# THE EFFECTS OF HIGH SCHOOL CURRICULUM ON AGE-EARNINGS PROFILES

John T. Grasso and John R. Shea*
Center for Human Resource Research, The Ohio State University

## 1. INTRODUCTION

Much of the support for vocational education evident in recent years stems from its alleged economic advantages for the individual (10). Within a multivariate framework this paper examines the relationship between high school curriculum and one important indicator of labor market success, hourly rate of pay subsequent to graduation. This evaluation, of course, is partial. A complete assessment of "curriculum effects" would take account of other performance criteria such as the dropout rate, the probability of attending college, job satisfaction, and the like.

Two important empirical issues are addressed in this paper. One concerns the shape of age-earnings profiles associated with different curricula. Some studies have shown an initial wage or earnings advantage for vocational graduates vis-a-vis graduates from either the general or academic track (2, 3, 7, 8), while other studies have not. At least two studies reveal a narrowing of an initial vocational wage (or earnings) advantage over time (3, 7, 8), while another well-known study suggests a widening gap (1). A second, related issue is how to treat post-secondary training. The shape of estimated age-earnings profiles can be distorted by research strategies which "control for" differences in post-secondary training by excluding high school graduates who have had such training. As this paper will demonstrate, such an approach ignores important interactions between curriculum and subsequent training. Taussig suggests that "vo ed" graduates may be at a disadvantage in regard to access to subsequent training programs (14). The work of Schriver and Bowlby indicates that post-secondary training in Tennessee Area Vocational-Technical Schools is complementary with subsequent training that paid off (12). The "widening gap" that Carroll and Ihnen found was based on a comparison of graduates of a post-secondary, two-year technical institute with high school graduates who had no additional training (1). The work of Horowitz and Herrnstadt indicates that for at least one important craft occupation (tool and die making), a vocational high school experience combined with apprenticeship leads to better performance ratings than any other path (6).

In the next section of this paper we identify the data base used in the analysis and specify the models that were tested. Results are presented and discussed in Section 3. This is followed in Section 4 by a short summary and conclusions.

## 2. DATA, MODELS, AND VARIABLES

This paper utilizes data derived from personal interviews with a national probability sample of young men who were part of the civilian, noninstitutional population 14 to 24 years of age when first interviewed as part of the National Longitudinal Surveys in October 1966. Supplementary information from school records, including scores on tests of mental ability, was obtained by the Census Bureau from a mailed questionnaire in 1968.[1] As long as each respondent remained in the civilian, noninstitutional population, an attempt was made to interview him every October through 1971. In October 1969--the most recent survey for which information is available--1,192 of the original 5,225 respondents were not interviewed, an attrition rate of 22 percent for the whites and 27 percent for the blacks.[2] By design, Negro and other races were overrepresented in the original sample by a three-to-one ratio relative to whites. This was done to permit a reasonably confident analysis of the black experience. For this reason, and because we have used unweighted sample cases in this paper, results are presented separately for whites and blacks. (Non-Caucasians, other than blacks, have been excluded from the analysis.) This paper, then, uses information from personal interviews conducted in the fall of 1966, 1967, 1968, and 1969, and from the school survey. For each year, our attention is restricted to respondents who (1) had completed 12 (but no additional) years of "regular" schooling by that time, (2) were not enrolled in school, and (3) were employed for wages or salaries.

We examine hourly rates of pay within the context of multiple linear regression analysis, using a method described by Gujarati to test for differences in relationships among several groups (4). We employ a general wage model with the following dummy variables: REGION (SOUTH = 1, otherwise = 0), SMSA (lives in SMSA = 1, otherwise = 0), HLTH (respondent reports his health limits the kind or amount of his work = 1, otherwise = 0), and MILEXP (has had military experience = 1, otherwise = 0). SES is an index of socioeconomic status of the respondent's family of orientation, consisting of the average of at least three of five normalized and equally weighted components: father's education, mother's education, oldest older sibling's education, Duncan index of father's occupation when the respondent was age 14, and a measure of the presence of reading material in the home at that time. Respondents for whom three of the five components were not available have been excluded from the analysis. IQ is a normalized measure of mental ability obtained in the survey of the high school.[3] TRNG consists of the actual number of months the respondent participated in post-school non-degree programs of various kinds; examples are apprenticeship and military programs. YRS is our proxy for length of potential work experience and equals the respondent's age less 17.

