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ABSTRACT

An analysis assessed the effects of a high school vocational curriculum over time as labor market experience accumulates. Since two additional years of labor market experience had become available for respondents to the National Longitudinal Survey of Labor Market Experience-Youth Cohort (NLS-Youth) and longer trends of effects could be observed, the study replicated the exact specifications of an earlier analysis and added the dimension of expected lifetime earnings. Data were from the NLS-Youth and High School and Beyond databases. Findings indicated that vocational education provided, in the short term, a direct wage advantage for vocational students. The advantage became indirect as time in the labor market accrued and appeared to operate through increased hours of work and fuller employment rather than differential wage rates. An optimum mix between vocational and academic courses in terms of lifetime earnings was characterized by moderate rather than heavy concentration in vocational education. An alternative theoretical model of the net societal effects of the vocational curriculum was evaluated. It did not appear to be adequate for evaluating the effects of vocational education because several of its key assumptions did not hold when tested by the available data. The analysis associated with this model testing suggested, however, that the pronounced effects of training-related placement operate not through training, but through assisting the vocational graduate in selecting a better-paying job. (YLB)

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DYNAMICS OF VOCATIONAL EDUCATION EFFECTS ON LABOR MARKET OUTCOMES

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FOREWORD

Several empirical studies suggest that wage differentials between vocational and nonvocational students change as years out of high school increase, demonstrating the importance of observing earnings profiles over time. This study expands the literature on the labor market effects of secondary vocational education by examining earnings at more than one point in time.

The study is presented in three parts: 1) a discussion of the background literature and theory (chapter 1), 2) an empirical investigation (chapters 2 and 3), and 3) an explicated theory of the market effects of vocational education (chapter 4). The NLS-Youth survey, 1979-1985, was the primary source of data for this analysis. Seven years of survey results currently provide the best opportunity to observe the labor market and educational behavior of a nationally representative sample of young adults. The High School and Beyond survey, 1980-1984, was used for the multivariate analyses presented in chapter 4.

This research was guided, in part, by a convening of scholars in July of 1987 at the National Center for Research in Vocational Education. These researchers have, individually and collectively, devoted considerable time and attention to the problem of assessing longterm effects of vocational education. They were Alan Gustman, Robert Meyer, George Farkas, and Ernst Stromsdorfer. Significant contributions to the discussion were also made by National Center staff, Lawrence Hotchkiss, N.L. McCaslin and Kevin Hollenbeck. Chapter 4 of this report, written by George Farkas, Lawrence Hotchkiss, and Ernst Stromsdorfer, advances the labor market theory discussed at the July convening.

The intended audience for this report includes policymakers, educators, and counselors. The executive summary and chapter 3 provide a concise description of findings with discussion and recommendations for policy.

This study was conducted in the Evaluation and Policy Division under the direction of N.L. McCaslin, Associate Director. Paul B. Campbell, Senior Research Specialist, served as project director. We wish to thank Jack Elliot, Graduate Research Associate, Suzanne Laughlin, Program Assistant, and Ellen Seusy, Program Associate, for their work in preparing this report. These researchers were the authors of the first three chapters of this report. In addition, we wish to thank computer programmers

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Ray Ryan
Executive Director
The National Center for Research
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EXECUTIVE SUMMARY

Vocational education involves millions of high school students at various levels of course taking, and corresponding allocations of educational resources. Recent work with national longitudinal databases has begun to provide a reasonably comprehensive picture of the outcomes of high school vocational education. Continued monitoring of its effects in the labor market is appropriate, however, because policy changes need to be based on the best evidence that can be obtained. The recent, more comprehensive work has been possible because rich descriptions of educational attainment, including high school transcripts, is available in the two most recent databases (NLS-Youth and High School and Beyond). This work has been criticized, however, for two reasons. First, the respondents in the databases are relatively young and are just beginning their working careers. There is reason to believe that the associations between work and high school vocational training will change as the worker accumulates experience in the labor market. Also, the traditional analytic models for the effects of schooling have been challenged and alternative models have been proposed.

This study was designed to address, in part, these two criticisms. First, two additional years of labor market experience had become available for the NLS-Youth respondents, and longer trends of effects could be observed. The study therefore replicated the exact specifications of an analysis done two years earlier, and added the dimension of expected lifetime earnings, estimated from census data. Second, an alternative theoretical model was evaluated, based on the total effects of vocational education for participants and nonparticipants.

The results are informative and suggest implications for policy. Vocational education provides, in the short term, a direct wage advantage for vocational students compared with those without such education for young people in jobs related to their training. This advantage becomes indirect as time in the labor market accrues. It appears to operate through increased hours of work and fuller employment rather than differential wage rates.

