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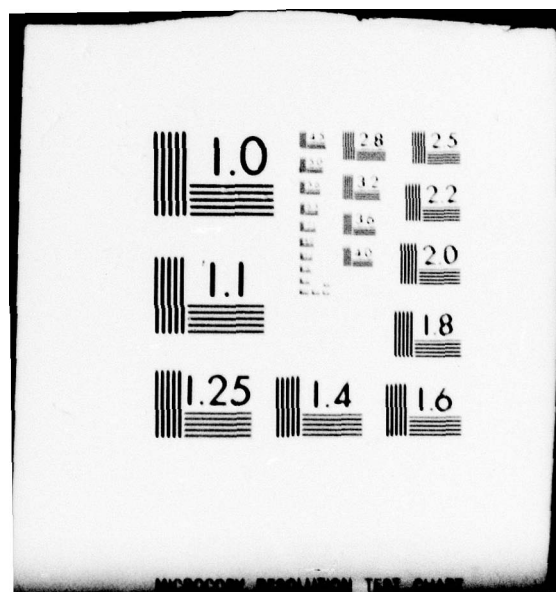
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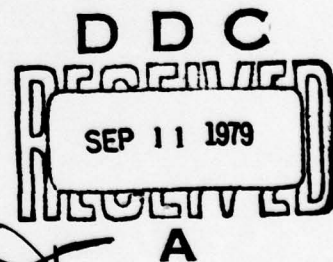
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EARNINGS LOSS DUE TO DISPLACEMENT

Louis Jacobson
Janet Thomason



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losses due to displacement. Losses are calculated by comparing the earnings of workers after they were displaced, with the earnings of similar workers, in similar conditions, who were not displaced. To measure the effects, it is necessary to distinguish displaced workers from those who left their jobs, voluntarily, either to take other jobs or to withdraw from the labor force.

The findings are that industries in which losses are large have three characteristics in common: workers are mostly male, the labor force is heavily unionized, and voluntary labor turnover is low. Within an industry, losses are generally largest among workers whose earnings have begun to grow rapidly. Losses are higher if workers are displaced into small labor markets or into labor markets where unemployment is already high. Among female workers, labor force withdrawal is more common than among males. As a result, findings about how displacement affects females are inconclusive.

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INTRODUCTION

Very often, legislation that yields substantial benefits for society as a whole can be costly to certain segments of society. For example, legislation such as the Clean Air Act can be expected to lead to a decrease in respiratory illnesses and cancer, but removing pollutants can raise production costs in some industries and, ultimately, raise output prices. As output prices rise, labor demand will fall, and some workers may be displaced from their jobs.

The purpose of this paper is to present the best available information about earnings losses that result from displacement (job loss) and to predict earnings losses that might result from future changes in government policies.* Although workers who lose their jobs are not the only individuals who can be adversely affected, they are likely to have the largest per capita losses, and the connection between their losses and a policy change is likely to be reasonably clear.

Losses can be measured in many ways and the methodology used to analyze losses must be carefully chosen. Severe methodological problems have limited the usefulness of most prior studies. In particular, most studies have lacked an appropriate baseline against which to measure earnings losses. In addition, most do not distinguish between losses due to labor force withdrawal and those due to unemployment or reduced wages. Several studies, completed by researchers at the Public Research Institute, have been reasonably successful in handling the methodological problems, and, equally important, they were designed to produce cross-industry comparisons. The results of these studies are discussed in the following sections.

The key conclusions are:

1. Industries in which worker losses are large, such as steel and automobile, have three characteristics in common. The workers tend to be mostly male employees, the labor force is heavily unionized and the voluntary attrition of workers is low. Over the first five years following displacement, losses are likely to total about twice the average annual

*Often, earnings loss is an excellent measure of "cost" (utility loss). In some circumstances, the distinction between the two measures is extremely important. Several such cases are discussed in the main text. The issue, in general, is discussed in appendix A.

pre-displacement earnings. For steel and auto workers, this is equivalent to a loss on average of about \$21,000 current dollars for each displaced worker. For such workers, losses will be particularly large at first, because of unemployment, and will decline in later years as displaced workers work their way into new careers. On average, earnings will be reduced to about half of what they otherwise would be for the first eighteen months. Over his working career, the worker's loss will be about 10-15 percent of what earnings would otherwise have been. Estimates of lifetime earnings losses for steel workers with differing levels of tenure indicate that starting at zero tenure, losses are small, and then rise very rapidly, reaching a peak at about eight years tenure. After that, losses decline slowly.

2. Male workers who are already likely to suffer large losses will be even more severely hurt if unemployment is high in their local labor markets. Studies of unemployment insurance claimants and displaced steel workers show that the loss for a given year can double if unemployment is about 1/3 greater than the national average (1.4 percentage points in the mid-sixties).

3. The size of the local labor market will also affect the amount of the loss. Generalizing from results for the steel industry, workers displaced into a labor market of 200,000 individuals will suffer losses about 50% higher than those displaced into a labor market of 900,000 individuals. For older workers the effect may be considerably greater.

4. Empirical findings about earnings losses by women, and, therefore, losses in industries predominantly employing women, are inconclusive. Losses appear to be considerably larger for women than men. The loss estimates, however, may be overstated because losses due to labor force withdrawal are not distinguished from losses due to unemployment and wage reduction.

MEASURING EARNINGS LOSSES

Typically, losses due to displacement are calculated by a simple comparison of a worker's earnings after displacement with his earnings before displacement. This method involves the implicit assumption that the worker's earnings would not have risen otherwise. Actual losses are likely a result of the loss of specific human capital. This type of human capital is acquired only on-the-job, and acquisition of the capital should lead to earnings growth. Thus, displaced workers who are likely to actually suffer large losses are those workers whose earnings, in the absence of displacement, were

likely to rise, often dramatically, with experience. A before-and-after comparison will therefore tend to underestimate the actual loss. Figure 1 illustrates the problem. The unbroken line represents the actual quarterly earnings* of a worker displaced at time t; the dashed line represents the projected earnings if the worker is not displaced. A simple before-and-after test results in an incorrect measurement of earnings losses as the cross hatched area in figure 1.

The proper way to measure earnings losses due to displacement is to measure the difference between what a worker actually earns after displacement and what he would have earned in the absence of displacement. To calculate this loss, we must know the earnings of displaced workers and be able to project their earnings profiles had they kept their jobs.

Two components of earnings losses are reflected in the post-displacement earnings curve shown in figure 1. The large dip that occurs in the first year or two following displacement primarily reflects unemployment while the worker searches for a new job. In later periods, annual losses are smaller and arise from a number of factors: reduced wages stemming from a loss of human capital, increased frequency and duration of temporary layoffs due to a loss in seniority, and unemployment while changing jobs either because of dissatisfaction with subsequent jobs or subsequent displacement. There is evidence that considerably more than half of the total loss is due to unemployment of one kind or another.

To determine what the earnings of displaced workers would have been, a group of similar workers who were not displaced at time t must be selected, and the actual earnings of both groups must be compared over time. Workers in the same industry are generally the most appropriate comparison group. In the specific application of determining the effect of a policy change, such as introduction of the Clean Air Act, it is critically important that the comparison group of workers not be affected by the change. One way to do this is to compare displaced workers only to individuals who worked in

*Quarterly earnings do not fall to zero because, typically, a worker who loses his job will have some pre-displacement earnings in the quarter, even if he has no earnings while he is unemployed.