Testing the effects of curriculum within this framework requires the construction of several more variables. We have focused on "interaction effects" involving high school curriculum. A set of K dummy terms that identify our groups was constructed (VOC = 1 for graduates of the vocational curriculum; COLL = 1 for college preparatory; and GEN = 1 for general). One of these, GENERAL, was omitted from the equation and serves as the reference group. The set of (K-1) dummies was multiplied by each of the P variables selected for testing.[4] The (K-1) time P new variables were added to the model, and those which were found to be statistically significant (e.g., $X_i * D_j$) can be interpreted to imply that the relationship between the dependent variable Y and the independent variable $X_i$ is different for group j than for the reference group. (Variables for which no new terms were added are assumed to operate similarly for all groups.)

We have tested for three kinds of potential differences in rate of pay: in starting wage rates, in the pattern of wage rate changes over time, and in the effects of post-secondary training. Our P variables are the intercept (i.e., age 17 when YRS = 0), the YRS variable, and TRNG, respectively. Thus we add six new variables, which are, respectively, VOC, COLL, YRS*VOC, YRS*COLL, TRNG*VOC, and TRNG*COLL. This gives us the following General Cross-Sectional Model:

$$\begin{aligned} WAGE_t = {} & b_1\ REGION_t + b_2\ SMSA_t + b_3\ HLTH_t + b_4\ SES \\ & + b_5\ IQ + b_6\ MILEXP_t + (b_7\ YRS_t + b_7'\ YRS_t{*}VOC \\ & + b_7''\ YRS_t{*}COLL) + (b_8\ TRNG_t + b_8'\ TRNG_t{*}VOC \\ & + b_8''\ TRNG_t{*}COLL) + (b_0 + b_0'\ VOC + b_0''\ COLL) + e, \\ & \text{where } t = 1969. \end{aligned}$$

The results generated sufficient interest to prompt the construction of a variation of the general cross-sectional model. In this modified version, the variable $TRNG_t$, defined as total cumulative months of training received, was replaced by the seven type-specific components from which it was constructed: Business College or Technical Institute (B), Company (C), Apprenticeship (A), Correspondence School (CS), Military (M), non-degree Regular School (R), and Other (O); and $TRNG_t$*VOC and $TRNG_t$*COLL were replaced with their respective counterparts. We have called the result our Training-Specific Cross-Sectional Model.

While cross-sectional estimates illuminate the probable relationships of our variables with rate of pay, these estimates are not completely satisfactory. We can also estimate the influence of high school curriculum on initial wages and on changes in wages over time by examining, first, the wage rates of 17 and 18 year-olds separately and, second, the change in wage rates between 1966 and 1969. These tests permit a validation of the findings in the General Cross-Sectional Model. Our Initial Wage Model, restricted to 17 and 18 year-olds, includes $REGION_t$, $SMSA_t$, $HLTH_t$, SES, IQ, the curriculum dummies and an error term. The Wage Change Model, applicable to respondents out-of-school all four years, takes the following form:

$$\begin{aligned} \Delta\ WAGE_{1966-1969} = {} & b_1\ SES + b_2\ IQ + b_3\ TRNG_{1966} \\ & + b_4\ TRNG_{1966-1969} + b_5\ YRS_{1966} + (b_0 \\ & + b_6\ VOC + b_7\ COLL) + e. \end{aligned}$$

## 3. RESULTS

Table 1 presents the results based on the General Cross-Sectional Model. Among the variables for which we did not test for differences by curriculum, REGION is significant for both races and SMSA, IQ, and MILEXP are also significant for whites. Coefficients of HLTH and SES, although not statistically significant, display the expected sign.

Among the variables that we tested for differences by curriculum, few significant differentials were found. As indicated by the VOC and COLL variables, there is no gap at the intercept. As for post-secondary training, TRNG is significant for all blacks, while for whites it is significant for vocational graduates only. In fact, training beyond high school is associated with more than two cents per hour for every month of training received. Finally, regarding the YRS variable, each year beyond school is associated with an increase of 17 cents per hour for the reference group of whites, and although it is not significantly different for the other groups, the negative coefficient for vocationals is noteworthy. Among the blacks, the age-wage profile is much flatter and clearly no different by curriculum.[5]

The Training-Specific Cross-Sectional Model provides results almost identical to the General Cross-Sectional Model on the nontraining variables; therefore, only the regression coefficients and t-values for the training variables are presented in Table 2. For the whites, apprenticeship training yields handsome returns for all respondents and perhaps more so for vocational and college preparatory graduates than general. Business college or technical institute (B) and company programs (C) appear to pay off for vocationals, and correspondence school (CS) yields a return for those from the academic track. On the other hand, training in the military (M) adds nothing to the wages of vocationals and general graduates and is negative for the college group. For the blacks, however, this latter relationship is reversed; $TRNG_t$M is positive and significant for all graduates and even higher for vocationals and academics than for graduates of the general curriculum.

