WILLIAMS

RP-172

RESEARCH PAPER SERIES THE DEPARTMENT OF ECONOMICS

WILLIAMS COLLEGE
WILLIAMSTOWN,
MASSACHUSETTS

WCDE

WILLIAMS

RP-172

RESEARCH PAPER SERIES THE DEPARTMENT OF ECONOMICS

TRAINING AND THE GROWTH IN WAGE INEQUALITY

by

Jill Constantine and
David Neumark

RP-172

February, 1996

WILLIAMS COLLEGE
WILLIAMSTOWN,
MASSACHUSETTS

WCDE

Research Paper No. 172
Department of Economics
Fernald House
Williams College
Williamstown, Massachusetts 01267

TRAINING AND THE GROWTH IN WAGE INEQUALITY

by

Jill Constantine and
David Neumark

RP-172

February, 1996

TRAINING AND THE GROWTH IN WAGE INEQUALITY*

Jill M. Constantine
Department of Economics
Williams College
Williamstown, MA 01267

David Neumark
Department of Economics
Michigan State University
East Lansing, MI 48824

February 1996

Forthcoming in Industrial Relations

*This research was supported by the Education Research and Development Center Program, agreement number R117Q00011-91, CFDA 84.117Q, as administered by the Office of Educational Research and Improvement, U.S. Department of Education. The findings and opinions expressed do not reflect the position or policies of the Office of Educational Research and Improvement or the U.S. Department of Education. We thank Augustine Faucher for assistance with some of the CPS calculations, and Paul Swain for helpful comments.

TRAINING AND THE GROWTH IN WAGE INEQUALITY*

Abstract

Shifts in the incidence of training over the 1980s favored more-educated, more-experienced workers. These shifts coupled with the increase in the returns to skill, suggest that training may have contributed to the growth of between-group wage inequality in this period. Wage equations estimated using data from the 1983 and 1991 CPS files, which include supplemental questions on training, show that training did not contribute much to the growth in between-group wage inequality. It appears that i) the shifts in training were too small and ii) the returns to training did not rise, implying only small fractions of the increases in returns to schooling and experience over this time period can be explained by changes in the distribution of returns to training.

I. Introduction

Wage inequality in the 1970s and 1980s increased along two dimensions. First, there was an increase in "within-group" wage inequality, or wage inequality among workers with the same schooling, age, etc. This dimension of inequality trended upwards through the 1970s and at least the early 1980s, although more strongly so in the 1970s (Katz and Murphy, 1992; Juhn, et al., 1993). Second, there was an increase in "between-group" inequality, in the form of growing wage differentials between workers with different amounts of schooling or experience. The increases in returns to schooling and experience were the largest contributors to the overall growth of wage inequality in the 1980s (Juhn, et al., 1993; Blackburn, et al., 1990; Katz and Murphy, 1992; Murphy and Welch, 1992). In this paper we ask whether changes in the distribution of training, or changes in the returns to training, can help to explain or account for the increased returns to schooling or experience.

Existing research that seeks to explain these changes in the wage structure has focused primarily on the rise in between-group inequality.[1] Not surprisingly, economic research has emphasized demand and supply explanations.[2] This research generally concludes that demand shifts explain relatively more of the growth of wage inequality, and in particular points to a shift in relative demand towards more-skilled workers, probably driven by technical change (Bound and Johnson, 1992; Berman, et al., 1993). One implication of this hypothesis should be that the returns to training have increased over this period, as training is one means by which workers acquire the skills that are now in greater demand.[3] Because more-educated and more-experienced workers generally have more training, increased returns to training would have contributed to widening wage differentials associated with schooling and experience.

Supply-based explanations of increases in between-group wage inequality have focused largely on the quantities of workers at different schooling levels. The "first-order" explanation based on supply changes does not fit the data, because the college-high school wage differential grew in the 1980s even though the relative supply of college-educated workers was higher in the 1980s than in the 1970s. However, the rate of growth of the college-educated workforce slowed in the 1980s, which, coupled with a steady growth of relative demand for more-educated workers, could partially explain the rising college wage premium in this period (Blackburn, et al., 1990; Katz and Murphy, 1992).

While supply-based analyses of changes in the wage structure in the 1980s have focused on quantities (or changes in quantities) of workers at different schooling levels, another potential supply-side explanation is that the quality of workers at various schooling levels has changed. This possibility was first raised by Blackburn, et al. (1990), who suggested that the relative ability of college- to high school-educated workers may have increased over the 1980s, either because of changing selectivity of colleges or changing school quality. However, the evidence is somewhat contradictory. Blackburn and Neumark (1993) find no evidence of a widening ability differential over this period between workers at different schooling levels, while Bishop (1991a) reports that the quality of college graduates relative to high school graduates increased over the 1980s.[4]

Explanations based on quality changes or shifts in the ability-schooling relationship have been criticized because they can at best provide a partial explanation of the increase in between-group wage inequality. The reason is that wage differentials by schooling level expanded not only for cohorts just entering the labor market, but for older cohorts as well, for whom the distribution of characteristics across schooling levels cannot have changed (Blackburn, et al., 1990; Levy and Murnane, 1992).[5] However, the "quality" of a worker is not determined solely by schooling, and is not fixed at the completion of schooling. In particular, training--which is likely to increase a worker's productivity and wage--may occur at any point in a worker's career (although theory suggests that it is more likely to occur at young ages). One goal of this paper is to explore further whether quality changes can explain changes in the wage structure over the 1980s. But rather than focusing on school quality or the relative ability of workers with different schooling levels, we examine the role of changes in training. Thus, a potentially important supply-based explanation of the rise in between-group wage inequality--in particular the rise in the return to schooling--is that the distribution of training has changed, possibly favoring more-educated or more-experienced workers.[6]

In our view, asking whether changes in either the returns to training or the distribution of training contributed to the growth of wage inequality in the 1980s is of interest for three reasons. First, demand-driven increases in the returns to skill should be reflected in increases in the returns to training, so we get an additional test of the demand-shift hypothesis, or at least additional knowledge regarding the types or sources of skills for which returns have increased. Second, changes in the distribution of training may be an important part of a supply-side, quality-based explanation of changes in the wage structure, which can explain widening schooling-wage differentials for less-experienced as well as more-experienced workers.[7] Finally, estimates of the contribution of changes in returns to training or changes in the distribution of training to rising wage inequality are useful in assessing the likely benefits of expanding training for lower-wage workers. This is particularly important in light of efforts to reverse the recent increase in wage inequality.[8]

II. The Data

We utilize data from the January 1983 and January 1991 supplements to the Current Population Survey (CPS). In both of these supplements, respondents were asked two questions regarding the incidence of training: "Did you need specific skills or training to obtain your current (last) job?" and "Since you obtained your present job, did you take any training to improve your skills?" Individuals responding affirmatively to either of these questions were then asked to list the sources of each type of training from a list including school, a formal company program, informal on the job training, and other types of training. (Individuals could identify more than one source.) We focus on the set of training questions that are common to the 1983 and 1991 surveys. We are interested both in training to qualify for the current job, and training to improve skills on the current job, since either type is likely to increase a worker's productivity. The first type of training is relatively more likely to be worker-financed, and the second employer-financed, although the information on financing is sparse and not common across the two surveys.[9,10] A response indicating that an individual received training in school (especially training to qualify for the current job) is somewhat ambiguous, since they may simply be referring to regular schooling. Nonetheless, such information is potentially interesting because it indicates schooling that the worker perceives as directly related to the skills or qualifications for the current job.

While the questions were asked of all employed and unemployed persons (except those unemployed persons who have never worked), we are ultimately interested in looking at the relationship between training and wages, and hence use data only on employed individuals in the outgoing rotation group, the members of which have wage data. We use the hourly wage when it is reported, and otherwise the weekly wage divided by usual weekly hours. The hourly wage is top-coded at $99 in both years, and we observe no top-coded hourly wages in our data. However, the weekly wage was top-coded at $999 in 1983, and $1923 in 1991. Because the $999 figure is often binding, this change in the top-coding may affect wage regression results, especially for more-educated workers whose earnings are likely to be higher. We handle this by imposing on both years the lower of the two top-codes, measured in real dollars. Thus, we use a top-code in 1991 of $999 inflated from 1983 to 1991 dollars using the PCE implicit price deflator, for a top-code of $1390.

The descriptive statistics we report are based on weighted data (as are the regressions). The weights were constructed to represent the universe of non-self-employed individuals, aged 16 and over, who reported working for a wage in the survey week. The original sampling weights were adjusted to reflect that the population used in this study includes only those individuals who reported complete data on training, wages, schooling and other variables used in the empirical analysis. The weights were adjusted separately by age (five-year intervals for individuals under 25, ten-year intervals for all others), race, and sex. The empirical analysis focuses on men, reflecting the emphasis in the literature on changes in their wage structure.

III. Results

Changes in the Distribution of Training

The first question is whether the distribution of training has changed in ways that may have contributed to changes in the wage structure. Some partial evidence on this question is provided in Bureau of Labor Statistics (1992), which documents an overall increase in training on the current job, and at the same time, sharper increases for more-educated workers. In this section, we provide a more detailed analysis of this question. To assess whether changes in the distribution of training could have generated changes in schooling-wage differentials for more-experienced as well as less-experienced workers, we consider: i) changes in each type of reported training, and the number of types of training, by schooling level, ii) changes in training by level of potential experience, and iii) changes in training by schooling level, within experience groups. Detailed tables on which the following discussion is based are available from the authors upon request, or in Constantine and Neumark (1994).