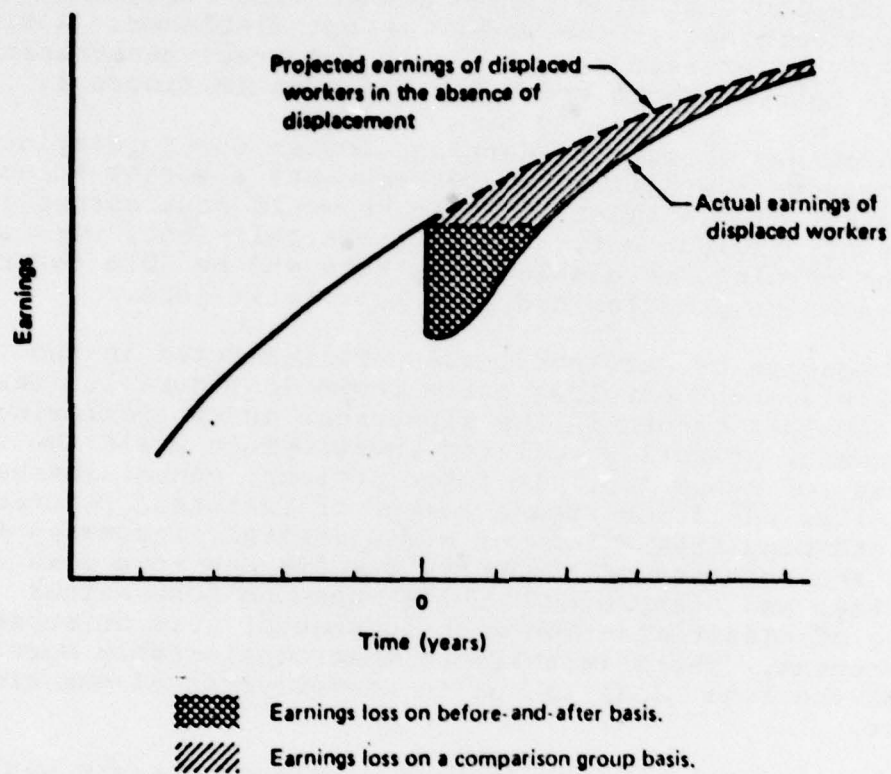


FIG 1: ALTERNATIVE MEASURES OF EARNINGS LOSS

firms where, in the year displacements occur, employment was not reduced.*

In selecting the comparison group, it would not be appropriate to exclude workers because they leave the industry in the years following the displacement year. If they leave voluntarily, they may be leaving because better jobs are available and those displaced would clearly have had similar options. If they are displaced from the industry, however, it must be assumed that the displacement would have occurred regardless of the policy changes. As a practical matter, displacements are not very numerous and are likely to occur only when general business conditions are depressed.

Measuring the cost to workers who drop out of the labor force after displacement is particularly difficult. Although the actual earnings of such individuals fall to zero, in most cases, unless they had sought but could not find new employment, their earnings would have been considerably greater than zero had they remained in the labor force. The fact that they withdrew indicates that, to them, the value of the income they could have earned by working was less than the value of leisure. Thus, workers who place a particularly high value on "leisure", such as women who have children and homes to care for, are especially likely to withdraw. Similarly, older workers and "secondary earners" may also choose to withdraw because the value of additional earnings is relatively low. Older workers may have sufficient resources (savings and pensions) to stop work. Married women often work primarily to supplement their husband's earnings.**

*In some circumstances, anti-pollution or other regulation will cause a shift in demand across firms in a given industry, rather than depress the industry as a whole. If this is the case, this procedure might lead to over-estimating losses.

**A good illustration of why withdrawal may cause earnings losses of women, in particular, to be overstated is found in the case study of a TV receiver assembly plant in Memphis [Russell 1975]. A very large fraction of the displaced female workers did not return to full-time work within the two years following the plant closing. Most of these same women had not worked full-time prior to the opening of the plant, however. Apparently, it was the particularly attractive opportunity offered by this one employer that caused these women to give up "home production". When the plant closed, they withdrew rather than work elsewhere at jobs which may have paid less or been less convenient.

For those who withdraw, it is probably more appropriate to measure the cost of displacement as the difference between what they would have earned had they not been displaced and their earnings opportunities had they remained in the labor force, rather than assuming that their only option was zero earnings.* Several different procedures can be used to make this estimate; each depends on making assumptions about the workers' earnings capacities and tastes. The simplest procedure is to assume that those who withdrew had about the same job opportunities as similar workers who remained in the labor force. This is done by excluding workers who dropped out of the labor force from the earnings loss computations.** For some groups of workers such as prime-age men with high earnings, the probability of withdrawal is relatively low and this procedure will have little effect on the estimate of the earnings loss. For other groups, such as women, and males approaching retirement age, the probability of withdrawal is high and the earnings loss estimates will be affected a great deal. This problem will be dealt with later by comparing loss estimates for displaced workers including those who withdrew from the labor force with loss estimates for only those displaced workers who did not withdraw.

EMPIRICAL STUDIES OF EARNINGS LOSSES

There is a large literature about the consequences of worker displacement due to plant closings or other employment reductions. In the course of carrying out its empirical research, the staff of the Public Research Institute reviewed this literature. A number of different types of studies have been examined. First, there are numerous case studies of plant closings or mass layoffs in each of several different industries. Second, there are studies of the effectiveness of manpower training. Manpower studies are relevant because workers who enter manpower training programs often are those whose normal career paths have been disrupted by unemployment. Third, there are studies of the effect of unemployment insurance (UI) on workers' earnings and "job search" activity. These studies are relevant because many individuals who collect UI were displaced from their last job. Finally, there are studies of human capital (earnings) determination. These studies can provide information about what earnings would "otherwise have been" if a worker had not been

*See Appendix A for a more complete discussion of this issue.

**Trost (1979) examines the question of whether displaced workers who withdraw from the labor force come from the same population (i.e. share similar characteristics and opportunities, etc.) as those who do not withdraw.

displaced, and the amount of firm specific capital inherent in different jobs.*

Unfortunately, most of the studies are not particularly useful for the present purpose of providing reasonably precise estimates of workers' losses due to a plant closing. One major problem is that only a few of them examine earnings losses; instead they use other measures of adverse effects, such as unemployment duration. Even studies of earnings losses frequently do not follow the workers long enough to determine the permanency of any loss. Furthermore, as indicated earlier, many studies suffer from the lack of an adequate comparison group.** Another problem is that many of these studies do not adequately distinguish between unemployment and labor force withdrawal. As discussed earlier, this makes evaluation of the loss for women and older men extremely difficult. Finally, it is often very difficult to generalize the findings of individual studies, even when they are methodologically sound. Many of the analyses are case studies of single closings or training situations. A particular closing that leads to large losses may involve unskilled, older men, in a small labor market. It is generally not possible to determine how much each of these factors contributes to the losses.

