLS there was less of a difference, but their inclusion of the trend terms for this sample also resulted in slightly larger estimated losses.

continue to use the simpler specification given by equation (1) since the estimated patterns of losses are not substantially altered by inclusion of the individual-specific trends.¹⁴

IV. Losses by worker characteristics

I next decompose earnings and wage reductions following displacement according to characteristics of workers prior to the displacement. Worker characteristics are interacted with the vector of displacement variables to obtain estimates of the effects of displacement for different groups of workers. These results are shown in Table 5. To reduce the number of separate estimates presented here, I have combined the time periods around displacement into four groups: the pre-displacement period, one to two years prior to job loss; the year of the displacement; an initial recovery period one to five years after the job loss; and the longer-term recovery period six or more years after displacement. The first row of this table shows the estimated losses for all workers, following only the first displacement, with the effects summarized in this way.

The negative relationship between pre-displacement job tenure and the short-term costs of displacement has been widely studied¹⁵; here I examine whether tenure-related differences in the impact of displacement carry over to the longer-term costs of displacement.¹⁶ For workers with

¹⁴ Two other estimation issues were also examined and found to have relatively little effect on the results. First, I corrected for serial correlation in the error terms of the earnings and wage equations using generalized least squares. This resulted in very small increases in the standard error estimates, and little change in point estimates. Second, because I require earnings only in a given year for inclusion in the sample, if workers facing severe losses are more likely to have zero earnings following displacement, changes in sample composition over time may be driving the pattern of displacement effects. Estimating the model requiring earnings in all years, or allowing for zero earnings in some years resulted in similar effects.

¹⁵ Hamermesh (1989) summarizes several studies noting the relationship between job tenure and displacement costs. Carrington (1993) shows that this relationship remains even when controlling for local labor market conditions.

¹⁶ Employer tenure in the PSID is measured differently across survey years. At various times, the interview questions refer to time with an "employer," in a "job," or in a "position." To reduce this inconsistency, the following changes were made. For years in which the survey asked for years with an "employer," this value of tenure was used to extrapolate backwards. Then, for years in which only tenure in a "job" or "position" was asked, this imputed employer tenure was compared to see which was greater. If employer tenure was greater than the "job" or "position" tenure, the value of employer tenure was used. Additionally, for the years 1968 through 1974, tenure is reported on the survey in brackets; these values were recoded to the middle of the bracket. These

fewer than three years of pre-displacement job tenure, I find relatively small and temporary effects on both wages and earnings. While earnings for these workers are initially reduced by about 16 percent, in the periods after displacement the remaining effects are estimated to be only three to four percent. Wages initially fall by around nine percent and recover to approximately five percent in the last period. For workers with more than three years of pre-displacement job tenure, the earnings costs of displacement are substantially larger. Earnings initially fall by nearly 29 percent, and remain approximately 11 percent reduced six or more years after job loss. Wage losses for the higher tenure group are estimated at around 12 percent throughout the recovery period.

The next section of Table 5 disaggregates displaced workers by the type of displacement, plant closings versus layoffs. In the period after displacement the costs for these two groups are similar. What distinguishes these groups are differences in their wage paths prior to displacement. Workers whose employers shut down at the time of displacement have very large wage reductions (12 percent) prior to the displacement, while those who will be laid off have no significant wage reduction over this period. The pattern of these results is unchanged by controlling for other characteristics, such as union status or pre-displacement tenure that might be related to the type of job loss experienced. This may shed light on findings reported by Gibbons and Katz (1991), who report smaller wage reductions for those displaced in plant closings as opposed to layoffs. They present a model in which workers losing jobs in plant closings are expected to suffer smaller losses since they (unlike workers who have been selected for layoffs) avoid being labeled as low ability workers. However, because Gibbons and Katz use DWS data, they are unable to control

corrections are similar to those used by Altonji and Shakotko (1985); Topel (1990b) suggests an alternative tenure recoding scheme.

for wage reductions in the years prior to the job loss. While it is true that wage changes from one year prior to the displacement until after the displacement are smaller for plant closings, this may not imply that the total wage reductions suffered by these workers are smaller once their pre-displacement wage cuts are taken into account. This example illustrates the importance of controlling for several years of pre-displacement wages when making inferences about the relative losses of displaced workers.¹⁷