We first discuss the incidence of training to qualify for the current job. Overall, the proportion reporting any training to qualify for the current job was slightly greater than one-half (.55) in 1983, and rose only slightly (by .015) as of 1991. There were larger (and significant) increases in the proportion reporting in-school training (an increase of .047, or 18.8 percent) and formal company programs (.020, or 16.7 percent), and a significant decrease in the proportion reporting informal on the job training (-.026, or -8.7 percent). The primary question, however, is whether disparities in training across schooling or experience groups widened between 1983 and 1991 in ways consistent with the widening of wage differentials by schooling or experience. In general, with respect to training to qualify for the current job, the answer appears to be no. For example, the proportion reporting any training fell by .011 (3.8 percent) for high school dropouts and .024 (2.8 percent) for college graduates. The same proportion rose by .023 (4.7 percent) for workers with 0-10 years of potential experience, and rose by .024 (4.4 percent) for workers with more than 20 years of potential experience.

We next turn to a similar analysis for training to improve skills on the current job. For this type of training, the evidence in favor of relative increases for more-educated and more-experienced workers is quite pronounced. The proportion reporting any training fell by .01 (5.6 percent) for high school dropouts, rose by .024 (7.3 percent) for high school graduates, and rose by .085 (15.5 percent) for college graduates (the latter two changes are significant). A similar, pronounced pattern of larger increases for more-educated workers appears for all types of training with the exception of in-school training, and also appears in the form of increases in the proportions reporting two or more types of training.

Relative increases in training also are apparent for more-experienced as compared with less-experienced workers. For example, the proportion reporting any training rose significantly by .075 (20.8 percent) for the most-experienced group (20 or more years), compared with insignificant increases of .013 (3.9 percent) and .026 (5.9 percent) for the two less-experienced groups (less than 10 years and 10-20 years). A similar pattern of relative increases in training favoring the most-experienced group (and sometimes also the group with 10-20 years of experience) is reflected for each type of training, and in the proportions reporting two or more types of training. Thus, the evidence with respect to training to improve skills on the current job is more suggestive of a role for changes in the distribution of training in generating the growth of between-group wage inequality over the sample period.

Part of the motivation for looking at training, as opposed to other supply-side, quality-based explanations of the rise in wage inequality, is the fact that schooling-wage differentials widened for more-experienced as well as less-experienced workers, as discussed in the Introduction. It is therefore of interest to ask whether training can potentially explain this phenomenon as well. If training contributed to widening schooling-wage differentials for workers of all experience levels, the relative proportion reporting training should have risen for more-educated workers, for both less- and more-experienced workers. To examine this question, we looked at changes in the proportion reporting training, disaggregated by schooling level, within experience groups. We focus on results for training to improve skills on the current job, the type of training for which changes by schooling and potential experience were most consistent with the observed changes in the wage structure.

Relative increases in training for more-educated workers are apparent for all experience groups, and if anything are sharper for workers with 10-20 or 20+ years of experience. For example, the proportion reporting any such training rose (significantly) by .116 (19.9 percent) for college graduates with 10-20 years of potential experience, and by .109 (20.6 percent) for those with 20 or more years of experience, compared with essentially no change for inexperienced workers. The incidence of company training increased for college-educated workers in all experience groups. Therefore it appears that changes in training to improve skills on the current job, in particular, could have played a role in widening schooling-wage differentials for more- as well as less-experienced workers.[11,12]

Changes in Between-Group Wage Inequality: Methods

To this point, the evidence on changes in the distribution of training is potentially consistent with changes in training having contributed to the growth of wage inequality in the 1980s. Training to improve skills on the current job increased relatively more for more-educated and more-experienced workers, and increased for more-educated workers among more-experienced as well as less-experienced workers. However, the key question is whether the changes themselves, combined with the effects of training on wages, are sufficiently large to have induced the observed changes in the wage structure. In this section we turn to evidence on this question.

We proceed in three steps. First, we estimate a standard log wage regression that captures the increase in between-group wage inequality in the 1980s, by adding interactions of a year dummy variable with both years of schooling and years of experience, as in

$$(1) \qquad \ln(w_i) = \alpha + \beta \cdot S_i + \beta' \cdot S_i \cdot D91_i + \gamma \cdot E_i + \gamma' \cdot E_i \cdot D91_i + \delta \cdot D91_i + Z_i \pi + \epsilon_i \ ,$$

where ln(w) is the log hourly wage, S is years of schooling, E is potential experience, D91 is a dummy variable for 1991, and Z is a matrix of other control variables described in the footnotes to Table 2.[13,14] Observations, which may be from 1983 or 1991, are indexed by 'i'. β' and γ' measure the changes in the returns to schooling and experience, respectively, the estimates of which, based on the existing research, we expect to be positive.

If training affects wages, and has increased relatively more for more-educated or more-experienced workers, then there is an omitted variable in equation (1) that is positively correlated with $S_i \cdot D91_i$ and with $E_i \cdot D91_i$ (in addition to being correlated with some of the other variables). This omission is likely to lead to overstatement of the increase in the return to schooling and experience over the sample period, or to upward bias in the estimates of β' and γ'. Thus, our second step is to add to the wage equation dummy variable controls for training (T), as in

$$(2) \qquad \ln(w_i) = \alpha + \beta \cdot S_i + \beta' \cdot S_i \cdot D91_i + \gamma \cdot E_i + \gamma' \cdot E_i \cdot D91_i + \delta \cdot D91_i + T_i \lambda + Z_i \pi + \epsilon_i \ .$$

Because this specification controls for changes in the distribution of training, the estimates of β' and γ' from equation (2) measure the increases in returns to schooling and experience not attributable to changes in the distribution of training. Alternatively, by comparing estimates of β' and γ' from equations (1) and (2), we can estimate the extent to which changes in the wage structure over this period are attributable to changes in the distribution of training.

Finally, we consider the possibility that the returns to training have increased. If they have, then because training is more prevalent among more-educated and more-experienced workers, estimates of equation (2) may still overstate the increases in the returns to schooling or experience.[15] We therefore augment the specification to include an interaction between the training variables and D91, as in

(3) $\ln(w_i) = \alpha + \beta \cdot S_i + \beta' \cdot S_i \cdot D91_i + \gamma \cdot E_i + \gamma' \cdot E_i \cdot D91_i + \delta \cdot D91_i + T_i\lambda + T_i \cdot D91_i \cdot \lambda' + Z_i\pi + \epsilon_i$,

which enables us to estimate the increases in the returns to schooling and experience independent of changes in the distribution of or returns to training.

A natural question raised by these specifications is whether any positive association between wages and training represents a causal effect of training, rather than heterogeneity or self-selection bias arising because higher-wage individuals receive more training. The literature on the returns to training establishes--conclusively in our view--that individuals (higher- as well as lower-skilled) experience faster wage growth during periods of training than at other times (Brown, 1989; Bishop, 1991b; Lynch, 1992; Holzer, 1990; Mincer, 1989). However, these studies simply establish that there is a positive causal effect of training on individual wage growth, or that the positive cross-sectional relationship between training and wages is not spurious. In this paper, though, we use cross-sectional estimates of equations (2) and (3) to ask how changes in the distribution of or returns to training have affected the wage structure. Thus, we should potentially be concerned with the magnitude of any self-selection biases in such cross-sectional estimates; knowing that a positive relationship persists in panel data, for example, is not enough to estimate effects on the wage structure. Furthermore, even if biases in the estimated cross-sectional relationship are constant across the years, our answer may be affected, because, for example, an increase in training of highly-educated workers will--if the cross-section estimate of the effect of training on the wage is biased upward--overstate the role of training in explaining the increase in the return to schooling.

The most direct attack on this problem would be to model the self-selection into training. This would require a model of the training decision, and exogenous variables that help to determine training but that do not directly affect the wage. Conceivably, in a rich longitudinal data set one might be able to come up with some variables that plausibly satisfy this criterion. However, in our view the CPS does not offer such variables. We have measures of things such as schooling, tenure, age, industry, and occupation, but all of these are standard ingredients of wage equations. Thus, we do not think that the direct modelling of self-selection into training would be fruitful with these data. Similarly, because the CPS data are not longitudinal, we cannot eliminate a fixed unobservable associated with training by differencing.

On the other hand, a subset of studies that explore the role of training in panel data also provides cross-sectional estimates with which longitudinal (or selection-corrected) estimates can be compared. Results from three such studies--the only studies we could find that look at relatively general populations, and provide both cross-sectional and longitudinal (or selection-corrected) estimates--are shown in Table 1. The Blanchflower and Lynch (1994) paper suggests that the cross-sectional estimates are downward biased, in contrast to the upward bias we would expect if higher-wage workers self-select into training. However, the other results in the table indicate the upward bias that the usual self-selection story would suggest--although in most cases the biases do not appear to be large--or indicate no bias. Thus, cross-section estimates of the effects of training are probably at worst slightly upward biased.

However, such biases do not drive our conclusions, and if anything appear to strengthen them. If the cross-section estimates--such as those we obtain from the CPS data--are upward biased, then as long as these biases are relatively constant over time, the effect should be that we overstate the contribution of shifts in the distribution of training to changes in the wage structure. As reported below, however, our results--despite any such biases--indicate that shifts in the distribution of training contributed little to shifts in the wage structure. Thus, if we had unbiased estimates of the effects of training, this conclusion would be even stronger.