By comparing the results across a number of studies, however, some general conclusions about the importance of various factors can be drawn. Most studies described in the literature support the notion that workers with high levels of general (transferable) skills, particularly well-educated individuals, are likely to lose relatively little. Workers with high earnings but relatively specific skills (such as meat packers) lose a great deal, particularly in heavily unionized industries. Older workers, women, and workers with high tenure generally suffer large losses, although these may be overstated because labor force withdrawal is not properly taken into account.

CROSS-INDUSTRY LOSS ESTIMATES FOR PRIME-AGE MALES

Of all available studies reported in the literature, two, by the Public Research Institute, provide a basis for predicting

*For a summary of empirical studies in these four areas see: Holen, 1976; O'Neill, 1973; Classen-Utgoff, 1978; Rosen 1977.

**If the lack of comparison group was the only short-coming of a given study, there are procedures by which an appropriate measure of comparison earnings could be developed and used. Generally, other methodological problems which cannot be overcome in retrospect are present in such studies as well.

earnings losses. One study [Jacobson, 1976] examined earnings losses of workers who lost jobs (not necessarily due to plant closings) in eleven diverse manufacturing industries. The "11 Industry Study" was limited to prime-age males (males 23-53 who separated from their industry of employment in 1962-66, and did not withdraw from the labor force.* Social Security records were used to follow earnings of job losers and a comparison group of workers who had not been displaced. Earnings losses were examined over a six-year period. The key findings and some characteristics of the samples are displayed in table 1.

A second study examined losses of workers displaced in plant closings that occurred in eight different manufacturing industries during 1969-71. Again, Social Security records were used to follow the earnings of the affected workers. (Comparison earnings were estimated using a statistical procedure based on measurement of the prior earnings trends of those affected and average growth of earnings in the given industries.)

The "plant closing study" sample was not limited in any way. For comparison with the "11 industry study," however, the results presented in table 2 were restricted to prime-age male workers (males age 23-53) who did not withdraw from the labor force.**

Four industries appeared in both studies - automobiles, electronic components, shoes, and cotton weaving. In addition, petroleum refining in the "11 industry study," and industrial chemicals in "plant closings" are similar enough to be treated as the same industry since both are part of the petro-chemicals industry.***

*Operationally, labor force withdrawal is assumed if a worker shows no earnings in any calendar year. The age restrictions were also imposed largely to eliminate workers who are particularly likely to withdraw from the civilian labor force. Older workers are likely to retire and young workers might return to school or join the military.

**Analysis showed that the age restriction made little difference in the estimate of industry losses. Young workers showed small losses or substantial gains; older workers had relatively large losses. In most cases, the two groups together had losses about equal to the average losses of workers age 23-53.

***Although one might think it logical to treat men's and women's clothing as the same industry, male workers in the men's clothing industry earn considerably more than male workers in the women's clothing industry, indicating that the former are substantially more skilled.

TABLE 1
EARNING LOSSES OF DISPLACED WORKERS

	Average predisplacement earnings of sample (1964 dollars)	Number of displaced workers in sample	Average Annual Percentage Loss	
			first 2 years	subsequent 4 years
Automobiles +	5688	68	43.4*	15.8*
Steel	5712	103	46.6*	12.6*
Meat Packing	5320	111	23.9*	18.1*
Aerospace	7132	394	23.6*	14.8*
Petroleum Refining +	7677	77	12.4*	12.5*
Women's Clothes	4670	55	13.3	2.1
Electronic Components +	6338	49	8.3	4.1
Shoes +	3824	56	11.3	1.5
Toys	4670	37	16.1	-2.7
TV Receivers	5874	28	0.7	-7.2
Cotton Weaving +	3705	46	7.4	-11.4

* Denotes loss estimate statistically significant at the 5% level.
+ Denotes industry included in plant closing study of table 2.
Negatives indicate gains.

TABLE 2

EARNINGS LOSSES OF PRIME-AGE MALE WORKERS
DISPLACED DUE TO PLANT CLOSINGS

	Average predisplacement earnings of sample (1970 dollars)	Number of displaced workers in sample	Average Annual Percentage Loss	
			first 2 years	subsequent 3 years
Automobiles +	7881	685	24.1	14.6
Industrial				
Chemicals +	7823	531	15.9	16.4
Flat Glass	7677	386	16.3	12.2
Men's Clothing	8165	109	21.3	8.7
Rubber Footwear	7220	39	32.2	-.9
Cotton Weaving +	5520	537	7.6	5.2
Electronic				
Components +	8495	421	10.1	.2
Shoes +	6744	426	11.3	-1.9

+ Denotes industry included in displacement study
Negatives indicate gains

The results are quite similar in each study.* Automobile workers lose the most and have particularly large initial losses. On average, earnings will be reduced to about half of what they would have been for the first eighteen months. Lifetime losses will be about 10-15 percent of what earnings would otherwise have been. Petro-chemical workers have somewhat smaller losses, particularly initially. Workers in the other three industries all have relatively small losses.

Generalizing Loss Estimates Across Industries

Given that the earnings loss estimates do not take into account differences in such factors as general economic conditions, characteristics of local labor markets, and workers' characteristics, the strong similarity in findings across the two studies indicates that inter-industry differences (whatever they might be) are key determinants of earnings losses and are relatively stable. If it were possible to isolate the factors that lead to different earnings losses in these industries, predictions of loss could probably be generated for industries that have not been directly studied simply by knowing the attributes of the industry. The development of such a procedure for calculation of the consequences of any actual or hypothetical job loss is a major aim of this report.

Prediction of losses using industry characteristics was part of the 11 industry study. This work has been expanded in this paper.

Selection of Predictive Variables

In order to select industry characteristics which are appropriate for prediction of losses, one must know why displacement leads to reduced earnings. Probably the best explanation for why a worker's losses vary is that the degree of transferability of skills varies. The more transferable a worker's skills, the easier it will be to find a new job and, more importantly, the less valuable human capital will be lost. If a worker finds a new job exactly the same as his old one, his earnings at the new job should be about the same as at the old one.

*The losses measured in the plant closing study are slightly different from analogous losses in the 11 industry study. One might expect workers displaced due to plant closings would have larger losses than average job losers. Differences in methodology or unmeasured differences in factors such as labor market conditions in the periods examined probably account for the losses in the plant closing study being smaller than expected.

Probably the best indicator of the lack of transferability of human capital is the existence of an "internal promotion" labor market, defined as one in which mostly young, inexperienced workers are hired and learn the tasks required for promotion on the job. In the extreme case, the tasks can only be learned on the job and the employer has no alternative but to promote from within. Even if some of the skills are general and workers could be hired from outside the firm, part of the worker's specific human capital is the superior information possessed by his employer about the worker's capabilities. Promoting from within greatly reduces the employer's risk. Similarly, promotion from within provides incentives for employees to remain with a particular firm. Thus, the most obvious characteristic of an "internal promotion" firm is that there is very little turnover except, possibly, among new entrants.