These findings support the results of the General Cross-Sectional Model. White vocational graduates who followed their graduation with additional training in business schools or technical institutes, in company programs, in apprenticeships, etc., experienced increases in rate of pay. Indeed, every training coefficient for white vocational graduates is positive, while in the absence of training, the vocational group's experience was less bright, certainly no better than the general curriculum group, and appears to have worsened over time. For the blacks, the absence of significant relationships may be due to (1) a lower rate of participation in training and shorter average length of training (except within the military category); (2) small sample sizes; (3) our inability within the context of the larger model to identify significant variables for explaining black wage rates; or (4) the lack of market alternatives equivalent to those of whites.

In an effort to test directly for a differential intercept (wage rate in October subsequent to graduation), our Initial Wage Model was fit to the data provided by 17 and 18 year-olds for each year from 1966 through 1969. While the number of sample cases is small (approximately 100 whites and 30 blacks each year), there is no evidence that having graduated from the VOC or COLL curricula had any influence, ceteris paribus, on the rate of pay reported by young high school graduates in the four years. None of the coefficients for the VOC or COLL dummies is statistically significant, and the signs are not consistent across the years.[6]

One of the values of longitudinal data can be to illuminate the determinants of change: in this case, change in hourly rate of pay. In our Wage Change Model, $\Delta WAGE_{1966-1969}$ is the dependent variable. Although results are not shown here,[7] the coefficient of $YRS_{1966}$, the amount of work experience as of the base year, is negative (reflecting the flattening out of earnings profiles with advancing age). SES, IQ, $TRNG_{1966}$, and $TRNG_{1966-1969}$ are positive, although not all are statistically significant. No differential by curriculum in wage rate change over time is supported.

Since training is an important correlate of rate of pay and interacts with curriculum, a few words should be said about the nature and magnitude of training received. Young white men reported more training than their black counterparts; three-fifths of the former but less than half of the latter had some training since leaving high school. Among those with training, the average duration was much longer for whites than blacks: about 15 months for the former and 9 months for the latter. There are, however, very few differences between curriculum groups in the pattern of training received. Somewhat to our surprise, for example, approximately one-twelfth of each of the three groups in our sample participated in apprenticeship programs, albeit the average duration was longer for VOC than for other graduates. However, since our sample excludes those with one or more years of college, two or three times as many vocational graduates entered apprenticeships as college preparatory graduates.[8]

## 4. SUMMARY AND CONCLUSIONS

In our judgment, the data do not fit a compelling theoretical framework, be it human capital theory or learning theory. Nor do our findings provide unambiguous answers for the formulation of educational policy. Before interpreting our principal findings, several caveats are in order. First, our evaluation of high school vocational programs has been limited to a single criterion: hourly rate of pay. We have ignored possible differences by curriculum in attitudes toward work, dropout prevention, and so forth. Second, observed wage rates may be a poor reflection of differences in productivity. Third, we have relied on respondents' self-reporting of high school program; and the vocational track includes such diverse areas as metalworking, woodworking, electrical, mechanical, and other fields. Finally, we have ignored potential differences in students that existed prior to choice of curriculum--differences in motivation, commitment to work, and the like.

In view of our failure to find a statistically significant difference in starting wages for any curriculum group, for either whites or blacks, it appears that the vocational high school curriculum per se does not provide skills which lead to immediate market advantages. With respect to change in hourly wage rates over time, the vocational and academic groups are again not significantly different from the general curriculum group. If anything, among whites, the vocational graduates advanced less rapidly over time.

The lower age-wage profiles of white vocational graduates may prompt a conclusion that vocational programs provide less-than-adequate attention to developing general learning abilities and to providing a solid base from which subsequent work experience can build. However, we cannot believe that vocational programs per se impart uniformly better or worse general skills for work, in light of the fact that vocationals appear to gain most from post-secondary training, even though they gain least from experience.