Changes in Between-Group Wage Inequality: Results

Table 2 reports the main wage regression results.[16] The first column shows estimates of equation (1), the wage equation that allows shifts in the returns to schooling and experience, but does not introduce training variables. The estimates reflect the continuation into this later period of the by now well-established changes in the wage structure. In particular, the estimated return to schooling rises by .021, indicating a wage that is higher by 2.1 percent for each additional year of schooling in 1991 than it was in 1983. We specify the effect of potential experience by including linear through quartic terms, as suggested by Murphy and Welch (1990). We could report the coefficients of each of these terms, and how they change from 1983 to 1991, but it is relatively difficult to interpret such results in terms of changes in the return to experience. Thus, we instead calculate the estimated log wage differential associated with five, 15, and 25 years of experience (relative to zero years of experience), and the changes in these differentials between 1983 and 1991. The log wage differential associated with experience increased at each of these experience levels, by .034 at five years of experience, .067 at 15 years of experience, and .079 at 25 years of experience.

Column (2) reports the estimates of equation (3), where we simply add a dummy variable for any training, and an interaction of this dummy variable with the 1991 dummy variable.[17] In this table, we focus on training to improve skills on the current job, because the changes in the distribution of this training variable appeared most consonant with changes in the wage structure. The estimated coefficient of the training variable is significant, and indicates that training is associated with wages that are higher by nearly 15 percent. On the other hand, there is no significant increase in the return to this training from 1983 to 1991; the estimated coefficient of the interaction variable is an insignificant .008. Most importantly, the changes in the wage structure from 1983 to 1991 are not moderated much by the inclusion of the training variables. The return to schooling is estimated to rise by .019, 9.5 percent less than in column (1). The returns to experience are estimated to rise by .034, .062, and .070 at five, 15, and 25 years of experience. The increase at five years is as large as in column (1), and those at 15 and 25 years are about 10 percent smaller than the increases reported in column (1).

Column (3) reports estimates of a similar specification, which differs by including dummy variables for each type of training (now including "other" training), and interactions of these dummy variables with the 1991 dummy variable. Each type of training is significantly positively associated with wages, with the estimates ranging from .055 (for informal on the job training) to .189 (for formal company training). However, there is no evidence of increases in the returns to training. For in-school training and informal on the job training, the estimates indicate that, if anything, the returns to training fell, although the estimates are not statistically significant. The estimated changes in returns to training are positive, but smaller and even less significant, for formal company and other training. The inclusion of the more disaggregated training variables does no more to explain changes in the wage structure. The return to schooling is now estimated to increase by slightly more (.020) than in column (2), and the estimated increases in the returns to experience are within about 10 percent of those in column (1).

Thus, to this point, the estimates indicate that changes in the distribution of and returns to training contributed relatively little to changes in the wage structure from 1983 to 1991. The first row of Table 3 summarizes the results, reporting the percentage of the increase in the return explained in column (3) of Table 2, relative to column (1).[18] For example, adding the training variables and their interactions in column (3) to the specification in column (1) explains only 5.8 percent of the increase in the return to schooling.

Table 3 then goes on to report similar calculations for alternative samples and wage equation specifications. The next three rows report results when the specifications in columns (1) and (3) of Table 2 are estimated for separate experience groups, to assess the role of training in explaining the increase in the return to schooling for different experience groups. For the least-experienced group, the training variables account for virtually none of the increase in the return to schooling (0.5 percent). For the group with 10-20 years of experience, the increase in the return to schooling is actually greater once the training variables are included. For the most-experienced group, the training variables explain a higher percentage of the increase in the return to schooling (13.1 percent). This is interesting, because it was the possibility that training, rather than changes in school quality or ability, explained the increase in return to schooling among more-experienced workers, that was part of the motivation for looking at the role of training in generating changes in the returns to schooling and experience. Nonetheless, in our view we explain relatively little of the increase in the return to schooling, even for this group.

The next row of Table 3 reports the results of allowing different effects for each type of training, but not allowing the returns to training to change over time, by estimating equation (2) rather than equation (3). The percentages of the increases in the returns to schooling and experience that are explained in this specification are similar to those in the first row; if anything they are slightly higher, reflecting the results in column (3) of Table 2 that some of the estimated changes in the returns to training are negative. In the next two rows we first include dummy variables for each type of training to qualify for the current job, and then also include interactions of these variables with the 1991 dummy variable. In the latter specification, the percentage of the increase in the return to schooling that is explained rises slightly, to 11.3 percent. But the increases in the return to experience at each level of experience reported in the table are actually larger, as indicated by the negative values for the percentage explained in the table. The next to last row excludes the in-school training variables, since in-school training may simply reflect schooling, and the last row includes tenure variables. The results for these specifications are similar to the others in the table.

Overall, the results in Tables 2 and 3 support two conclusions regarding the role of training in generating the rise in between-group wage inequality. First, in contrast to what we might expect based on other evidence that the returns to skill increased, the returns to training did not increase over this period. Second, changes in the distribution of training account for at most relatively small percentages of the increases in the returns to schooling and experience over this period. Depending on the specification and sample, changes in the distribution of and returns to training explain 2.3 to 13.1 percent of the increase in the return to schooling. Changes in the distribution of and returns to training explain about six to 12 percent of the increase in the return to experience, although one specification suggests that the return to experience would have risen by more, not less, absent changes in the distribution of and returns to training.

The Role of Computers

As discussed above, part of the motivation for looking at the role of training in generating the increase in wage inequality was the finding that computer use at work partly accounts for the increase in the return to schooling (Krueger, 1993), along with the presumption that computer use at work is closely linked to training. The 1991 January supplement includes two questions relating to computers that are useful in exploring the relationship between training, computers, and wages. First, individuals indicate whether their training to improve skills on the current job included computer skills. Second, individuals are asked whether they use PCs or computer terminals at work (to which they can respond never, less than once a week, one or more times per week, or every day).

Table 4 provides some evidence documenting the linkages between training, computer training, and computer use. The first row of panel A reports the proportion of those reporting each type of training to improve skills on the current job who also report that the training taught computer skills. The numbers reveal that, depending on the type of training, between 30 and 39 percent of workers who report training learned computer skills. The next four rows report on the relationship between computer use at work and training to improve skills. The numbers show that, on the one hand, about one-quarter to one-third of those who received training never use a computer at work. On the other hand, about one-half of those who received training use a computer every day. In addition, workers who did not receive training are much less likely to use computers at work, as the last column reveals. Panel B shows the proportion reporting computer-related training, classified by computer use at work, and indicates that computer use at work is related to computer training. Virtually no workers (one percent) of those reporting computer-related training report that they never use a computer at work, whereas 28 percent of those who use a computer every day report computer-related training.

The figures in Table 4 relating training to computer use at work might suggest that our findings regarding the role of training in generating changes in the wage structure ought to closely parallel Krueger's (1993) findings regarding the role of computer use at work in generating these changes. In fact, though, our finding that changes in training explain relatively little of the increase in the return to schooling contrasts with Krueger's conclusion that "the proliferation of computers can account for between one-third and one-half of the increase in the rate of return to education observed between 1984 and 1989" (1993, p. 55).

However, while Table 4 documents positive relationships between training, computer-related training specifically, and computer use at work, the table also shows that there are sizable fractions of workers who use computers at work but do not report computer-related training or any training.[19] Therefore, some of the increased use of computers at work may be independent of training, at least insofar as we measure such training. In addition, Table 4 demonstrates that there is a good deal of training unrelated to computers, which may have different effects on wages than computer-related training. Thus, general information on training may not capture the full effects on the wage structure of the spread of computers because computer use at work that is independent of training may raise wages, and because the returns to computer-related training may be higher than returns to other training.

Panel C of Table 4 presents some evidence on these questions. We first add to the basic specification in column (1) of Table 2 dummy variables for computer use at work, and report the estimated coefficients of these dummy variables in the first row.[20] These estimates are large and significant, in line with the magnitudes reported by Krueger (although his estimates are for men and women). In particular, computer use every day is associated with the largest wage differential. Next, we add dummy variables for each type of training, as in column (3) of Table 2. The estimated coefficients for computer use fall by about one-quarter, but they remain large and statistically significant. This suggests that computer use is associated with higher wages, independently of the training a worker has received. We also estimated this specification including a dummy variable indicating whether the training was computer-related. The estimated coefficients of the computer-use dummy variables were nearly identical, and the estimated coefficient of this training variable was actually negative.[21] Thus, computer use is associated with higher wages even independently of computer-related training, and the return to computer-related training is no higher than the return to other training. On the one hand, these results help to explain why we find that changes in the distribution of and returns to training contributed little to changes in the wage structure, while changes in computer use apparently contributed relatively more. On the other hand, the results suggest that computer-related training on the job is unlikely to confer on workers all of the gains associated with computer use at work. Rather, the wage differentials associated with computer use at work reflect, at least in part, other factors such as computer skills learned in school or on previous jobs, or worker heterogeneity associated with computer use.

IV. Conclusion

Shifts in the incidence of various types of training over the 1980s favored more-educated, more-experienced workers. In addition, other evidence on increased returns to skill suggests that the returns to training should have increased. Given that training is associated with higher wages, and that training is more prevalent among more-educated and more-experienced workers, changes in the distribution of and returns to training may have contributed to the growth of wage inequality in this period. However, wage regression results indicate that only small proportions of the increases in the returns to schooling and experience are explained by changes in the distribution of training across schooling and experience groups, and changes in the returns to training. This is because the returns to training did not in fact increase, and because the changes in the distribution of training were not sufficiently large to have substantial effects on the wage structure, given the size of the effect of training on wages.