The natural rate of attrition (rate of voluntary turnover) of a given group of workers beyond the entry level is, therefore, likely to be an excellent indicator of the amount of specific training required in an industry, and, hence, the magnitude of the potential loss from displacement.* If few workers leave a given position voluntarily, it is strong evidence that comparable job possibilities are unavailable elsewhere. This is true even if the amount of specific human capital is not the only determinant of the loss. For instance, labor demand in the local market may play a major role in determining how much capital will be lost. Even if skills are transferable to some extent, finding a suitable opportunity to apply them can be difficult in a small, depressed labor market. Workers in industries which tend to be located in such areas still should exhibit both low rates of voluntary turnover and large losses.**

The same factor, large amounts of specific human capital, that leads to high earnings losses due to displacement also leads to a high degree of unionization. When workers' training is specific, their value to their current employer is greater than it is to any other employer, and there is considerable room to bargain over wage rates and benefits. Workers with specific training therefore have strong

*The rate of voluntary turnover should also have a major effect on the aggregate loss across all workers in an industry as well as the per capita loss. See Appendix B.

**The effect of labor market conditions on intra-industry losses is discussed in a separate section.

incentives to join together to bargain collectively.*

In addition, unions may be able to raise wages of workers above competitive levels for workers with general skills. In such a circumstance, displacement will lead to the loss of an economic rent. For both of the above reasons, a measure of unionization within an industry is likely to be an effective predictor of losses.

Other variables can also be useful predictors of losses. To an extent, voluntary turnover rates (and the amount of specific training) differ across industries because characteristics of the work force differ. Some industries have more males or more high tenure workers than others. Males and high tenure workers tend to have lower quit rates.

Workers with large amounts of specific training should have higher earnings than average workers. The relation between earnings losses and earnings levels is weakened because many workers with high earnings, such as most professionals and managers, have general skills, engendered by formal training, that are highly transferable. It is workers with high earnings, but with little formal training, who are likely to have large losses. Thus, a measure of the amount of on-the-job training should be a good predictor of loss. A measure of educational achievement, or other formal training, may be of value as well.

Empirical Findings

We examined the relation between earnings losses and as many

*Declining industries are most hard hit by policy change and unions might be especially valuable in declining industries. Theory implies that the workers joining a firm where specific human capital is high must be offered a wage package which, over time, equals the value of alternative packages (including wages in firms where general training is important). Because the cost of losing one's job is particularly high where a worker possesses a large amount of specific training, there must be some (at least implicit) guarantees of long run hours (employment) and wage levels. An employer who violates this implicit contract stands to find recruitment of new employees difficult. This, of course, may be relatively unimportant if a firm anticipates falling employment over a number of years. In such a situation, lowering relative wages is particularly attractive to the firm. Because of their specific human capital, current workers can not leave without experiencing large losses. They, therefore, have relatively little recourse in such a situation unless protected by some more explicit contractual obligations, such as collective bargaining arrangements, seniority rights, and provision for severance pay.

of the variables discussed above as possible for the industries covered in the two PRI studies. Three factors with especially strong predictive capacity were isolated.* These factors are listed below along with their simple correlations with average annual losses from the 11 industry study, for the six years following displacement:

- o the attrition rate of prime-age males (-.82)
- o the percentage of the industry labor force that is prime-age male (.78)
- o the percentage of production workers in the industry who belong to a union (.76)

Regression analysis showed that the attrition variable explains about 86% of the variation in the percentage loss across the 11 industries. The other two variables each explain about 83% of the variation.**

In combination, these variables explain about 87% of the variation. The explanatory power of the predictive equation is relatively unaffected by the use of the variables in combination because the variables themselves are highly collinear.

Although the explanatory power of these variables is high, it is difficult to use them to predict losses for industries not directly studied. Only the unionization variable was derived from published data [Freeman, 1979]. The "Attrition" and "Percent-Male" variables were derived from tabulation of Social Security "LEED"*** data. In order to develop generally useful equations, these two variables were replaced by comparable BLS statistics.

*Variables describing the racial, age, and tenure composition of the work force, as well as average earnings levels, were also examined for their predictive capacity. Their correlations with losses were relatively weak (.22, .14, .35, .43 respectively). Further analysis suggested that these variables were important only to the extent they were correlated with the other three key variables. Variables describing on-the-job-training appear to be available only by occupation, not industry.

**The regressions were weighted to take into account differences in the variance of the losses across the industries. This increased the R^2 above the simple correlation coefficient.

***LEED refers to the Longitudinal Employee-Employer Data file. The data cover all earnings records reported to the Social Security Administration for the period 1957-71 for 1% of all Social Security card holders.

It was simple to calculate the percentage of males in each industry's labor force from BLS employment data. The correlation with the LEED generated "percent prime-age male" was .987. Use of the BLS measure reduces the prediction of losses only slightly. The R^2 fell from .83 to .82.

The attrition variable was replaced by what BLS reports as the average quit rate in each industry 1960-70. Despite the fact that attrition was measured only for prime-age males and that these workers made up only a small fraction of the workers in several of the industries, the correlation between quits and attritions was surprisingly high, .872. The quit variable explained 84% of the variation in losses. Only the attrition variable had more explanatory power.

The best prediction of losses from the 11 industry study involved only two of the three generally available variables. The equation is shown below. (t-statistics, shown in parentheses, are low because of collinearity.)

$$(1) \quad \% \text{ Loss} = 10.27 + .22 \times \% \text{ Union} - 5.39 \times \text{Quit Rate} \quad R^2 = .84$$

$(1.22) \qquad \qquad \qquad (-1.6)$

The three variables were also used to predict losses shown in table 2 from the plant closing study. The results were remarkably similar to those found using data from the eleven industry study. The quit rate had about the same predictive capability (as measured by the simple correlation) across both industry groups. The union and percent male variables had somewhat lower predictive capability.

ESTIMATES OF EARNINGS LOSSES OF WOMEN

We can state with considerable confidence that in industries, such as automobiles, steel, meat packing, and flat glass, where a high percentage of total employment are prime-age males, displacement will be costly. Although losses by males in industries with relatively few male employees are likely to be small, we must know female losses in order to determine if displacement is costly in these industries.* Development of a reliable measure of earnings losses of women is considerably more difficult than it is for men.

*In industries with a low proportion of male employees, it is plausible that the males are not production workers but managers, other white collar workers, or technicians that keep machinery in repair. They are therefore likely to have general skills. The production workers are predominantly female and are therefore more likely to possess industry specific skills and experience large losses.

TABLE 3

EARNINGS LOSS OF PRIME-AGE FEMALE WORKERS
DISPLACED DUE TO PLANT CLOSINGS

Industry	Average pre- displacement earnings of sample (1970 dollars)	Number of displaced workers in sample	Average Annual Percentage Loss		Female/ male ratio of average loss first 5 years
			first 2 years	subsequent 3 years	
Automobiles	6433	23	22.9	18.3	1.1
Industrial					
Chemicals	6580	53	8.6	10.8	.6
Flat Glass	7140	13	16.5	31.8	1.9
Men's Clothing	4977	250	38.4	20.6	2.0
Rubber Footwear	5077	153	16.3	-12.2	-.06
Cotton Weaving	4212	333	20.4	12.5	2.6
Electronic					
Components	4366	304	36.5	9.9	4.9
Shoes	3540	608	16.0	4.0	2.6

Systematic information about inter-industry differences in earnings losses for women have been derived from PRI's plant closing study. Table 3 summarizes these results for prime-age females who showed some earnings in each year following displacement. To facilitate comparison of males and females, the right-most column of table 3 displays the estimated losses by women, relative to losses by males. Except for the automobile and chemical industries, the estimated losses differ markedly by sex. Women show consistently larger losses than men in several of the industries where losses are large on an absolute basis. Losses in the shoe industry are also considerably greater for women than for men but are still rather low, particularly in the later time period.