When discounted lifetime earnings are considered, some even more interesting results can be observed. There appears to be an optimum mix between vocational and academic courses in terms of lifetime earnings. It is characterized by moderate rather than heavy concentration in vocational education. Academic courses taken to the exclusion of vocational courses have a <u>negative</u> association with discounted lifetime earnings when postsecondary attendance is controlled. Also, we find a neutral effect of strong concentration in vocational courses but a positive effect of moderate concentration. Thus, a mix of courses rather than exclusive concentration in academic or vocational courses appears preferable.

The alternative model that was tested did not appear to be adequate for evaluating the effects of vocational education. This was true because several of its key assumptions did not hold when tested by the available data. The analyses associated with this model testing did, however, suggest that the pronounced effects of training-related placement operate not through training, but through assisting the vocational graduate to select a better-paying job.

These findings suggest several points for policy consideration. First, if the assumption is correct that higher lifetime earnings reflect higher productivity that in turn offsets any added costs of vocational education, then there is a net societal advantage in continuing an investment in high school vocational education. Second, the current thrust toward increased graduation requirements that may exclude vocational course work, even at a moderate level, is likely to produce a net disadvantage for society. Third, the importance of job placement suggests strongly that the schools should be committed to helping students secure appropriate placement for those who participate in vocational programs. Finally, although the alternative model for analysis was not supported by the evidence contained in this report, the search for alternative explanations of the observed learning and labor market experiences should continue, because the criticisms of current analytic techniques remain unanswered.

CHAPTER 1

THE STUDY BACKGROUND

Problem

An accumulation of substantial empirical research on the earnings and employment outcomes of secondary vocational education exists (See Campbell et al. [1986] for a recent review and Mertens et al. [1980] for a comprehensive review of earlier research). Without exception, this work has focused on the economic returns that accrue, in the first few years following high school, to individuals who take vocational courses in high school. The early research on the economic benefits of vocational education concluded that the benefits were generally small. Women who pursued business and office courses were found to reap the most benefits, and men who studied trade and industry also tended to achieve some economic advantage (Grasso and Shea 1979; Woods and Haney 1981; Meyer and Wise 1982; Meyer 1982).

Most of the early research was based on student self-report of the vocational track and omitted any consideration of the training relatedness of the job that a youth obtained following high school.[1] More recent studies have used a conceptually sophisticated schema based on high school transcripts to define vocational study in high school. Campbell et al. (1985, 1986) find strong effects of vocational training on labor market outcomes after high school, provided that one's job is "training related."

Accumulated research to date represents an excellent foundation for continued investigation of a deceptively simple matter--the question of identifying the economic outcomes of secondary vocational education. There are three extensions of past work that deserve immediate attention. First, none of the studies assess economic benefits for more than a few years following high school. Yet, human capital theory is framed within the context of lifetime discounted earnings. It is well known that age-earnings curves vary dramatically by years of schooling and occupation and that earnings differentials are highly compressed at young ages. Two considerations suggest the importance of the economic effects of vocational education over as long a period as is feasible with available data. First, at least some theory suggests that initial wage advantages of vocational training dissipate over time. Meyer (1982) and Gustman and Steinmeier (1982a) argue that vocational education in high school is a (partial) substitute for on-the-job training after leaving high school. Since human capital theory indicates that employees help to pay for on-the-job training by accepting reduced wages during the training period, those in jobs for which vocational training constitutes preparation, but who

1 Daymont and Rumberger (1982) and Meyer and Wise (1982) are notable exceptions.

received no high school vocational training, would earn a lower wage than former vocational students, but only for the duration of the training. Figure 1, adapted from Meyer (1982), shows how the annual earnings curves of vocational and nonvocational (former) students are predicted by theory to intersect. Given the premises on which the theory is based, it is clear from the figure that assessing earnings advantages of vocational training early in the respondent's career shows inordinately large advantage, and the same assessment in mid-career would show inordinately large disadvantage. In fact, the present value of the two income streams should be the same.