None of this is intended to say that training cannot be used to boost the wages of lower-wage workers. In addition, there may be long-term reasons for the lower incidence of training among less-educated, lower-wage workers, which may be amenable to policy intervention. However, in policy debates regarding approaches to increasing the relative pay of less-educated and younger workers, it is important to understand that the relative wage declines that such workers experienced in the past 10-15 years are for the most part not attributable to absolute or relative declines in training.

Endnotes

1. Blackburn and Neumark (1993) provide some evidence on potential explanations of increased within-group inequality, in particular whether the price of ability has risen, as conjectured by Juhn, et al. (1993).

2. There is also research on institutional changes regarding minimum wages and union organization (Blackburn, et al., 1990), and the changing composition of jobs in the U.S. economy (Bluestone and Harrison, 1986).

3. For example, Krueger (1993) shows that the return to use of computers at work has increased.

4. In related research, Cameron and Heckman (1993) show that over the 1980s an increasing proportion of high school graduates held GEDs, and that the return to such degrees is lower than the return to a high school diploma.

5. In principle, such changes could arise through selection into employment. But this seems implausible for prime-age males, who have employment rates exceeding 90 percent.

6. There are at least two existing empirical clues that suggest this is a promising hypothesis. First, Krueger (1993) provides evidence that changes in the incidence of computer use at work can explain a significant portion of the increase in the return to schooling from 1984 to 1989, partly because computer use at work rose relatively more for more-educated workers. It seems plausible that computer use on the job (especially when it is independent of computer use at home) is associated with training. Second, CPS tabulations suggest that increases in the incidence of training over the 1980s were more pronounced for more-educated workers (Bureau of Labor Statistics, 1992).

7. Of course, such changes cannot be viewed as entirely distinct from demand-side changes, since changes in the demands for skills may spur training.

8. For a pessimistic assessment of the possibility of accomplishing this via increased training, see Heckman (1993).

9. In the 1983 survey respondents were asked if their in-school and formal company training was paid for by their employer. In the 1991 supplement, respondents were asked if their employers paid for all, half or more, less than half, or none of their in-school training only.

10. Studies that have tested whether workers or employers pay for general and specific training have shown that although most employers and workers consider the training they receive to be fairly general, employers appear to pay for a large portion of training (Baron, Berger, and Black, 1993; Bishop, 1991b).

11. Changes in the distribution of training can explain widening schooling-wage differentials for more-experienced as well as less-experienced workers only if some of the increased training of more-experienced, more-educated workers occurred at the same time that schooling differentials were widening, rather than in the distant past. (That is, increased training must be partly a period effect, and not just a cohort effect.) Otherwise, changes in the distribution of training could not have contributed to the widening of the schooling-wage differential for less-experienced workers. This is an implicit assumption, although it cannot be definitively established in the CPS data. However, the median job tenure of male workers was 6.8 years for those aged 35-44, and 11.6 years for those aged 45-54 (Farber, 1994). It therefore seems plausible that at least some of the training to improve skills on the current job, for more-experienced workers, is relatively recent.

12. In Constantine and Neumark (1994) we also examine data on length of training programs, since the duration of training, and not only its incidence, is likely to affect wages (Mincer, 1989; Barron, Berger and Black, 1993). Because of the ambiguity regarding the interpretation of in-school training, we focused only on the length of formal company training programs. With respect to training to qualify for the current job, there were relative increases in the length of training for more-educated and more-experienced workers. The results for training to improve skills on the current job were more ambiguous. Disaggregated by experience group, the results paralleled those for training to qualify for the current job, although the changes were less sharp. However, the results were reversed by schooling level, where the least-educated had the sharpest increases in length of programs.

13. We include higher-order experience terms, but for expository purposes here refer only to the linear term.

14. We originally intended to consider within-group inequality as well. However, it turns out that in these data evidence on changes in within-group wage inequality between 1983 and 1991 is ambiguous. Overall wage inequality did increase. The difference between the 50th and 10th percentile of log wages rose from .79 to .81 from 1983 to 1991, while the 90th-50th difference rose from .66 to .70. However, looking at the residuals from the first regression reported in Table 2, the 50th-10th difference rose from .56 to .57 from 1983 to 1991, while the 90th-50th difference fell from .51 to .50. The absence of an unambiguous rise in within-group inequality from 1983 to 1991 is not inconsistent with earlier evidence documenting the rise in this dimension of inequality, evidence which focused on earlier years and did not extend out to 1991. For example, the CPS data used by Katz and Murphy (1992) only extend through 1987, and in their data residual wage inequality for men levels off by 1983 or 1984, after rising sharply through the 1970s (Figure II, p. 45). The CPS data used in Juhn, et al. (1993) extend through 1989. Their data reflect a similar levelling off of within-group wage inequality by 1984, but additional increases in 1988 and 1989 (Figure 7, p. 427).

15. That is, there is an omitted variable $\lambda' \cdot T_i \cdot D91_i$ that, because training is positively correlated with schooling and experience, is positively correlated with $S_i \cdot D91_i$ and $E_i \cdot D91_i$, and hence (assuming $\lambda' > 0$) leads to upward bias in the estimates of β' and γ'.

16. Throughout the wage equation analysis, we ignore issues of selection into employment. This is unlikely to be much of an issue since we study men. In addition, modeling such selection requires data for all individuals on the determinants of market wages, such as training, that appear in the wage equation. But the training questions in the CPS are not asked of those out of the labor force.

17. Below, we report abbreviated results for equation (2).

18. The percentages do not correspond exactly to what one could compute from Table 2, because Table 2 reports estimates rounded to two or three places to the right of the decimal point.

19. For example, 72 percent of those using computers every day did not report computer-related training.

20. The only difference is that the year interactions are omitted, since the computer-use and computer-training data are available only in 1991.

21. We also estimated the specifications with interactions between the computer use and computer training variables, to check whether the returns to computer-related training are higher for those who use computers at work (or, alternatively, whether the returns to computer use at work are higher for those who receive computer-related training). In fact, the estimated coefficients of these interactions are negative, although insignificant, and the results suggest that, if anything, those who use computers at work and received computer-related training earn lower wages. This may reflect greater firm specificity of computer skills that were obtained via training on the current job. At any rate, the estimated coefficients of the computer use dummy variables were unchanged, so the results continue to suggest that there are significant wage differentials associated with computer use at work, independently of training.

References

Barron, John, Mark Berger, and Dan Black. 1993. "Do Workers Pay for On-The-Job Training?" Working Paper No. E-1169-93, University of Kentucky Business School .

Bartel, Ann P. 1992. "Training, Wage Growth and Job Performance: Evidence from a Company Database." NBER Working Paper No. 4027. Cambridge, MA: National Bureau of Economic Research.

Berman, Eli, John Bound, and Zvi Griliches. 1993. "Changes in the Demand for Skilled Labor Within U.S. Manufacturing Industries: Evidence from the Annual Survey of Manufacturing." Working Paper No. 4255. Cambridge, MA: National Bureau of Economic Research.

Bishop, John H. 1991a. "Achievement, Test Scores, and Relative Wages." In Workers and Their Wages: Changing Patterns in the United States, edited by Marvin H. Kosters, pp. 146-186. Washington, D.C.: The AEI Press.

_____. 1991b. "On-The-Job Training of New Hires." In Market Failure in Training?, edited by D. Stern and J. M. Ritzen, pp. 61-98. Berlin: Springer-Verlag.

Blackburn, McKinley L., David E. Bloom, and Richard B. Freeman. 1990. "The Declining Economic Position of Less Skilled American Men." In A Future of Lousy Jobs? The Changing Structure of U.S. Wages, edited by Gary Burtless, pp. 31-67. Washington, D.C.: The Brookings Institution.

Blackburn, McKinley L., and David Neumark. 1993. "Omitted-Ability Bias and the Increase in the Return to Schooling." Journal of Labor Economics 11(3): 521-544.

Blanchflower, David G., and Lisa M. Lynch. 1994. "Training at Work: A Comparison of U.S. and British Youths." In Training and the Private Sector: International Comparisons, edited by Lisa M. Lynch, pp. 233-260. Chicago, IL: The University of Chicago Press.

Bound, John, and George Johnson. 1992. "Changes in the Structure of Wages in the 1980s: An Evaluation of Alternative Explanations." American Economic Review 82(3): 371-392.

Brown, James. 1989. "Why Do Wages Increase with Tenure?" American Economic Review 79(5): 971-992.

Bureau of Labor Statistics. 1992. "How Workers Get Their Training: A 1991 Update." Bulletin 2407.

Cameron, Stephen V., and James J. Heckman. 1993. "The Nonequivalence of High School Equivalents." Journal of Labor Economics 11(1): pp. 1-47.

Constantine, Jill M., and David Neumark. 1994. "Training and the Growth of Wage Inequality." Working Paper No. 4729. Cambridge, MA: National Bureau of Economic Research.

Farber, Henry S. 1994. "Are Lifetime Jobs Disappearing? Job Duration in the United States: 1973-1993." Unpublished paper, Princeton University.

Heckman, James. 1993. "Assessing Clinton's Program on Job Training, Workfare, and Education in the Workplace." Working Paper No. 4428. Cambridge, MA: National Bureau of Economic Research.

Holzer, Harry J. 1990. "The Determinants of Employee Productivity and Earnings." Industrial Relations 29(3): 403-422.