Generalization of Female Losses

We examined the relationship between the losses by females in the plant closing study and the three general industry characteristics found to successfully predict male losses. As shown in table 4, the correlation between each variable and female losses were all in the expected direction but less than half as strong as the corresponding correlation with male losses in the plant closing study.

TABLE 4
CORRELATION OF MALE AND FEMALE LOSSES WITH INDUSTRY
CHARACTERISTICS IN THE PLANT CLOSING STUDY

	<u>Female Losses</u>	<u>Male Losses</u>
Quit rate	-.410	-.820
% Unionized	.239	.672
% Male	.233	.581

Our inability to identify factors associated with losses by females as well as we identify the factors for males may be due to the fact that women who lose their jobs withdraw, at least partially, from the labor force far more frequently than do men.* Although those who withdrew for an entire year were screened out of the sample, partial withdrawals could not be screened out. Clearly, all earnings reductions due to partial withdrawal should not be counted, dollar for dollar,

*Galloway (1967) offers differential withdrawal rates between the sexes as an explanation of why the same strong negative association between earnings levels and turnover rates found for men does not also hold for women. Our research supports such an explanation as well.

as a utility loss; the worker who withdraws partially receives some utility from increased leisure. Thus, treating all earnings reductions as losses will result in an overestimate of the loss of utility. The effect of labor force withdrawal could also explain why losses measured for females are greater than for males in the same industry.* Labor force withdrawal is discussed further in the next section.

LABOR FORCE WITHDRAWAL

Measuring the cost of displacement for those who withdraw is a major methodological problem. Almost all studies from which any inferences can be drawn suggest that withdrawal following displacement is very common among some groups of workers.

The PRI plant closing study is no exception.** Table 5 presents detailed information about the incidence of zero earnings in the plant closing samples. A sizable fraction of workers in the 23-53 age group was omitted from both the male and female samples because of this restriction. The male samples were reduced by 17-22% in most industries. The reduction was only 10% in the men's clothing industry and 14% in cotton weaving. Considerably more women than men were excluded because of zero earnings. Between 28% and 42% of the workers in the female samples were excluded.

Looking at differences in results across age groups we see that more than 50% of workers older than 53 show some zero earnings in every industry. Workers ages 41-53 show somewhat higher incidence of zero earnings than workers ages 23-40. Workers less than 23 also show a slightly higher incidence of zero earnings than workers 23-40. This may reflect the return to school or entrance into other training programs.

Table 6 presents estimates of the average loss for workers in each industry, when workers 23-53 with zero earnings following the plant closing are included in the sample. The numbers in parentheses are the percentage point increases in the

*The finding that losses for women were greater than for men was most surprising. Available evidence suggests voluntary turnover is higher for females than males (Parsons, 1977: 209). Based on our earlier discussion linking losses and voluntary turnover, we would therefore expect that the losses by females would be lower than losses by males.

**The incidence of zero earnings in any calendar year (our measure of withdrawal) can not be examined for the 11 industry study at present. The sample was preselected to exclude zero earners.

TABLE 5
INCIDENCE OF ZERO EARNINGS
IN PLANT CLOSING SAMPLE

	<u>Men's Suits and Coats</u>	<u>Cotton Weaving</u>	<u>Electronic Components</u>	<u>Auto</u>
Both Sexes	33.1	33.3	37.8	28.2
All Males	16.2	25.6	26.1	27.7
Males Age:				
23	7.7*	13.6	25.0	22.1
23-40	6.5	13.4	17.8	17.3
41-53	11.1	13.8	17.8	26.9
53	52.0	52.4	53.8	59.4
All Females	37.4	44.5	48.6	39.6
Females Age:				
23	34.5	52.4	44.4	50.0*
23-40	34.3	36.3	42.0	27.8
41-53	31.6	34.0	45.7	41.2
53	58.6	65.4	72.0	60.0*
	<u>Glass</u>	<u>Chemicals</u>	<u>Rubber Footwear</u>	<u>Shoes</u>
Both Sexes	31.6	33.8	43.1	44.4
All Males	31.6	33.9	36.6	37.0
Males Age:				
23	7.7*	18.2*	-	21.0
23-40	10.7	11.6	18.2	18.4
41-53	30.2	16.6	32.3	23.8
53	66.5	62.4	66.7*	58.7
All Females	31.6*	32.8	44.6	48.3
Females Age:				
23	-	60.0*	33.3*	44.0
23-40	14.3*	26.5	43.6	41.7
41-53	12.5*	26.9	42.1	33.4
53	100.0*	62.5*	56.1	63.3

*Denotes a sample of less than 20 workers.

-Denotes a sample size of zero.

estimates relative to the estimates with "zero earners" removed (in tables 2 and 3).

Inclusion of the workers who had zero earnings following the plant closing increases the measure of earnings losses substantially. On average, inclusion of "zero earners" increases the estimated losses of prime-age males shown in table 2 by five percentage points in the first two years following separation and eleven percentage points over the subsequent three years. Estimated losses for females are increased by thirteen percentage points initially and twenty-one percentage points in the later period.

The reader is cautioned that the earnings losses presented in table 6 are probably not good estimates of the cost (utility loss) of displacement.* To reiterate, the losses shown in the table reflect lost utility only under the extreme assumption that the value of leisure is zero.

A better measure of the utility loss is the earnings the workers would have generated had they not withdrawn. The results reported earlier, in tables 2 and 3, which omit zero earners, attempt to reflect utility loss under the assumption that those who withdrew had the same earning capacity as those who did not withdraw. It may be, however, that the earning capacity of those who withdrew is lower than the average capacity of those who worked. This "selectivity bias" will cause the estimates shown in tables 2 and 3 to be lower than the average per capita loss. On the other hand, the incidence of zero earnings is so high that it is likely that many workers who show some earnings each year in fact withdrew for part of the year or "partially" withdrew by accepting less than full time employment. Such partial withdrawal leads the estimates in tables 2 and 3 to be greater than the utility loss.

*The losses reported in table 6 are over-estimates of the earnings loss as well. Some zero earnings are due to work in uncovered employment, death, disability, and administrative error rather than withdrawal. Since plant closings are not likely to cause these conditions and these effects are largely absent from the comparison group, the inclusion of these sources of loss in the estimates in table 6 leads to an over-estimation of earnings loss. About 20-30 percent of workers who show any zero earnings show zero earnings in each year. This rate may be taken as an estimate of the extent to which zero earnings is due to reasons other than withdrawal. The over-estimates are, therefore, likely to be about four percentage points for males and eight percentage points for females.