Given the pattern of post-secondary training, high school vocational programs appear to be essentially pre-vocational and must be followed with further, more specific training after graduation for maximum benefit. Although the results indicate that nonvocational graduates may have benefited from selective training experiences, the vocationals who received training beyond high school appear to have gained the most. Although black men participated in training programs less frequently than white (and for shorter durations even when they did), post-school training for blacks--including that taken in the military--was a profitable course of action regardless of curriculum.

We suggest that the key to interpretation of our findings (e.g., that vocationals profit most from training but least from experience) may lie in the structure of jobs and labor markets toward which at least some vocational students are prepared. In some cases, vocational programs may fulfill an important social function by imparting skills and knowledge which would not be provided elsewhere in their absence, particularly in industries composed of many small firms that cannot undertake training efficiently. It may be an advantage for society to provide some vocational programs in schools, so that workers in these industries earn starting wages which are no less than for other workers. Other vocational programs may sometimes permit entry to superior training programs. Yet, students from other curricula enter apprenticeships, and both vocational and nonvocational graduates reap benefits. There also may be a relatively limited number of high-wage, blue-collar jobs, which some graduates with vocational skills obtain, while the remainder choose jobs from poorer alternatives. Finally, union dominance of entry to some sectors of the economy, market, and technological factors--some or all may promote a market structure consistent with the empirical findings presented here. Needless to say, the results of our work thus far have been sufficiently intriguing that we expect to continue our inquiry into the linkages between curriculum in the schools and later labor market success.

## FOOTNOTES

*This paper is based on data from The National Longitudinal Surveys, a project sponsored by the Manpower Administration of the U.S. Department of Labor under the authority of the Manpower Development and Training Act. The work is carried out in collaboration with the U.S. Bureau of the Census. Since researchers are encouraged to use their own judgments freely, this paper does not necessarily represent the official position or policy of the Department of Labor. The authors would like to thank Andrew I. Kohen, Herbert S. Parnes, and several other colleagues for helpful comments on an earlier draft of the paper. Responsibility for interpretations and conclusions, of course, rests with the authors.

[1]Results from various kinds of tests--intelligence, achievement, scholastic aptitude, etc.--were standardized and pooled. While somewhat imprecise, we use the terms "mental ability" and "IQ" in referring to these measures, which are described in (9).

[2]Approximately three-fifths of the losses were due to induction into military service. Efforts are made to reestablish contact with these young men as they return to civilian life.

[3]Both measures, SES and IQ, are more fully described in (9), Appendixes A and B. Respondents for whom an IQ score was not available have been excluded from the analysis.

[4]If the intercept term is one of the P variables, the new terms are simply the dummies themselves.

[5]In order to examine the implications of restricting wage comparisons to graduates with no post-secondary training whatsoever, the General Cross-Sectional Model was rerun excluding any respondent with training or military experience. The results are similar to those discussed here. Repeated cross-sectional tests of the basic model using data from the 1966, 1967, and 1968 surveys reveal about the same pattern as the more complete and more recent (1969) data. Results are available from the authors.

[6]The detailed results may be obtained by writing to the authors.

[7]Once again, the results may be obtained from the authors.

[8]If the base were expanded to include all high school graduates, whether or not they attended college, a somewhat different picture would emerge. Data not shown here suggest that about two-thirds of the college preparatory graduates went on to college, 25 to 35 percent of the generals, and 10 to 20 percent of the vocationals. Thus, on a relative basis, two or three times as many vocational graduates entered apprenticeship as college preparatory graduates.

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Table 1 Hourly Rate of Pay (Cents per Hour), 1969: Means, Standard Deviations, and Estimated Regression Coefficients for General Cross-Sectional Model