Juhn, Chinhui, Kevin M. Murphy, and Brooks Pierce. 1993. "Wage Inequality and the Rise in Returns to Skill." Journal of Political Economy 101(3): 410-442.

Katz, Lawrence F., and Kevin M. Murphy. 1992. "Changes in Relative Wages, 1963-1987: Supply and Demand Factors." Quarterly Journal of Economics CVII(1): 35-78.

Krueger, Alan B. 1993. "How Computers Have Changed the Wage Structure: Evidence from Microdata, 1984-1989." Quarterly Journal of Economics CVIII(1): 33-61.

Levy, Frank, and Richard J. Murnane. 1992. "U.S. Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations." Journal of Economic Literature 30(3): 1333-1381.

Lynch, Lisa M. 1992. "Private Sector Training and the Earnings of Young Workers." American Economic Review 82(1): 299-312.

Mincer, Jacob. 1991. "Job Training: Costs, Returns, and Wage Profiles." In Market Failure in Training?, edited by D. Stern and J. M. Ritzen, pp. 15-39. Berlin: Springer-Verlag.

Murphy, Kevin M., and Finis Welch. 1992. "The Structure of Wages." Quarterly Journal of Economics CVII(1): 285-326.

_____. 1990. "Empirical Age-Earnings Profiles." Journal of Labor Economics 8(2): 202-229.

Table 1: Evidence on Self-Selection Bias in Cross-Section Estimates of the Effects of Training on Wages[a]

Author	Data	Cross-section estimates		Fixed-effects estimates	Selectivity-corrected estimates
Lynch (1992)	NLSY	Previous weeks of on-the-job training:	.0002 (.17)	-.0002 (.17)	-.0001 (.06)
		Previous apprenticeship, weeks:	.004 (3.29)	.002 (2.05)	.003 (3.33)
		Previous weeks of off-the-job training:	.002 (5.23)	.002 (4.38)	.002 (3.07)
Blanchflower and Lynch (1994)	NLSY, non-college grads	Previous company training (dummy):	-.03 (.65)	.12 (1.94)	
		Previous off-the-job training (dummy):	.03 (2.07)	.05 (1.02)	
		Ever had apprenticeship (dummy):	.19 (3.16)	.38 (3.38)	
Bartel (1992)	Company data set, professional employees	Days of formal training:	.002 (4.49)	.001 (4.46)	

a. Estimates are for log wage or log earnings equations. T-statistics are reported in parentheses. These results are for samples including men and women. Blanchflower and Lynch report similar results for men only, and Lynch reports similar cross-section and fixed-effects estimates for white men only.

Table 2: Log Wage Equation Estimates Incorporating Training, 1983 and 1991 CPS Samples, Men[a]

	(1)	(2)	(3)
Years of schooling	.068	.062	.061
	(.002)	(.002)	(.002)
× 1991	.021	.019	.020
	(.003)	(.003)	(.003)
Potential experience, log wage differential[b]			
5 years	.30	.29	.29
15 years	.62	.60	.59
25 years	.70	.69	.68
5 years × 1991	.034	.034	.031
15 years × 1991	.067	.062	.060
25 years × 1991	.079	.070	.070
Training to improve skills on current job			
Any training	...	.149	...
		(.013)	
× 1991	...	.008	...
		(.017)	
In-school	...	...	.103
			(.019)
× 1991	...	...	-.033
			(.025)
Informal on the job	...	...	.055
			(.017)
× 1991	...	...	-.030
			(.022)
Formal company	...	...	.189
			(.018)
× 1991	...	...	.002
			(.022)
Other	...	...	.102
			(.031)
× 1991	...	...	.017
			(.038)
$\bar{R}^2$	.435	.448	.452

a. Other control variables included are: dummy variables for 1991, married with spouse present, residence in the south and in urban areas, and black. For training to qualify for the current job, there is a residual "other" training category, which is a combination of responses including training from correspondence courses, informal training from a friend, or other training. For training to improve skills on the current job, there is a residual "other" training category, which is a single response distinct from the other training categories indicated in the table. Estimates are based on 6994 observations in 1983, and 5825 observations in 1991. Estimates are based on weighted data.

b. Linear, quadratic, cubic, and quartic terms, and their interactions with a dummy variable for 1991, are included.

Table 3: Additional Analyses of Log Wage Equation Estimates Incorporating Training, 1983 and 1991 CPS Samples, Men[a]

	Percentage of Increase in Return Explained			
	Years of Schooling	Experience (at 5 years)	Experience (at 15 years)	Experience (at 25 years)
Specification	(1)	(2)	(3)	(4)
Table 2, column (3)	5.8	8.0	10.1	10.8
Potential experience < 10[b]	0.5	...	...	...
$10 \leq$ Potential experience < 20	-2.9	...	...	...
Potential experience ≥ 20	13.1	...	...	...
Exclude training × 1991 interactions	9.9	9.3	12.7	13.7
Include dummy variables for training to qualify for current job	12.6	14.3	12.3	8.1
Include dummy variables for training to qualify for current job, and interactions with 1991	11.3	-7.2	-10.3	-12.6
Exclude in-school training variables	9.6	8.0	12.2	13.7
Include linear-quartic tenure variables[c]	2.3	3.5	5.7	6.8

a. Each specification is a variation of the specification in column (3) of Table 2. See footnotes to Table 2 for additional details.

b. Linear through quartic potential experience terms are included in the regression for each subgroup.

c. The tenure variables are also included in the "baseline" specification (equation (1)) from which the increases in returns to schooling and experience are estimated.

Table 4: Training to Improve Skills on Current Job, Computer Training to Improve Skills on Current Job, and Computer Use at Work, 1991 CPS Sample, Men and Women[a]

	In-school	Informal on the job	Company training	No Training
A. Proportion reporting training in computer-related skills	.39	.30	.36	.00
Proportion reporting use of a PC or computer terminal:				
Never	.27	.38	.26	.69
Less than once per week	.07	.06	.08	.04
One or more times per week	.12	.09	.09	.05
Every day	.54	.47	.57	.23
	Never uses computer	**Uses computer less than once per week**	**Uses computer one or more times per week**	**Uses computer every day**
B. Proportion reporting training in computer-related skills	.01	.10	.16	.28
C. Regression estimates of effects of computer use on log wages:[b]				
Excluding training variables	...	.19	.18	.26
		(.03)	(.02)	(.01)
Including training variables	...	.14	.13	.20
		(.03)	(.02)	(.01)

a. Estimates are based on 5756 observations in 1991. The sample is slightly smaller than in the preceding tables because of non-response to the computer use questions. Estimates are based on weighted data. See footnotes to Table 2 for more details.
b. Based on the same specification as in column (1) of Table 2 (although with 1991 data only), with the addition of dummy variables for computer use. In the second row, we add the training dummy variables included in column (3) of Table 2.

Department of Economics
Williams College
RESEARCH PAPER SERIES

A series of papers written by members of the Department of Economics on topics that do not pertain directly to less developed countries. From time to time documentation for computer programs and other research tools developed by members of the department will be distributed in this series as Special Research Papers and denoted by the letters RPS. A copy of any paper (and/or a reprint of the published version) will be mailed on request. See the order blank for further details.

1984-1996 Research Papers

RP-63 Lee J. Alston, Samar K. Datta and Jeffrey B. Nugent, "Tenancy Choice in a Competitive Framework with Transactions Costs: A Theoretical and Empirical Analysis," February, 1984 (Journal of Political Economy, December, 1984).

RP-64 Lee J. Alston and Morton Owen Schapiro, "Inheritance Laws Across Colonies: Causes and Consequences," February, 1984 (Journal of Economic History, May, 1984).

RP-65 P. Srinagesh, "Public Utility Pricing Under Risk: Self-Rationing With Non-Linear Prices," March, 1984.

RP-66 David R. Ross, "A Measure of Conditional Bivariate Association," April, 1984.

RP-67 P. Srinagesh, "Nonlinear Prices and the Regulated Firm," April, 1984 (Quarterly Journal of Economics, Feb. 1986).

RP-68 Stefano Fenoaltea, "Public Works Construction in Italy, 1861-1913: A Progress Report," May, 1984.

RP-69 Stefano Fenoaltea, "The Industrialization of Italy, 1861-1913: A Progress Report," May, 1984.

RP-70 James Neumann, "Natural Resource Policy in New Jersey's Pinelands," July, 1984.

RP-71 David R. Ross, "Learning by a Monopolist," August, 1984.

RP-72 Gordon C. Winston, "Activities in Time: A New Theory of Work and Consumption," September, 1984.

RP-73 David R. Ross, "Learning to Dominate," September, 1984.

RP-74** Roger Bolton, "Multiregional Models: Introduction to a Symposium," Journal of Regional Science, Vol. 20, No. 2, 1980.

RP-75** Morton Owen Schapiro, "Land Availability and Fertility in the United States, 1760-1870" in Journal of Economic History, Vol. XLII, No. 3 (Sept. 1982).

RP-76** Morton Owen Schapiro and Dennis A. Ahlburg, "Suicide: The Ultimate Cost of Unemployment" in Journal of Post-Keynesian Economics, Winter 1982-83, Vol. V, No. 2.

RP-77** Dennis A. Ahlburg and Morton Owen Schapiro, "Socioeconomic Ramifications Changing Cohort Size: An Analysis of U.S. Postwar Suicide Rates by Age and Sex" in Demography, Vol. 21, No. 1, February, 1984.