TABLE 6
EARNINGS LOSS OF PRIME-AGE MALES AND
FEMALES INCLUDING WORKERS WITH ZERO EARNINGS

SIC	Industry	Average Annual Percentage Loss			
		Males		Females	
		First 2 years	Subsequent 3 years	First 2 years	Subsequent 3 years
371	Automobiles	31.5 (7.4)	26.3 (11.7)	33.4 (10.5)	38.8 (20.5)
281	Industrial Chemicals	21.3 (5.4)	25.6 (9.2)	20.5 (11.9)	27.0 (16.2)
321	Flat Glass	20.7 (4.4)	25.6 (13.4)	22.9 (6.4)	34.8 (3.0)
231	Men's Clothing	25.1 (3.8)	15.4 (6.7)	46.1 (7.7)	37.8 (17.2)
302	Rubber Footwear	38.5 (6.3)	19.1 (20.0)	34.1 (17.8)	14.9 (17.1)
221	Cotton Weaving	11.2 (3.6)	13.0 (7.8)	30.0 (9.6)	31.5 (19)
367	Electronic Components	14.8 (35.9)	10.0 (9.8)	51.7 (15.2)	30.3 (20.4)
314	Shoes	16.7 (5.4)	11.3 (13.2)	28.8 (12.8)	22.2 (18.2)

Numbers in parentheses denote percentage point increases relative to estimates with restriction on "zero earners".

Additional research is required in order to determine the precise effects of these two sources of bias on the loss estimates presented in tables 2 and 3. Preliminary analysis at PRI suggests, however, that undetected withdrawal increases loss estimates more than selectivity bias decreases the estimates. This implies that the losses in tables 2 and 3 are, if anything, over-estimates of the utility loss.

Generalizing Loss Estimates Including Withdrawals

The ability of the quit, union, and percent male variables to predict losses with zero earners included in the sample was tested. The results for males were not very different from the results where zero earners were omitted. The quit variable had slightly less predictive value (the simple correlation was $-.760$ vs. $-.820$). The percent male variable had about the same predictive value ($.557$ vs. $.581$), and the union variables somewhat better predictive value ($.819$ vs. $.672$). In general, the three variables predict about the same relative losses across the eight industries in the plant closing study regardless of whether or not zero earners are included. The magnitude of the loss is, of course, considerably greater when zero earners are included. The three variables can therefore probably be relied upon to determine industries in which male workers will be affected a lot or a little. The exact magnitude of the loss is more difficult to predict.

The three variables have almost no ability to predict losses of females when zero earners are included. In contrast, the variables have considerably greater ability to predict losses of females when zero earners were excluded. In particular, the relation between quits and losses excluding zero earners is fairly strong.

This is consistent with the hypothesis the three variables are more capable of predicting utility loss than they are of predicting earning losses. Apparently, (partial) withdrawal is so prevalent among females and the utility value of leisure is so much greater than zero, that an earnings loss measure (even when zero earners are excluded) is not a reliable measure of utility losses for women.

THE EFFECT OF LOCAL LABOR MARKET CHARACTERISTICS ON LOSSES

There is considerable empirical evidence that local labor market characteristics, particularly the unemployment rate, affect "job search" outcomes, the duration of unemployment, and subsequent earnings of displaced workers. A cyclical swing of about 2 percentage points in the unemployment rate can increase the average duration of unemployment by more than two weeks [Classen, 1977]. Since displaced workers lose

seniority, they are likely to be considerably more affected by temporary or permanent layoffs than average workers who maintain their seniority.

Thus, losses in the period directly following a closing may be considerably higher if displacement occurs in a labor market with high rather than low unemployment. Since subsequent earnings are likely to be affected as well, adverse labor market conditions will probably affect earnings for several years following displacement.

In general, the pattern described above is strongly supported by findings about displaced steel workers [Jacobson, 1977]. This study found that if the worker was displaced into a local labor market where unemployment was 1.4 percentage points higher than average,* losses over the first six years following displacement were about eight percentage points higher than average. The average unemployment rate for the sample period studied (1962-63 and 67) was 4.1%.

The effects of local labor market characteristics were also analyzed for steel workers in specific age-tenure groups. Losses for young, low-tenure workers were particularly strongly affected by the level of unemployment. For these individuals, displacement in labor markets with low unemployment resulted in negligible losses, while displacement in labor markets with high unemployment resulted in large losses. Losses of older workers were particularly affected by labor market size.

Both results are consistent with human capital theory. We expect that workers with little specific training, such as young low-tenured workers, will be most strongly affected by general business conditions. Workers with a great deal of specific human capital, such as older, high-tenured workers, are likely to be relatively unaffected by general conditions but strongly affected by the availability of just the right jobs. Presumably, such jobs are easier to find in large labor markets.

The effect of local labor market size on earnings loss was found to be somewhat smaller than the effect of the unemployment rate. On the average, a worker displaced into a small labor market loses about five percentage points more than he would if he were displaced into an average labor market. (A small labor market was defined as one with a

*Unemployment in each labor market was actually measured by what is called a "cycle placer" variable, not by the unemployment rate itself. This measure compares current unemployment to peak unemployment and was selected because it better reflects local labor market tightness.

population of 200,000.) On average, steel workers were employed in labor markets with a population of 900,000.

The study of displaced steel workers was concerned with males only. Several other studies that examine the effect of labor market factors on earnings of both men and women suggest that labor market factors are considerably less important influences for women than for men. For instance, in a study of job search outcomes using National Longitudinal Survey data [Ehrenberg and Oaxaca, 1976] unemployment levels proved to have fairly strong, statistically significant effects on both unemployment duration and subsequent wage rates for older males only.

Considerably more research is required to be confident about the effects of labor market characteristics. At this point, it is reasonable to conclude that in industries where most production workers are high income males whose earning losses due to displacement would be relatively large, local labor market characteristics will matter a great deal. It is possible, but far less certain, that labor market conditions are substantially less important in industries employing mostly women or in industries where male workers would incur relatively low earnings losses due to displacement.

THE EFFECT OF PERSONAL CHARACTERISTICS ON EARNINGS LOSSES

Although personal characteristics, such as age, race, sex, tenure, and education may systematically affect losses experienced by displaced workers, it is probably not necessary to know these effects in order to predict earning losses associated with plant closings. Plants within the same industry are likely to have relatively similar work forces. It has already been suggested that a measure of natural attrition, such as the quit rate, may be an excellent predictor of inter-industry differences in loss.

Knowledge of the effect of specific characteristics on losses can, nevertheless, be very useful in guiding the design of ameliorative programs. This is particularly important because past studies may have given false impressions about who loses the most. Although it is well documented that older workers with high tenure, ethnic minorities, women, and poorly educated workers have relatively large losses, this finding is not necessarily correct. As discussed earlier, most studies do not use a comparison group. They calculate losses on a simple "before-after" basis and fail to measure the long-run earnings loss due to displacement.

Young, low-tenure workers employed in industries with low attrition rates, for instance, may sustain relatively low initial losses due to unemployment but may suffer relatively large costs in future earnings, particularly if their

earnings had begun the rapid ascent shown in figure 1. While older high-tenure workers may have relatively large initial earnings losses due to unemployment, and lose considerable amounts of human capital, their lifetime earnings losses are likely to be less because relatively little of their work life remains. Similarly, poorly educated, minority workers who characteristically move frequently from one job to another may lose relatively little if displaced. For such workers, displacement may simply accelerate changing jobs, resulting in an earnings loss not very different from what the worker would have experienced naturally.