I next examine the extent to which the loss of union coverage explains post-displacement wage and earnings losses. While JLS did not have data available on workers' union status, Topel (1990a) shows that those losing union status have substantially larger losses than other displaced workers. I also find that those who lose union coverage suffer the largest and most persistent wage and earnings reductions. For this group earnings initially fall by 40 percent, and wages by 21 percent. Even during the period six or more years after job loss, earnings for union-coverage losers remain reduced by 32 percent and wages by 25 percent. Workers who never had union coverage have wage and earnings paths that are very close to the average paths of all displaced workers. Workers who retain union coverage, in contrast, face only short term employment reductions, with no statistically significant wage or earnings reductions in the years after displacement.

While those losing and retaining union coverage have very large and very small losses, respectively, they make up a relatively small portion of all displaced workers. Approximately 75 percent of displaced workers in my sample were non-union both before and after the displacement; 15 percent retained their union status, and 10 percent lost union status. These

¹⁷ Several previous authors, including de La Rica (1992) and Blanchflower (1991), have also noted the importance of and explored potential reasons for pre-displacement wage reductions.

results indicate, however, for sectors or groups of displaced workers that are highly unionized, subsequent union status may be an important indicator of recovery prospects.

Workers' education levels also significantly affect the magnitude and persistence of earnings and wage reductions. None of the previous studies of the costs of displacement have examined long-term differences by education levels. The results of interacting workers' education levels with the displacement effects show large, but non-linear, effects for years of education. Those with no more than a high school education lose less than more educated groups. Earnings for those with 12 or fewer years of education fall by about 22 percent immediately after displacement, and recover rapidly; wages for this group fall by eight percent initially and recover slightly. Workers with more than a high school education, but no college degree, lose substantially more in both earnings and wages. Those reporting 13 to 15 years of education have initial earnings reductions of 34 percent, and wage reductions of 25 percent. These effects are very persistent over the next five years, and recover only slightly in later years. In contrast, those with a college degree lose only slightly more than the high school group, although their initial losses are more persistent.

The large and non-linear differences in displacement costs by education are somewhat surprising. It is possible that educational levels are capturing the occupational and industrial distribution of workers. Controlling for broad occupational and industrial categories of displaced workers, as well as for their union status, however, does not change the pattern of effects with respect to education. The finding with respect to highly educated workers is consistent with the findings of Kletzer (1989) who argues that those employed in white collar jobs have more transferable human capital, and so may lose less from displacement and recover more rapidly.

The finding that those with low levels of education have relatively small displacement costs remains surprising.

Finally, I examine the consequences of displacement based on post-displacement mobility. In line with previous research, I find large differences in the long-term costs of job loss by whether workers remain employed in the same industry.¹⁸ For those who are not displaced from their industries, I find rapid recovery in both earnings and wages, with neither estimated long-term effect being significantly different from zero. In contrast, those workers who are displaced from their industry suffer long-term earnings reductions of 24 percent, and wage reductions of 17 percent. The long-term effects of occupational changes after displacement are similar. This does not necessarily imply, of course, that changing industry or occupation itself causes larger earnings and wage reductions. It is likely that workers changing industry or occupation would have fared even worse by remaining in their original sector. Because industry and occupation changing is likely to be correlated with the loss of union status, I also estimated these mobility effects controlling for workers' union status change. Even among those workers not losing union status, industry and occupational movers experienced much larger wage and earnings reductions.

I next consider whether differences in long-term effects of displacement based on these characteristics are related to the likelihood of experiencing subsequent displacements. In Table 6 I repeat the disaggregation of the displacement effects in Table 5, controlling for time since a worker's most recent job loss, and so isolating the effect of a single displacement. The impact of subsequent displacements on earnings and wage recovery is spread across most of the categories in these tables. Among workers with more than three years of pre-displacement job tenure, for

¹⁸ Carrington (1993), for example, finds that industry changers experience larger short-term wage losses, even once local labor market conditions are held constant. JLS find that industry changers in Pennsylvania have much larger earnings reductions than those who maintain their industry affiliation.

example, earnings losses are approximately eight percent in the first five years after displacement, and are less than two percent six or more years after job loss. The comparable figures from Table 5 are 10 and 11 percent. Across all categories the estimated long-term earnings and wage reductions are substantially reduced as time elapses without another displacement. For workers experiencing very large long-term costs of displacement, such as union coverage losers and workers with 13 to 15 years of education, controlling for time since the most recent displacement continues to show substantial long-term losses, but these losses are smaller than the overall reductions implied by Table 5. Additional job losses are an important mechanism through which some portion of the costs of an initial displacement persist.