RP-78** Roger Bolton, "Regional Policy in the United States in The Canadian Journal of Regional Science, V, 2 (1982).

RP-79** Roger Bolton, "Industrial and Regional Policy in Multiregional Modeling," chapter 7 in Regional Dimensions of Industrial Policy (Lexington: Lexington Books, 1982).

RP-80** Brian Levy, "World Oil Marketing in Transition" in International Organization 36, 1, Winter 1982.

RP-81** Ralph M. Bradburd and Richard E. Caves, "A Closer Look at the Effect of Market Growth on Industries' Profits" in The Review of Economics and Statistics, Vol. LXIV, No. 4, November, 1982.

RP-82** S. R. Lewis, Jr. and D. N. Mokgethi, "Fiscal policy in Botswana, 1966-82" in Botswana's Economy since Independence (New Delhi: Tata McGraw-Hill Publishing Co. Limited, 1983).

RP-83 Lee J. Alston and Joseph P. Ferrie, "Resisting the Welfare State: Southern Opposition to the Farm Security Administration," September, 1984.

RP-84 Lee J. Alston, "'True Tenancy' in the South: Estimates for 1900 and 1910," September, 1984.

RP-85** Michael S. McPherson, "Want Formation, Morality, and Some 'Interpretive' Aspects of Economic Inquiry" in Social Science as Moral Inquiry (New York: Columbia University Press, 1983).

RP-86** Michael McPherson, "Efficiency and Liberty in the Productive Enterprise: Recent Work in the Economics of Work Organization" in Philosophy & Public Affairs, Vol. 12, No. 4, Fall 1983.

RP-87** Michael S. McPherson and Morton Owen Schapiro, "Economic Public Policy Implications of an 'Outmoded' Work Force" in Educational Record, Fall 1983.

RP-88 Gordon C. Winston, "Three Problems with the Treatment of Time in Economics," January, 1985.

RP-89 David R. Ross, "The Significance of Learning in Reducing Costs," February, 1985.

RP-90 Richard Krouse and Michael McPherson, "A 'Mixed' Property Regime: Equality and Liberty in a Market Economy," February, 1985.

RP-91 David Fairris, "Unions and the Work Environment: Voice Versus Monopoly Power Effects," September, 1985.

RP-92 Richard Krouse and Michael McPherson, "On Rawlsian Justice in Political Economy: Capitalism, 'Property-Owning Democracy,' and the Welfare State," September, 1985.

RP-93 T.R. Lakshmanan and Roger Bolton, "Regional Energy and Environmental Analysis," October 1985.

RP-94 Randal R. Rucker and Lee J. Alston, "The Effectiveness of Government Policies to Alleviate Agricultural Distress, 1925-1939," March, 1986.

RP-95 Edward R. Morey and W. Douglass Shaw, "The Impact of Acid Rain: A Characteristics Approach to Estimating the Demand For and Benefits From Recreational Fishing," March, 1986.

RP-96 Gordon C. Winston, "Leisure," March, 1986.

RP-97 Richard M. Peck and Padmanabhan Srinagesh, "Uncertain Lifetime and Ordinal Impatience," April, 1986.

RP-98 David K. Howe and David Fairris, "Unions, Fringe Benefits, and Nonpositional Goods Consumption," November, 1986.

RP-99 John Wakeman-Linn, "Coverage Ceilings on Outpatient Mental Health Care: The Patient's Perspective," January, 1987.

RP-100 Lori Gladstein Kletzer, "Job Tenure and Earnings After Permanent Job Loss," March, 1987.

RP-101 Gerald Epstein, "The Illiquidity Trap," May, 1987.

RP-102 Charles P. Kindleberger, "Henry George's Protection or Free Trade," May, 1987.

RP-103** Michael S. McPherson and Mary S. Skinner, "Paying for College: A Lifetime Proposition," July, 1987 (The Brookings Review, Fall, 1986).

RP-104 Michael S. McPherson, "Federal Student Aid Policy: Can We Learn from Experience?" July, 1987 (The Rockefeller Institute Conference Proceedings, Spring, 1986).

RP-105** Morton Owen Schapiro, "A General Dynamic Model of 19th Century US Population Change," July, 1987 (Economic Modelling, October, 1985).

RP-106 Ralph M. Bradburd and David R. Ross, "A General Measure of Multidimensional Inequality," July, 1987. (Oxford Bulletin of Economics and Statistics, November 1988)

RP-107 David R. Ross, "The Profitability-Concentration Relation: Applying a U.K. Test to U.S. Data," Sept., 1987.

RP-108 Gordon C. Winston, "Imperfectly Rational Choice: Rationality as the Result of a Costly Activity," October, 1987.

RP-109 Padmanabhan Srinagesh, "Random Demand, Capacity and Pricing Below Cost", November, 1987.

RP-110 Ralph M. Bradburd & David R. Ross, "Can Small Firms Find and Defend Strategic Niches? A Test of the Porter Hypothesis", November, 1987.

RP-111 David R. Ross & Ralph M. Bradburd, "The Effect of Industry Heterogeneity in Structure-Performance Studies," December, 1987.

RP-112 Michael S. McPherson, "Appearance and Reality in the Guaranteed Student Loan Program," December, 1987.

RP-113 Morton Owen Schapiro, "Socio-Economic Effects of Relative Income and Relative Cohort Size", January, 1988.

RP-114 Michael S. McPherson, "How Can We Tell if Federal Student Aid is Working?", January, 1988.

RP-115 Michael S. McPherson, "Family Ability to Pay: A Lifetime Perspective", February, 1988.

RP-116 P. Srinagesh, David R. Ross, and Gordon C. Winston, "On the Applicability of Shephard's Lemma when Capital is Optimally Idle", February, 1988.

RP-117 Padmanabhan Srinagesh and Ralph M. Bradburd, "Quality Distortion by a Discriminating Monopolist", February, 1988.

RP-118 David R. Ross, "Profits, Concentration and Raw Materials-Based Manufacturing", February, 1988.

RP-119 John Wakeman-Linn, "Alternative Notions of Credit Market Equilibrium: Their Significance for Monetary Policy," March, 1988.

RP-120 Lori Gladstein Kletzer, "Industry Wage Differentials and Permanent Job Loss: Do Workers Displaced from High-Wage Industries Have Longer Durations of Joblessness?", May, 1988.

RP-121 John Wakeman-Linn, "Monetary Policy and Endogenous Credit Rationing," May, 1988.

RP-122 Gordon C. Winston and Richard G. Woodbury, "Myopic Discounting: Empirical Evidence," July, 1988.

RP-123 Catherine B. Hill, "Different Types of Commercial Policies, Employment, and the Current Account Assuming Optimizing Behavior in an Intertemporal Framework," August, 1988.

RP-124 Catherine B. Hill, "The Effects of Different Trade Policies in Open Economy Macroeconomic Models," August, 1988.

RP-125 Padmanabhan Srinagesh and Ralph Bradburd, "Quality Discrimination and Bidirectional Quality Distortion: Generating the Dupuit Outcome," October, 1988.

RP-126 Roger Bolton, "Integrating Economic and Environmental Models: Some Preliminary Considerations," October, 1988.

RP-127 Richard Sabot and John Wakeman-Linn, "Grade Inflation and Course Choice," November, 1988.

RP-128 David Fairris, "Shopfloor Relations in the Postwar Capital-Labor Accord," December, 1988.

RP-129 Lori Kletzer, "Returns to Seniority After Permanent Job Loss," December, 1988. (American Economic Review, June 1989.)

RP-130 Roger Bolton, "An Economic Interpretation of a "Sense Of Place," January, 1989.

RP-131 Lori Gladstein Kletzer, "Earnings After Job Displacement: Job Tenure, Industry, and Occupation," April, 1989.

RP-132** Duncan P. Mann and Jennifer P. Wissink, "Money-back Contracts with Double Moral Hazard," June, 1989. (RAND Journal of Economics, Summer 1988.)

RP-133 Duncan P. Mann and Jennifer P. Wissink, "Hidden Actions and Hidden Characteristics In Warranty Markets," June, 1989. (International Journal of Industrial Organization, forthcoming.)

RP-134 David Fairris, "Compensating Payments and Hazardous Work in Union and Nonunion Settings," July, 1989.

RP-135** Michael S. McPherson, Morton Owen Schapiro, and Gordon C. Winston, "Recent Trends in U.S. Higher Education Costs and Prices: The Role of Government Funding," July, 1989. (AEA Papers and Proceedings, Vol. 79 No. 2, May 1989.)

RP-136 Catherine B. Hill, "The Costs of Mismanaging Commodity Booms and The Optimal Policies Given Uncertainty," July, 1989.

RP-137 Michael S. McPherson and Morton Owen Schapiro, "Student Aid and Enrollment in Higher Education: Reconciling Econometric Findings and Historical Data," August, 1989.

RP-138 David Fairris and Lee J. Alston, "Wages and the Intensity of Labor Effort: Efficiency Wages Versus Compensating Payments," March, 1990.

RP-139 Richard Sabot and John Wakeman-Linn, "Performance in Introductory Courses: A Production Function Analysis," March, 1990.

RP-140 Roger Bolton, Randall Jackson, and Guy West, "Editors Introduction" (to special issue of a journal, Socio-Economic Planning Sciences, vol. 23, No. 5, 1989, pp. 237-240, March, 1990).