There is relatively little reliable evidence from studies using appropriate comparison groups, concerning the effect of various personal characteristics on lifetime loss. What little evidence there is supports the ideas discussed above. For example, estimates of the lifetime loss as a function of tenure were made in Jacobson's steel study. Figure 2 illustrates the findings. Lifetime losses are low for workers with low tenure. Starting at zero tenure, losses are small, and then rise very rapidly, reaching a peak at about eight years tenure. Beyond eight years of tenure, losses decline slowly. For most workers, earnings losses represent a total loss of about two years of annual earnings.

SUMMARY AND CONCLUSIONS

The purpose of this paper was to provide information about the costs to workers of displacement (job loss). In particular, we focused on variation in earnings losses across industries.

Because of methodological weaknesses, primarily the lack of appropriate comparison groups, evidence from most prior studies is unreliable. Several recent studies by staff members of the Public Research Institute provide evidence from which some reliable generalizations can be made.

The most clear cut finding is that losses by male workers will be large in industries that are heavily unionized, have low quit rates, or have a high fraction of males in their industry. Typically high loss industries, such as steel and autos, exhibit all three traits. Importantly, strong logical arguments for the existence of the observed relationship between losses and industry characteristics reinforce our confidence in these findings.

The magnitude of the loss is less clearcut. If we define the loss as the difference between what a displaced worker earns, given that he remains in the labor force, and what he would have earned had he not been displaced, the loss over a five year period will be about twice his average annual earnings.

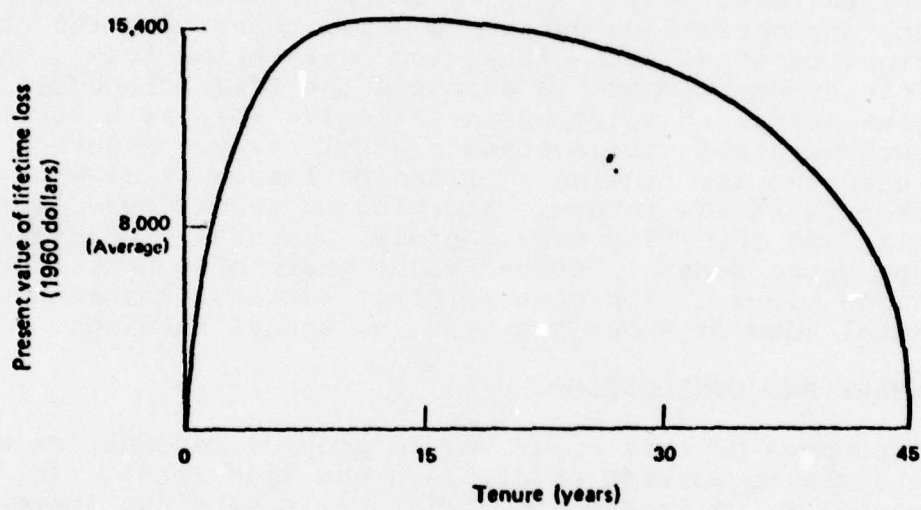


FIG. 2: LIFETIME EARNINGS LOSS BY TENURE
FOR STEEL WORKERS

For steel or auto workers, this amounts to about \$21,000 current dollars. If we define losses as the difference between what a displaced worker actually earns (even if he withdraws from the labor force) and what he would earn if not displaced, the losses are at least 50% greater. On the other hand, transfer payments, particularly unemployment insurance, reduce the income loss by at least 12%.

We have reached no firm conclusions regarding the appropriate way to measure losses by females. We, therefore, cannot say that losses in predominantly female industries will be small (although we can say that losses by males in these industries will be small). In fact, if we accept the second definition of loss discussed above (where the effect of labor force withdrawal is included in the measure), losses by women far exceed those of men and losses will be large in industries with predominantly female work forces. This definition of loss probably deviates so far from a measure of lost utility of female workers that it is inappropriate for most purposes.* The fact that losses by women under this definition do not show the expected relationship with industry characteristics is evidence that the loss measures are inadequate. Theory makes it clear that the full effect of volitional withdrawal on earnings should not enter utility loss calculations. The practical problems involved in screening out volitional withdrawal have not been solved totally satisfactorily. Results presented in this paper, however, suggest that, when volitional withdrawal is eliminated, losses in industries predominantly employing female workers are small and that the relation between female losses and industry characteristics are as expected. Additional research is required in order to develop reliable estimates of female losses.

The distribution of losses across workers in the same industry has also been examined in this paper. Differences in general economic conditions, size of the local labor market, and the worker's tenure can create substantial differences in the size of earnings losses. An increase in the unemployment rate of about one-third the national average (1.4 percentage points in the mid-sixties) doubles the losses of displaced steel workers. Steel workers displaced in a small labor market (population 200,000) lose 50% more than workers displaced in an average market (population 900,000). Finally, in the steel industry losses increase rapidly with workers' tenure. The largest lifetime loss is by workers with about 7 years tenure, not older-high tenured workers. The findings dealing with tenure contrast with conventional wisdom. They are more reliable than earlier estimates, however, since they

*The issue of what makes an "ideal" measure of loss is too complex to discuss here. See appendix A.

are based on the application of a new, more appropriate methodology. Additional research is needed to determine how the above characteristics affect females and workers in other than the steel industry.

APPENDIX A

**EARNINGS LOSS AS A MEASURE
OF THE COST OF DISPLACEMENT**

APPENDIX A: EARNINGS LOSS AS A MEASURE OF THE COST OF DISPLACEMENT

In this paper earnings loss is used as the primary measure of the cost of displacement borne by a given worker. It is not a perfect measure. Omitted from consideration are the loss of fringe benefits, the gains of transfer payments, particularly unemployment insurance, the psychic costs of leaving a familiar work environment, and the value of leisure time during periods of labor force withdrawal. Technically, what we seek is a measure of the "utility" loss. By definition this "utility" measure of the cost of displacement would be the lump sum cash payment that would just make a worker indifferent between leaving his job and staying. In order to produce a utility measure, the monetary value of all factors that are part of the total compensation package must be included in the computation.

We can divide the workers' post displacement experience into three labor market categories:

- employment
- unemployment
- labor force withdrawal

We will consider the extent to which an earnings measure diverges from a utility measure for each case.

EMPLOYMENT

To the extent that the worker is engaged in full-time work following his displacement, the earnings measure is likely to be very close to a utility measure. Fringe benefits are omitted from the earnings measure but tend to be highly correlated with earnings levels. Thus, on a percentage basis the loss estimates are likely to be unaffected.

The major reason earnings will diverge from utility for an employed worker is that part of the worker's earnings may represent what is called a compensatory wage differential. A worker may receive extra pay - a positive compensatory differential - because the job is especially unpleasant or dangerous. If the worker was receiving such a differential prior to displacement and finds a safer, more pleasant and therefore lower paying job subsequently, earnings loss will over-estimate the utility loss. On the other hand, the worker may have received a negative differential because his previous job was especially pleasant or because other workers

were particularly congenial. In such a case, the earnings loss will under-estimate the utility loss.

Compensatory differentials are not likely to be very large. Earnings differ across individuals primarily due to differences in their human capital, not to the attributes of the job they hold, per se.