Given the comparisons between Tables 5 and 6 across a variety of worker groups, multiple displacements do not seem to be highly concentrated among a particular group of workers. To investigate further the distribution of multiple job losses across workers I estimated a logit model for the probability of an additional job loss conditional on having experienced one displacement. Variables for worker and job characteristics prior to the first displacement were entered as explanatory variables, along with year dummies and a variable indicating years since the first displacement. Worker's education, pre-displacement job tenure and the type of job separation have relatively small but statistically significant effects on the probability of additional displacements. College educated workers have an estimated probability of additional displacements in the period two to five years after the first displacement of approximately six percent per year, compared to nine percent for less educated workers. A worker with just two years of pre-displacement job tenure has approximately a ten percent chance of losing another job in each of the next five years; the probability for a worker with six years of pre-displacement job

tenure is around eight percent. Being displaced as the result of a plant closing, rather than a layoff, decreases the annual probability of future displacements from nine percent to around seven percent.

Other characteristics considered in Tables 5 and 6 were not found to affect future displacement probabilities. Union status and changes in industry or occupation were not significantly correlated with the likelihood of additional displacements. Calendar year effects were not significant predictors of the probability of multiple job losses.¹⁹ These results, along with the comparisons between Tables 5 and 6, indicate that the role of additional job losses in the persistence of earnings and wage reductions associated with displacement is significant across workers with a variety of observable characteristics.

V. Comparisons with previous findings

Before concluding, I briefly compare the overall losses estimated in other studies of long-term displacement costs with those presented here. Table 7 summarizes previous estimates of wage and earnings patterns in the five years following displacement. While some differences exist across studies in the magnitude of estimated costs, there is general agreement that, for many groups of displaced workers, these costs are very persistent. One difficulty in comparing these estimates is that losses do vary somewhat across workers with different pre-displacement characteristics. In each of the studies summarized in Table 7, however, the basic results presented pertain to a base group of workers with particular characteristics that may affect the estimated short- and long-term losses. In column three of Table 7 I have noted those base group characteristics that are likely to affect comparability of these results. In the final few rows of

¹⁹ These year effects capture only national economic conditions. It is likely that more localized measures of labor market conditions would be important predictors of the likelihood of additional displacements. While the current sample sizes and data limitations preclude an examination of these effects, this could be an important area for future research.

Table 7 I show my results for groups of workers with characteristics that are comparable to those summarized in the rest of the table.

The two studies by Ruhm find losses are very persistent, and of roughly the same magnitude as those presented here. The figures for Ruhm presented in Table 7 are those in which no control for unobserved heterogeneity was used. On this basis alone, it might seem surprising that Ruhm's estimated losses are not larger than mine. This could be because the Ruhm's estimates are for a narrowly defined base group of unmarried, male workers, with more than 12 years of education, and from particular occupations and industries. Without knowing the coefficients on his non-displacement regressors and how they change over time, it is impossible to know how sensitive these findings are to his reference group. My results indicate that, in particular, the educational category may make some difference. Despite differences in the base group and in the estimation method, noted at the beginning of this paper, Ruhm's results are generally consistent with other findings that wage losses are persistent over the five years after job loss.

The next section of Table 7 summarizes the findings of Topel (1990) based on both the PSID and the Displaced Workers Survey. Here, the choice of a base group in his reported estimates is also of some importance. Topel reports results for those employed as craftsmen and operatives in the manufacturing sector. I find that these occupational groups suffer somewhat larger and more persistent earnings reductions than other groups following displacement. In lines (8) and (9) of the table, I report my results for displaced workers with characteristics comparable to Topel's base group. Topel's estimates of the earnings patterns show somewhat larger losses than mine, but the qualitative conclusions are largely the same. The estimated initial wage

reductions from Topel's and my studies are somewhat more similar. It should be emphasized that Topel's recovery estimates do not take into account that workers should expect some wage growth with experience even in the absence of displacement. So while Topel's estimates from the DWS, for example, seem to suggest substantial recovery, they are in fact consistent with my findings of extremely persistent costs of displacement for these blue-collar workers.