RP-141** Duncan P. Mann and Jennifer P. Wissink, "Money-Back Warranties vs. Replacement Warranties: A Simple Comparison," July, 1990. (AEA Papers and Proceedings, Vol. 80, No. 2, May 1990.)

RP-142** D. J. Macunovich and R. A. Easterlin, "Application of Granger-Sims Causality Tests to Monthly Fertility Data, 1958-1984," August, 1990. (Journal of Population Economics, 1:71-88, 1988.)

RP-143** Richard H. Day, Kyoo-Hong Kim, and Diane Macunovich, "Complex Demoeconomic Dynamics," August, 1990. (Journal of Population Economics, 2:139-159, 1989.)

RP-144 Lori G. Kletzer, "Job Displacement, 1979-1986: How Have Black Workers Fared Relative to White Workers?" June, 1990.

RP-145 Jere R. Behrman, "Macroeconomic Policies and Rural Poverty: Issues and Research Strategies," September, 1990.

RP-146 Jere R. Behrman, "The Debt Crisis, Structural Adjustment and the Rural Poor," September, 1990.

RP-147 Jere R. Behrman, "Women's Schooling and Nonmarket Productivity: A Survey and a Reappraisal," September, 1990.

RP-148 Jere R. Behrman and Anil B. Deolaikar, "School Repetition, Dropouts and the Returns to School: The Case of Indonesia," October, 1990.

RP-149 Jere R. Behrman, "Nutrient Intake Demand Relations: Income, Prices, Schooling," September, 1990.

RP-150 Barbara L. Wolfe and Jere R. Behrman, "The Synthesis Economic Fertility Model: A Latent Variable Investigation of Some Critical Attributes," September, 1990.

RP-151 Jere R. Behrman and Anil B. Deolaikar, "Unobserved Household and Community Heterogeneity and the Labor Market Impact of Schooling: A Case Study for Indonesia," October, 1990.

RP-152 Jere R. Behrman and Anil B. Deolaikar, "The Poor and the Social Sectors During a Period of Macroeconomic Adjustment: Empirical Evidence for Jamaica," October, 1990.

RP-153 Jere R. Behrman and Santiago Levy, "The Drawbacks of Export Drawbacks," November, 1990.

RP-154 Jere R. Behrman, Robert A. Pollak, and Paul Taubman, "The Wealth Model: Efficiency in Education an Distribution in the Family," November, 1990.

RP-155 Diane J. Macunovich, "An Evaluation of the Butz-Ward Hypothesis of Countercyclical Fertility," November, 1990.

RP-156 Diane J. Macunovich, "An Evaluation of the Butz-Ward Hypothesis of Countercyclical Fertility: Technical Documentation," November, 1990.

RP-157 Roger Bolton, "'Place Prosperity vs. People Prosperity' Revisited: An Old Issue With a New Angle," May, 1991.

RP-158 Craufurd D. Goodwin, "Political Economy and Civil Society," Henry George Lecture, Williams College, May, 1991.

RP-159 Jere R. Behrman, "Gender Issues in Labor Markets and Household Behavior," May, 1991.

RP-160 Lori G. Kletzer, "Industrial Mobility Following Job Displacement: Evidence from the Displaced Worker Surveys," March, 1992.

RP-161 Lori G. Kletzer, "Industry Wage Differentials and Wait Unemployment: Evidence from the 1988 Displaced Worker Survey," March, 1992.

RP-162 Roger Bolton, "What Power on Earth? Arthur Latham Perry's Reaction to Henry George," June, 1993.

RP-163 William K. Jaeger, "The Welfare Cost of a Global Carbon Tax when Tax Revenues Are Recycled," May, 1993.

RP-164 Diane J. Macunovich, "A Review of Recent Developments In the Economics of Fertility," June, 1993.

RP-165 Diane J. Macunovich, "The Missing Factor: Variations in the Income Effect of the Female Wage on Fertility in the U.S.," June, 1993.

RP-166 Thomas C. Pinckney and Peter K. Kimuyu, "Land Tenure Reform in East Africa: Good, Bad, or Unimportant?" June, 1993.

RP-167 Lori G. Kletzer, "Sector-Specific Skills and the Returns to Seniority: Evidence from Reemployment Following Job Displacement," June, 1993.

RP-168 William K. Jaeger, "Is Sustainability Optimal?: Examining the Differences Between Economists and Environmentalists," November, 1993.

RP-169 Roger Bolton and Rodney C. Jensen, "Regional Science and Regional Practice," October, 1994.

RP-170 Ted Burczak, "Radical Subjectivism and Prediction," March, 1995.

RP-171 Roger E. Bolton, "Classroom Computer Simulation of the Alonso Model of the Household's Residential Location," January, 1996.

RP-172 Jill Constantine and David Neumark, "Training and the Growth in Wage Inequality," February, 1996.

** Reprint only available

Center for Development Economics
Department of Economics
Williams College
RESEARCH MEMORANDUM SERIES

A series of papers written by members of the Department of Economics on topics pertaining to the economics of less developed countries. A copy of any paper (and/or a reprint of the published version) will be mailed on request. See the order blank for further details.

1984-1996 Research Memorandum

RM-89 John Sheahan, "The Elusive Balance Between Stimulation and Constraint in Analysis of Development," July, 1984.

RM-90 Paul G. Clark, "The Policy Environment for Egyptian Industry," July, 1984.

RM-91 Brian Levy, "A Theory of Public Enterprise Behavior," September, 1984.

RM-92** Stephen R. Lewis, Jr., "The Impact of Shashe Project on Botswana's Economy" in C. Harvey, Ed., Papers on the Economy of Botswana, 1981.

RM-93* Stephen R. Lewis, Jr., Taxation for Development, Oxford University Press, 1984 (available only through the publisher).

RM-94 Gordon C. Winston, "The Utilization of Capital in Developing Countries: A Survey of Empirical Estimates," October, 1984.

RM-95** Brian Levy, "The Perils of Partnership: Dow in Korea," chapter 4 in Karl Moskowitz, ed., From Patron to Partner: The Development of U.S.-Korean Business and Trade Relations (Lexington: Lexington Books, 1984).

RM-96** S. R. Lewis, Jr. and D. N. Mokgethi, "Fiscal Policy in Botswana, 1966-82" in Botswana's Economy since Independence (New Delhi: Tata McGraw-Hill Publishing Co. Limited, 1983).

RM-97 John Sheahan, "Economic Policies and the Prospects for Successful Transition From Authoritarianism in Latin America", January, 1985.

RM-98 Morton Owen Schapiro, "Economic Development and Population Growth: Implications from a Model of U.S. Demographic History," January, 1985.

RM-99 J. Armitage and R. H. Sabot, "Efficiency and Equity Implications of Subsidies of Secondary Education in Kenya," January, 1985.

RM-100 Brian Levy, "The State-owned Enterprise as an Entrepreneurial Substitute in Developing Countries: The Case of Nitrogen Fertilizer," June, 1985.

RM-101 Lee J. Alston and Joseph P. Ferrie, "The Use of In-Kind Benefits in Agriculture: A Synthesis and Test," July, 1985.

RM-102 Amartya Sen, "Property and Hunger," August, 1985.

RM-103 Stephen R. Lewis, Jr., "Africa's Development and the World Economy," September, 1985.

RM-104 J.B. Knight and R.H. Sabot, "Educational Policy and Labor Productivity: An Output Accounting Exercise," October, 1985.

RM-105 Brian Levy, "The Determinants of Manufacturing Ownership in Less Developed Countries: A Comparative Analysis," November 1986.

RM-106 Brian Levy, "Foreign Aid in the Making of Economic Policy in Sri Lanka, 1977-1983," March, 1987.

RM-107 Stephen R. Lewis, Jr., "Economic Realities in Southern Africa: One Hundred Million Futures," in C. Bryant, ed., Poverty, Policy, and Food Security in Southern Africa (Boulder, CO: Lynne Rienner Publishers, 1988), pp. 39-92.

RM-108 A. Gelb, J. B. Knight and R. H. Sabot, "Lewis Through a Looking Glass: Public Sector Employment, Rent-Seeking and Economic Growth," January, 1988.

RM-109 Humberto Barreto and Robert Whitesell, "Estimation of Output Loss from Allocative Inefficiency: Comparison of the Soviet Union and the U.S.", April, 1988.

RM-110** Brian Levy, "Korean and Taiwanese Firms as International Competitors: The Challenges Ahead," September, 1988.

RM-111 Henry J. Bruton, "The United States and the Less Developed Countries in the 1990s", November, 1988.

RM-112 Brian Levy, "Transactions Costs, the Size of Firms and Industrial Policy: Lessons from A Comparative Case Study of the Footwear Industry in Korea and Taiwan," December, 1988.

RM-113 Robert S. Whitesell, "Why Does the Soviet Economy Appear to Be Allocatively Efficient?" December, 1988.

RM-114 Brian Levy, "Export Traders, Market Development, and Industrial Expansion," March, 1989.

RM-115 Brian Levy, "Industrial Interests and the Structure of Protection in Less Developed Countries: Some Evidence from Brazil," July, 1989.

RM-116 Henry J. Bruton, "Protection and Development," July, 1989.

RM-117 Thomas C. Pinckney, "The Multiple Effects of Procurement Price on Production and Procurement of Wheat in Pakistan," February, 1990.

RM-118 Catherine B. Hill, "Commodity Booms in Botswana and the Permanent Income Hypothesis," February, 1990.

RM-119 John Sheahan, "Reducing Poverty in Latin America: Markets, Democracy, and Social Change," March, 1990.