| Variables and statistics | WHITES | | | | BLACKS | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | S.D. | b | t value | Mean | S.D. | b | t value |
| $REGION_t$ (1=South) | .26 | .44 | -36.4 *** | -3.53 | .54 | .50 | -75.9 *** | -5.30 |
| $SMSA_t$ (1=Yes) | .69 | .46 | 35.4 *** | 3.66 | .80 | .40 | 8.13 | .43 |
| $HLTH_t$ (1=Limits) | .09 | .28 | -22.5 | -1.50 | .08 | .28 | -33.7 | -1.31 |
| SES (Index; $\bar{X}$=10; S.D.=1.7) | 10.6 | 1.8 | 1.03 | .41 | 9.0 | 1.8 | 4.34 | 1.00 |
| IQ ($\bar{X}$=100; S.D.=16) | 99.6 | 11.7 | 1.46*** | 3.74 | 85.8 | 14.4 | .72 | 1.39 |
| $MILEXP_t$ (1=Yes) | .27 | .44 | -23.0 ** | -2.18 | .18 | .39 | - 8.56 | - .39 |
| $YRS_t$ (from age 17) | 5.0 | 3.3 | 15.7 *** | 8.25 | 4.4 | 3.1 | 3.89 | 1.27 |
| $YRS_t$*VOC[a] | - | - | - 5.92 | -1.56 | - | - | - 1.67 | - .29 |
| $YRS_t$*COLL[a] | - | - | - 1.14 | - .31 | - | - | 1.18 | .17 |
| $TRNG_t$ (months) | 9.2 | 15.1 | .48 | 1.11 | 3.6 | 7.6 | 2.28** | 2.03 |
| $TRNG_t$*VOC[a] | - | - | 2.32*** | 3.14 | - | - | 3.46 | 1.23 |
| $TRNG_t$*COLL[a] | - | - | .91 | 1.17 | - | - | - 3.46 | - .61 |
| Constant term (at age 17) | - | - | 73.5 | 1.54 | - | - | 173.2*** | 3.21 |
| VOC[a] | .21 | .41 | 2.64 | .13 | .19 | .40 | -15.0 | - .52 |
| COLL[a] | .19 | .39 | -22.2 | -1.13 | .12 | .32 | 24.8 | .62 |
| $WAGE_t$ | 316 | 116 | - | - | 261 | 90 | - | - |
| # of observations | 532 | | | | 130 | | | |
| $\bar{R}^2$ | .29 | | | | .29 | | | |
| F | 16.69*** | | | | 4.75*** | | | |

a The omitted category is GEN, the group of graduates from the general curriculum.
** Significant at .05 level.
*** Significant at .01 level.

Table 2 Hourly Rate of Pay (Cents per Hour), 1969: Estimated Regression Coefficients for Training Variables in Training-Specific Cross-Sectional Model

| Variables and statistics | WHITES | | BLACKS | |
|---|---|---|---|---|
| | b | t value | b | t value |
| - - | - - | - | - - | - |
| TRNG$_t$B | - 1.55* | -1.92 | - 1.85 | - .41 |
| TRNG$_t$B*VOC | 3.39** | 2.09 | .64 | .04 |
| TRNG$_t$B*COLL | .42 | .21 | 2.14 | .27 |
| TRNG$_t$C | - 1.85 | -1.42 | 2.97 | .97 |
| TRNG$_t$C*VOC | 6.40*** | 2.81 | 6.01 | .59 |
| TRNG$_t$C*COLL | 3.00 | 1.25 | - 9.61 | - .88 |
| TRNG$_t$A | 1.95** | 2.31 | 3.44 | 1.04 |
| TRNG$_t$A*VOC | 1.95 | 1.51 | .30 | .06 |
| TRNG$_t$A*COLL | 2.27 | 1.57 | (No respondents) | |
| TRNG$_t$CS | - .71 | - .40 | (No respondents) | |
| TRNG$_t$CS*VOC | 2.86 | .63 | (No respondents) | |
| TRNG$_t$CS*COLL | 10.12*** | 3.18 | (No respondents) | |
| TRNG$_t$M | .87 | .64 | 2.83** | 2.02 |
| TRNG$_t$M*VOC | - .30 | - .18 | 10.36 | 1.14 |
| TRNG$_t$M*COLL | - 3.61* | -1.81 | 34.86 | 1.49 |
| TRNG$_t$R | 5.81 | 1.41 | 10.71 | .80 |
| TRNG$_t$R*VOC | - 5.14 | -1.00 | (No respondents) | |
| TRNG$_t$R*COLL | - 5.22 | - .76 | - 5.37 | - .25 |
| TRNG$_t$O | 5.81*** | 2.61 | - 1.14 | - .27 |
| TRNG$_t$O*VOC | - 1.78 | - .43 | 15.49* | 1.67 |
| TRNG$_t$O*COLL | -11.77* | -1.89 | 62.98** | 1.96 |
| # of observations | 532 | | 130 | |
| $\bar{R}^2$ | .35 | | .24 | |
| F | 9.84*** | | 2.30*** | |

* Significant at .10 level.
** Significant at .05 level.
*** Significant at .01 level.