While Ruhm and Topel use the same data set as I have (but different estimation methods) to estimate the costs of displacement, JLS present estimates of the long-term effects of displacement using similar methodology, but a unique data set. Again, several features of their sample are important to understanding the comparability of their results with findings presented here. JLS are unable to distinguish between quits and layoffs and so focus on workers with more than six years of pre-displacement job tenure (who are less likely to have quit their position) who separate from their firms during mass layoffs,²⁰ although they also report effects for those displaced in other than mass layoffs. For the mass layoff sample, the estimated reduction in annual earnings is 36 percent in the year immediately after displacement and around 26 percent five years later. For the non mass-layoff sample, in contrast, the estimated effects are around 20 percent initially and about eight percent after five years. My estimates of the earnings losses for workers with six or more years of pre-displacement tenure fall, not surprisingly, in between these two estimates. In addition, while not repeated in Table 7, my finding of large wage reductions for workers who change industry is consistent with the findings of JLS. I do find more substantial recovery for those who stay in their current industry than do JLS, but this is probably again due to the overall differences in sample composition.

²⁰ Mass layoffs are defined as those separating from firms with employment reductions in excess of 30 percent.

VI. Conclusion

This study finds substantial persistence in earnings and wage reductions that follow job displacement, consistent with the findings of several recent investigations of the long-term effects of displacement. Additionally, I show that an important factor behind this persistence is additional involuntary separations that follow in the wake of an initial job loss. Average earnings reductions six or more years after a job loss are approximately nine percent. If the effect of a single displacement is isolated, however, average earnings six or more years after a worker's most recent job loss are only one percent below their expected level. Hourly wages are reduced by nine percent six or more years after displacement, or approximately four percent controlling for the most recent displacement.

An investigation of which workers are most likely to face multiple job losses finds this phenomenon to be evenly spread across the population of recently displaced workers. Less educated workers and those losing jobs due to layoffs (as opposed to plant closings) are somewhat more likely to experience more than one displacement over the sample period. For virtually all subsamples of workers based on pre-displacement characteristics, there are substantial differences in the recovery patterns estimated controlling for the first versus the most recent job loss.

These results point to the importance of stable attachment to a given employer for workers' recovery prospects after displacement. Workers do experience some recovery if they are able to establish and maintain a stable employment pattern with a new employer. This suggests that the accumulation of job tenure, or perhaps re-investment in firm-specific human capital, may be an important part of recovery following job loss. Additional investigations into

patterns of job changing following displacement may be an important step in developing effective assistance policies for displaced workers.

Table 1
Displacements by Year
1969-1986

Year	Displacements	Displacements as % of all workers	First displacements
1969	44	2.9	44
1970	43	2.9	40
1971	58	4.0	48
1972	53	3.6	35
1973	37	2.6	27
1974	37	2.6	25
1975	54	3.9	36
1976	41	3.0	24
1977	43	3.2	18
1978	34	2.6	16
1979	25	2.0	11
1980	35	2.9	14
1981	41	3.4	23
1982	42	3.7	21
1983	41	3.7	21
1984	31	2.9	13
1985	39	3.8	14
1986	36	3.6	11
Total	734		441

Table 2
Frequency and Timing of Multiple Displacements

Number of displacements observed	Number of workers	Percent of workers
1	258	58.5
2	118	26.8
3	41	9.3
4 or more	24	5.4
Total	441	100.0

Years since first displacement	Probability of subsequent displacement	Standard error
1	.099	.015
2	.117	.016
3	.077	.014
4	.064	.013
5	.086	.016
6 or more	.044	.004

Table 3
Annual Earnings and Hourly Wages Around Year of
Displacement
(\$1982)