RM-120 David M. Kemme and Robert S. Whitesell, "Industrial Growth and Efficiency in Eastern Europe," April, 1990.

RM-121** Henry J. Bruton, "Import Substitution," July, 1990.

RM-122** John Wakeman-Linn, "International Insurance for Developing Country Debt: A Natural Successor to the Brady Plan?" July, 1990.

RM-123 William K. Jaeger, "The Causes and Extent of Africa's Food Crisis," December, 1990.

RM-124 Jere R. Behrman and Mathana Phananiramai, "Thai Morbidity Determinants by Age Groups and Conditional Projections to the Year 2010," (original December, 1990) Revised July, 1991.

RM-125 Catherine B. Hill, "A Precautionary Demand for Savings and Tests of the Permanent Income Hypothesis in Botswana," January, 1991.

RM-126 Henry Bruton and Catherine Hill, "The Development Impact of Counterpart Funds: A Review of the Literature," May, 1991.

RM-127 Jere R. Behrman and Ryan Schneider, "Bolivian Schooling Investments in an International Perspective: Where Does Bolivia Fit?" May, 1991.

RM-128 Jere Behrman, Nancy Birdsall and Anil Deolaikar, "Marriage Markets, Labor Markets and Unobserved Human Capital: An Empirical Exploration for South-Central India," May, 1991.

RM-129 Jere R. Behrman, "Investing in Female Education for Development: Women in Development Strategy for the 1990's in Asia and the Near East," May, 1991.

RM-130 Jere R. Behrman and Ryan Schneider, "Thai Schooling Investments in an International Perspective," May, 1991.

RM-131 Jere R. Behrman and Robert Moffitt, "Framework for Analysis of Female Paid Labor Supply in Islamic Emena Countries," May, 1991.

RM-132 Jere R. Behrman and Chalongphob Sussangkarn, "Do The More Wealthy Save Less?" June, 1991.

RM-133 Jere R. Behrman, "Human Capital: An International Perspective on Bolivian Performance and Policy Options," July, 1991.

RM-134 Jere R. Behrman and Ryan Schneider, "Where Does Brazil Fit? Brazilian Schooling Investments in an International Perspective," July, 1991.

RM-135 John Sheahan, "Peru's Return Toward an Open Economy: Macroeconomic Complications and Structural Questions," June, 1993.

RM-136 Henry J. Bruton, "Asian Lessons for African Development," October, 1993.

RM-137 Sandeep H. Patel, Thomas C. Pinckney and William K. Jaeger, "Smallholder Wood Production and Population Pressures in East Africa: Evidence of an Environmental Kuznets Curve?" December, 1993.

RM-138 Nguyuru H.I. Lipumba, "Structural Adjustment Policies and Economic Performance of African Countries," October, 1994.

RM-139 Henry J. Bruton, "Total Factor Productivity Growth," February, 1995.

RM-140 Jere R. Behrman, David Ross, Richard Sabot, Matthew Tropp, "Improving The Quality Versus Increasing the Quantity of Schooling," May, 1994.

RM-141 Harold Alderman, Jere R. Behrman, David R. Ross, and Richard Sabot, "The Returns to Endogenous Human Capital in Pakistan's Rural Wage Labor Market," November, 1994.

RM-142 Nancy Birdsall, David Ross, and Richard Sabot, "Inequality and Growth Reconsidered," February 1995.

RM-143 Vijayendra Rao, "Wife-beating in a Rural South Indian Community: An Statistical and Ethnographic Case-Study of Its Causes and Its Effect on Caloric Allocations to Children," March, 1995.

RM-144 William K. Jaeger, "Developing Countries and the Net Welfare Cost of a Global Carbon Tax," March, 1995.

RM-145 Harold Aldermen, Jere R. Behrman, Shahrukh Khan, David R. Ross, and Richard Sabot, "Public Schooling Expenditures in Rural Pakistan: Efficiently Tarketing Girls and a Lagging Region," April, 1995.

RM-146 Young-Bum Park, David R. Ross, and Richard Sabot, "Educational Expansion and the Inequality of Pay in Brazil and Korea," April, 1995.

RM-147 Jere R. Behrman, Shahrukh Khan, David R. Ross, and Richard Sabot, "Low Schooling and Large Schooling Gender Gaps in Pakistan: Market Failure? Policy Failure?" April, 1995.

RM-148 Nancy Birdsall, Thomas C. Pinckney, and Richard Sabot, "Inequality, Savings and Growth," November, 1995.

RM-149 Francis Bloch and Vijayendra Rao, "Domestic Violence as a Bargaining Instrument in Rural India," November, 1995.

RM-150 John Sheahan, "Effects of Adjustment Programs on Poverty and on Autonomy: Chile, Mexico, and Peru," January, 1996.

RM-151 Ralph Bradburd, "Zimbabwe's New Entrepreneurs: An Emerging Success Story," February, 1996.

RM-152 Ralph Bradburd, "Regulatory Rigidity: Causes, Consequences and Implications For Public Policy in Developing Countries, February, 1996.

RM-153 Vijayendra Rao and Margaret E. Greene, "Bargaining and Fertility in Brazil: A Qualitative and Econometric Analysis," February, 1996.

** Reprint only available

Research Series
Department of Economics
Fernald House
Williams College
Williamstown, Massachusetts 01267

ORDER BLANK
FOR RESEARCH MEMORANDA AND RESEARCH PAPERS

Please send the indicated number of copies of each paper.

RM-63__	RM-90__	RM-116__	RP-02__	RP-30__	RP-56__	RP-82__	RP-108__	RP-134__	RP-160__
RM-65__	RM-91__	RM-117__	RP-05__	RP-31__	RP-57__	RP-83__	RP-109__	RP-135__	RP-161__
RM-66__	RM-92__	RM-118__	RP-06__	RP-32__	RP-58__	RP-84__	RP-110__	RP-136__	RP-162__
RM-67__	RM-93__	RM-119__	RP-07__	RP-33__	RP-59__	RP-85__	RP-111__	RP-137__	RP-163__
RM-68__	RM-94__	RM-120__	RP-08__	RP-34__	RP-60__	RP-86__	RP-112__	RP-138__	RP-164__
RM-69__	RM-95__	RM-121__	RP-09__	RP-35__	RP-61__	RP-87__	RP-113__	RP-139__	RP-165__
RM-70__	RM-96__	RM-122__	RP-10__	RP-36__	RP-62__	RP-88__	RP-114__	RP-140__	RP-166__
RM-71__	RM-97__	RM-123__	RP-11__	RP-37__	RP-63__	RP-89__	RP-115__	RP-141__	RP-167__
RM-72__	RM-98__	RM-124__	RP-12__	RP-38__	RP-64__	RP-90__	RP-116__	RP-142__	RP-168__
RM-73__	RM-99__	RM-125__	RP-13__	RP-39__	RP-65__	RP-91__	RP-117__	RP-143__	RP-169__
RM-74__	RM-100	RM-126__	RP-14__	RP-40__	RP-66__	RP-92__	RP-118__	RP-144__	RP-170__
RM-75__	RM-101__	RM-127__	RP-15__	RP-41__	RP-67__	RP-93__	RP-119__	RP-145__	RP-171__
RM-76__	RM-102__	RM-128__	RP-16__	RP-42__	RP-68__	RP-94__	RP-120__	RP-146__	RP-172__
RM-77__	RM-103__	RM-129__	RP-17__	RP-43__	RP-69__	RP-95__	RP-121__	RP-147__	
RM-78__	RM-104__	RM-130__	RP-18__	RP-44__	RP-70__	RP-96__	RP-122__	RP-148__	
RM-79__	RM-105__	RM-131__	RP-19__	RP-45__	RP-71__	RP-97__	RP-123__	RP-149__	
RM-80__	RM-106__	RM-132__	RP-20__	RP-46__	RP-72__	RP-98__	RP-124__	RP-150__	
RM-81__	RM-107__	RM-133__	RP-21__	RP-47__	RP-73__	RP-99__	RP-125__	RP-151__	
RM-82__	RM-108__	RM-134__	RP-22__	RP-48__	RP-74__	RP-100_	RP-126__	RP-152__	
RM-83__	RM-109__	RM-135__	RP-23__	RP-49__	RP-75__	RP-101_	RP-127__	RP-153__	
RM-84__	RM-110__	RM-136__	RP-24__	RP-50__	RP-76__	RP-102_	RP-128__	RP-154__	
RM-85__	RM-111__	RM-137__	RP-25__	RP-51__	RP-77__	RP-103_	RP-129__	RP-155__	
RM-86__	RM-112__	RM-138__	RP-26__	RP-52__	RP-78__	RP-104_	RP-130__	RP-156__	
RM-87__	RM-113__	RM-139__	RP-27__	RP-53__	RP-79__	RP-105_	RP-131__	RP-157__	
RM-88__	RM-114__	RM-140__	RP-28__	RP-54__	RP-80__	RP-106_	RP-132__	RP-158__	
RM-89__	RM-115__	RM-141__	RP-29__	RP-55__	RP-81__	RP-107_	RP-133__	RP-159__	

RM-142__	RM-148__
RM-143__	RM-149__
RM-144__	RM-150__
RM-145__	RM-151__
RM-146__	RM-152__
RM-147__	RM-153__

My correct mailing address is:

MAIL THIS COMPLETED ORDER BLANK TO THE ADDRESS IN THE TOP LEFT CORNER.

* Please Note: There is a 10 paper limit with only one copy of each paper.