UNEMPLOYMENT

Earnings loss measures omit the receipt of unemployment insurance and the value of leisure; thus, it might seem that earnings losses substantially over-estimate the utility loss due to unemployment. This is likely to be the case if unemployment is due to temporary layoff. If the worker is displaced and is searching for work, however, the psychic costs may be great. In addition, the loss of fringe benefits, such as pensions and medical insurance, can, under some circumstances, be very costly. During periods of job search, it is likely that earnings losses and utility losses are quite similar.

It has been estimated that at least half of the earnings loss of steel workers is due to unemployment. This occurs even though much of the unemployment period is probably spent searching for a new job. Moreover, the loss of seniority makes displaced steel workers considerably more vulnerable to temporary layoff on any subsequent job as well. Let us assume that half of the unemployment is due to temporary layoff. Unemployment compensation equals about half of the worker's prior earnings. The fact that it is tax free raises the value, but the loss of some fringes (such as paid vacation) probably raises the cost about an equal amount. A conservative estimate of the degree to which earnings loss estimates over-estimate the utility loss is therefore 12%. [One-half of the loss is due to unemployment - one half of the loss due to unemployment is due to temporary layoff - one half the actual earnings is the rate of compensation ($1/2 \times 1/2 = 1/8 @ .125$)].

A major reason that this is a conservative estimate is that the value of leisure is ignored entirely.

LABOR FORCE WITHDRAWAL

An earnings measure values periods of withdrawal at zero. The utility value of leisure is probably considerably greater than zero. This is especially true if the withdrawal is primarily volitional.

In large measure, the withdrawal of women is probably voluntary. Married women often place particularly high value on non-market time because it is devoted to the care of children. Often they work primarily to supplement the earnings of their husbands and, unless particularly attractive opportunities are available, they are likely to withdraw.

There are circumstances, however, such as the closing of a plant which is the primary support of most workers in a given community, where few alternative jobs are available.

Thus, at least in the short run, workers must withdraw from the labor force or relocate. For some workers, relocation can be prohibitively expensive. At least some of these workers would greatly prefer working to forced leisure. The leisure may therefore have relatively little value.

In most circumstances, however, there are jobs available, although they may not be particularly well paying or pleasant. Rejection of these jobs implies that the value of leisure is greater than the compensation afforded by working.

An accurate estimate of the earnings potential of a worker who withdraws would therefore be a reasonable measure of the utility of leisure. It may be difficult to obtain such a measure. Displaced workers who do not withdraw, who appear to have similar earnings capacity to those that do withdraw, may have superior ability in locating a new job. The potential earnings of those that withdraw may be overestimated. On the other hand, workers will withdraw as long as the value of leisure is at least equal to the value of earnings from work. When the value of leisure is greater than the earnings foregone, the earnings measure underestimates the value of leisure. Further research is needed to determine, precisely, the magnitudes of these potentially offsetting biases.

Earnings loss measures also ignore transfers available to workers who withdraw. This is particularly important for older workers who qualify for Social Security retirement benefits and private pensions. Many displaced workers younger than 65 are likely to qualify for pensions under an early retirement plan. Older workers are therefore particularly likely to withdraw because their incomes (and accumulated savings) are sufficient for their needs. Workers with low income may be eligible for welfare programs of various kinds. These programs may provide incomes very close to the returns from work. Such workers are therefore also very likely to withdraw.

Young workers present a problem of a different sort. They may withdraw to "invest" in formal training programs. Logically, this activity should be expected to raise their income in the long run. The problem here is that the follow-up period is too short to capture the return. Including such workers will clearly lead to overestimation of the loss.

APPENDIX B

ESTIMATION OF THE TOTAL COST OF DISPLACEMENT

APPENDIX B
ESTIMATION OF THE TOTAL COST OF DISPLACEMENT

The main body of the paper deals with earnings losses of individual workers. The total cost of worker displacement will depend not only on per capita earnings losses but also on the number of individuals displaced. Even if per capita losses are small, the aggregate loss can be large if many workers are affected. Thus, it is important to know the number of workers displaced as well as the losses for each worker.

In measuring the number of workers displaced from an industry, it is essential to distinguish those who leave because of a policy change from those who would have left anyway. In any industry there are always some firms in which employment is declining or plants are shutting down. It is not proper to attribute all employment declines to government action.

If a policy change affects an industry by slowing strong employment growth, it is likely that no workers will be displaced. Small reductions in employment will usually be met by reduced hiring while attrition remains normal. Unfortunately, pollution control, or other policy changes, often affect industries which are declining anyway. Even in a declining industry, few workers might be displaced in the absence of a policy change. Change can, however, push the industry over the limit that can be handled without displacements. In such a situation, even a small, additional impetus might have to be met primarily by displacing workers. Several of the studies discussed in the main body of this report contain useful information about the relationships among a given employment decline, the number of displacements, and the per capita loss.

It was noted in the main body of the paper that male workers in industries with low attrition have large per capita losses. The low attrition rate in these industries also means that only a small employment decline can be met by not replacing workers who leave due to attrition. Jacobson [1977] estimates that attrition can reduce employment by about six percent in an individual firm in the steel industry.

In any industry, employment changes will not be distributed equally across plants. Some will increase employment even when net industry employment declines. Thus, all attritions do not go unreplaced. Jacobson estimated that, given a five percent industry-wide decline in steel employment, about two percent of the reduction will be met by attrition, and three

percent will be displacements. The results for the steel industry are probably applicable to other manufacturing industries where per capita losses for males are high. Attrition rates for males are from three to five times higher in industries where per capita losses by males are lower than they are in high per capita loss industries. These low loss industries can meet much larger declines by attrition. This result probably holds for women as well. Industries employing mostly females have relatively high quit rates. Even though the earnings loss of a displaced female worker appears to be high, the probability of displacement is generally low. Thus, aggregate losses by women should be considerably smaller than the total loss by men.*

Additional evidence about the extent to which employment changes can be accomplished through quits rather than layoffs can be drawn from time series studies. One study, Hammermesh [1969], indicates that, on average, about 80% of an employment decline in durable goods manufacturing can be accomplished through attrition. A later study by Brechling [1976] suggests that a little less than 20% of a decline can be met by attrition. Brechling's estimate is smaller because his model takes into account the cyclical sensitivity of quits. Quits fall in a recession and rise in a boom.** When demand declines in one industry, it often declines in most other industries as well. Thus, few workers find such a period propitious for quitting. Policy changes, however, can be timed so that they occur in relatively prosperous times. In such circumstances, attrition is likely to absorb a sizable fraction of any decline. Similarly, if policy changes, such as increased requirements for pollution control, are introduced slowly, so that the employment reduction is distributed over a number of years, displacement will be less.

Employment trends in the affected industry, prior to the introduction of a change, can also have an important effect on the degree to which attrition can absorb any decline. If employment was growing in the industry, a relatively high percentage of the labor force will have low tenure, and, therefore, high quit propensities. In the steel industry,

*Plant closings are probably the major source of displacement in high attrition industries. Obviously, when employment declines by 100%, attrition can only reduce employment by a small fraction of the amount. Plant closings are very rare, however.

**There is some question that fluctuation in BLS quits (as opposed to inter-industry difference levels) are an accurate measure of fluctuation in attrition (voluntary turnover). See Jacobson, Louis S. [1978].

for example, 40% of the industry's attrition typically occurs among workers with less than three years' tenure, although these workers comprise only about 20% of the labor force.

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