Years before/after displacement:	First displacement			Most recent displacement		
	Annual Earnings	Hourly Wage	Sample Size	Annual Earnings	Hourly Wage	Sample Size
5 before	20,880	\$9.83	312	20,880	\$9.83	312
4 before	20,369	9.64	342	20,369	9.64	342
3 before	20,603	9.82	387	20,603	9.82	387
2 before	19,852	9.70	426	19,852	9.70	426
1 before	16,621	9.16	466	16,621	9.16	466
Year of displacement	15,884	8.77	441	14,665	8.51	734
1 after	17,660	8.75	435	16,398	8.47	623
2 after	17,474	9.14	413	17,191	8.76	508
3 after	18,136	8.78	394	18,394	8.83	436
4 after	18,144	8.92	369	18,690	8.94	371
5 after	18,940	9.56	340	19,994	9.83	314
6 after	18,935	9.63	315	19,893	10.08	279
7 after	18,729	9.46	313	21,256	10.33	244
8 after	19,293	9.79	286	22,140	10.80	212
9 after	18,250	8.97	258	20,693	9.94	181
10 or more years after	20,888	10.34	978	22,725	10.96	640
Not displaced workers¹ :						
1968	20,360	9.41	1317			
1977	23,783	11.80	965			
1986	24,473	12.42	623			

¹ Includes workers who are not displaced during the entire sample period and workers six or more years prior to their first displacement.

Table 4
Wage and Earnings Effects of Displacement¹

	Annual Earnings			Hourly Wages		
	(1)	(2)	(3)	(4)	(5)	(6)
Displacement followed: ²	1st	All	1st	1st	All	1st
Worker-specific trends:	no	no	yes	no	no	yes
Years before/after displacement						
2 years before	-.043	-.036	-.062	-.012	-.006	-.023
	.030	.030	.026	.022	.022	.022
1 year before	-.222	-.213	-.249	-.081	-.074	-.090
	.030	.030	.028	.021	.021	.023
Year of displacement	-.282	-.305	-.312	-.131	-.139	-.139
	.031	.026	.032	.022	.019	.0248
1 year after	-.141	-.156	-.174	-.116	-.109	-.124
	.031	.028	.034	.022	.020	.027
2 years after	-.122	-.082	-.155	-.074	-.071	-.082
	.032	.030	.036	.023	.021	.030
3 years after	-.120	-.089	-.145	-.097	-.096	-.101
	.033	.032	.039	.023	.023	.032
4 years after	-.107	-.051	-.144	-.106	-.101	-.118
	.034	.034	.043	.024	.024	.036
5 years after	-.027	-.003	-.079	-.065	-.061	-.071
	.036	.037	.048	.025	.026	.039
6 years after	-.070	-.042	-.113	-.060	-.069	-.073
	.037	.039	.053	.027	.028	.043
7 years after	-.117	-.040	-.134	-.084	-.069	-.082
	.038	.042	.057	.028	.030	.047
8 years after	-.117	-.029	-.145	-.113	-.080	-.108
	.039	.044	.062	.028	.032	.051
9 years after	-.138	-.037	-.163	-.213	-.123	-.204
	.041	.048	.067	.029	.034	.055
10 or more years after	-.061	.023	-.094	-.070	-.007	-.078
	.031	.035	.078	.022	.025	.063

¹ Regressions also control for individual-specific effects, experience, experience-sex interactions, and calendar years. Estimated coefficients are in bold, with standard error estimates immediately below. N=24,165.

² 1st=Only first observed displacement followed; All = all displacements followed.

Table 5
Wage and Earnings Effects by Pre-displacement Characteristics
and Years Since First Displacement¹

	Annual Earnings				Hourly Wages			
	1-2 years before	Year of displacement	1-5 years after	6 or more years after	1-2 years before	Year of displacement	1-5 years after	6 or more years after
All workers	-.141	-.288	-.113	-.097	-.049	-.133	-.095	-.097
	.023	.031	.021	.025	.016	.022	.015	.017
Pre-displacement job tenure								
3 years or less	-.064	-.174	-.040	-.027	-.078	-.096	-.082	-.050
	.040	.051	.035	.037	.028	.037	.025	.026
More than 3 years	-.047	-.304	-.106	-.120	.004	-.128	-.092	-.114
	.031	.042	.027	.031	.022	.030	.018	.022
Type of displacement								
Plant closing	-.156	-.261	-.085	-.095	-.125	-.154	-.091	-.093
	.034	.045	.030	.035	.024	.032	.021	.025
Layoff	-.129	-.309	-.134	-.099	.013	-.113	-.095	-.097
	.031	.041	.027	.031	.022	.029	.019	.022
Union Status								
No union membership	-.144	-.283	-.116	-.103	-.047	-.141	-.078	-.086
	.025	.034	.024	.028	.019	.025	.018	.020
Retained union membership	-.059	-.168	.041	.194	-.009	-.018	-.026	.015
	.053	.077	.048	.056	.039	.055	.035	.040
Lost union membership	-.059	-.503	-.305	-.392	-.009	-.232	-.301	-.287
	.053	.092	.057	.058	.039	.066	.039	.041

¹ Regressions also control for individual-specific effects, experience, experience-sex interactions, and calendar years. Estimated coefficients are in bold, with standard error estimates immediately below.

Table 5 (cont'd)
Wage and Earnings Effects by Pre-displacement Characteristics
and Years Since First Displacement¹

	Annual Earnings				Hourly Wages			
	1-2 years before	Year of displacement	1-5 years after	6 or more years after	1-2 years before	Year of displacement	1-5 years after	6 or more years after
Years of education								
12 or less	-.136	-.249	-.038	-.029	-.039	-.083	-.032	-.065
	.029	.038	.025	.029	.020	.027	.018	.021
13-15	-.192	-.418	-.288	-.268	-.113	-.293	-.238	-.150
	.045	.061	.037	.043	.032	.043	.026	.031
16 or more	-.038	-.190	-.066	-.055	.052	-.087	-.067	-.116
	.062	.081	.052	.058	.044	.057	.037	.041
Changed industry²								
no	-.103	-.290	-.023	.032	-.030	-.099	-.061	-.038
	.027	.040	.027	.032	.019	.028	.019	.023
yes	-.103	-.378	-.264	-.281	-.030	-.222	-.158	-.190
	.027	.058	.039	.044	.019	.019	.028	.031
Changed occupation								
no	-.132	-.285	-.080	-.025	-.048	-.098	-.069	-.096
	.023	.039	.023	.028	.017	.027	.016	.020
yes	-.132	-.387	-.246	-.258	-.048	-.210	-.162	-.145
	.023	.048	.037	.041	.017	.034	.026	.029

¹ Regressions also control for individual-specific effects, experience, experience-sex interactions, and calendar years. Estimated coefficients are in bold, with standard error estimates immediately below.

² Industry data are not available prior to 1971. These rows are estimated on a sample from 1971 through 1986.

Table 6
Wage and Earnings Effects by Pre-displacement Characteristics
and Years Since Most Recent Displacement¹

	Annual Earnings				Hourly Wages			
	1-2 years before	Year of displacement	1-5 years after	6 or more years after	1-2 years before	Year of displacement	1-5 years after	6 or more years after
All workers	-.122	-.290	-.077	-.009	-.031	-.121	-.070	-.038
	.022	.025	.019	.025	.016	.018	.013	.018
Pre-displacement job tenure								
3 years or less	-.058	-.185	-.024	.022	-.068	-.092	-.069	-.015
	.038	.040	.031	.037	.028	.029	.022	.027
More than 3 years	-.030	-.322	-.085	-.016	.022	-.126	-.072	-.048
	.031	.035	.025	.033	.022	.025	.018	.023
Type of displacement								
Plant closing	-.147	-.280	-.066	-.034	-.109	-.144	-.066	-.039
	.033	.038	.028	.036	.024	.027	.020	.025
Layoff	-.102	-.297	-.085	.010	.032	-.102	-.072	-.036
	.031	.033	.025	.032	.022	.024	.018	.023
Union Status								
No union membership	-.121	-.285	-.074	-.018	-.027	-.116	-.052	-.031
	.026	.029	.021	.022	.018	.020	.015	.020
Retained union membership	-.073	-.205	.034	.212	-.013	-.078	-.035	.044
	.051	.067	.045	.058	.038	.049	.032	.041
Lost union membership	-.073	-.440	-.244	-.227	-.013	-.210	-.241	-.178
	.051	.069	.051	.064	.038	.050	.037	.045

¹ Regressions also control for individual-specific effects, experience, experience-sex interactions, and calendar years. Estimated coefficients are in bold, with standard error estimates immediately below.

Table 6 (cont'd)
Wage and Earnings Effects by Pre-displacement Characteristics
and Years Since Most Recent Displacement¹

	Annual Earnings				Hourly Wages			
	1-2 years before	Year of displacement	1-5 years after	6 or more years after	1-2 years before	Year of displacement	1-5 years after	6 or more years after
Years of education								
12 or less	-.132	-.256	-.013	.016	-.026	-.073	-.018	-.017
	.029	.031	.024	.032	.020	.022	.017	.022
13-15	-.140	-.338	-.232	-.083	-.083	-.222	-.192	-.053
	.043	.046	.033	.044	.030	.034	.024	.031
16 or more	-.020	-.335	-.011	.036	.067	-.128	-.030	-.081
	.059	.066	.047	.057	.042	.046	.034	.040
Changed industry²								
no	-.092	-.266	.000	.096	-.011	-.086	-.035	.028
	.026	.033	.024	.032	.019	.023	.018	.023
yes	-.092	-.370	-.175	-.155	-.011	-.184	-.102	-.134
	.026	.046	.0355	.046	.019	.033	.025	.033
Changed occupation								
no	-.109	-.282	-.035	.068	-.029	-.090	-.052	-.045
	.023	.032	.023	.030	.016	.023	.016	.022
yes	-.109	-.362	-.183	-.153	-.029	-.173	-.109	-.055
	.023	.039	.031	.038	.016	.028	.023	.028

¹ Regressions also control for individual-specific effects, experience, experience-sex interactions, and calendar years. Estimated coefficients are in bold, with standard error estimates immediately below.

² Industry data are not available prior to 1971. These rows are estimated on a sample from 1971 through 1986.

Table 7
Comparison of Studies of Long-Term Wage and Earnings Effects from Displacement

	Study	Data used	Base group characteristics	Dependent variable	Initial Loss ¹	Recovery Period Loss ²
					(percentage of wages or earnings)	
	Ruhm					
(1)	(1991a)	PSID 1971-1975	more than 12 years education, unmarried, male ³	log weekly wage	16% ⁴	14% ⁴
(2)	(1991b)	" "	" "	change in log weekly wage	13% ⁴	14% ⁴
	Topel (1990a)					
(3)		PSID 1968-1985	craftsmen and operatives in manufacturing	change in log annual earnings	42%	31% ⁵
(4)		" "	" "	change in log weekly wage	16%	21% ⁵
(5)		DWS 1979-1985	" "	change in log weekly wage	19%	10% ⁵

¹ Estimate of loss in the first post-displacement period.

² Recover periods are from three to five years after displacement.

³Ruhm also includes controls for industry and occupation, experience and pre-displacement tenure.

⁴Estimated without controls for unobserved heterogeneity. Ruhm's methods of controlling for unobserved characteristics reduced estimated losses by one to three percentage points.

⁵Topel's method does not control for lifecycle wage growth. Estimates of recovery are in terms of pre-displacement wage and earnings levels, not allowing for normal growth.

Table 7 (cont'd)
Comparison of Studies of Long-Term Wage and Earnings Effects from Displacement

	Jacobson, LaLonde, and Sullivan (1993)	Administrative earnings data from Pennsylvania, 1974-1986	Pennsylvania workers with 6 or more years of pre- displacement job tenure			
(6)		" "	displaced ⁶ in mass-layoffs	quarterly earnings	36%	26%
(7)		" "	displaced ⁶ in other than mass-layoffs	quarterly earnings	20%	8%
	Stevens	PSID 1969-86				
(8)		" "	craftsmen, operatives in manufacturing	log annual earnings	30%	21%
(9)		" "	" "	log hourly wages	14%	15%
(10)		" "	more than 6 years pre- displacement tenure	log annual earnings	28%	11%
(11)		" "	" "	log hourly wages	12%	9%

⁶Sample can contain voluntary separations; given the restrictions on job tenure, this is probably a small number of the observed job separations.

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