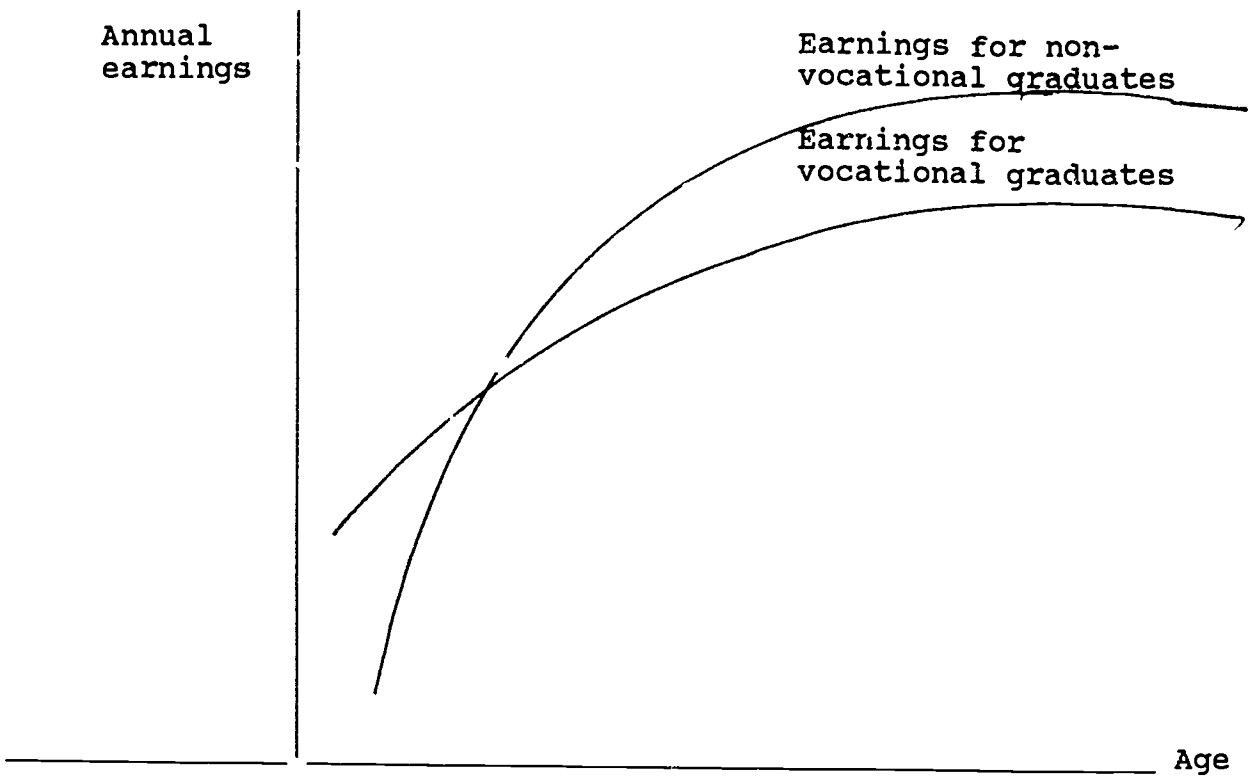

Figure 1. Earnings by age

Second, some empirical studies demonstrate the importance of observing earnings profiles over time. Meyer (1982) presents analyses based on the NLS class of 1972 data covering an 8-year time span after high school; he finds that the theory of declining vocational education wage differentials is supported. Haller and Spenner (1977) present graphs of age-earnings profiles for 1970 3-digit census occupation categories. Their graphs dramatically illustrate the extent to which yearly earnings differentials among occupations are relatively small in the early career and expand with age.

Both theory and observation indicate that adequate assessment of the impacts of education and training on economic outcomes requires lengthy time series on the economic outcomes. Since income advantages of vocational education may vanish or become income detriments at various time points, each new time point in the sequence adds a qualitatively new set of information. Extension of the analyses to additional time points improves the stability of past results in an incremental fashion.

Furthermore, high school education remains a complex system. To date, no study has adequately integrated tests of various aspects of vocational education. The Campbell studies (Campbell et al. [1985, 1986]), for example, reflect the most adequate evaluation of labor market outcomes of vocational education, but they do not investigate effects of vocational specialty. Conversely, other studies note that commercial and business education for females and trade and industrial education for males generate the most economic benefits (e.g., Woods and Haney 1981; Meyer 1982; Grasso and Shea 1979; Daymont and Rumberger 1982). The concept of training relatedness and the vocational profiles that proved useful in the Campbell sequence of studies need to be incorporated with the vocational specialties. Vocational specialty must be defined separately for males and females.

A number of studies reveal that the main advantages of high school vocational education for females accrue to those who select business and office occupations (Grasso and Shea 1979; Woods and Haney 1981; Meyer 1982; Daymont and Rumberger 1982; Gustman and Steinmeier 1982b). Campbell et al., in contrast, do not analyze the effects of separate vocational specialities but do emphasize the importance of training-related jobs. Employees in jobs related to their high school training gain economic advantages due to their training. Others do not. Daymont and Rumberger (1982) present an interesting table cross-classifying training relatedness with vocational speciality. These data show a strong relationship between the two. Women with business and office training have a much higher rate of training-related placement than do women with most other specialties (60 percent in business and office specialties vs. about 24 percent for women with other specialities). This relationship suggests that part of the influence of training relatedness on the economic benefits to women in vocational education may be due to a confounding between vocational specialty and training-related placement. The possibility also exists that the strong economic impact of business and office training is due to training-related placement. Whatever the case, past findings indicate the importance of conducting analyses in which both vocational specialty and training-related placement are examined simultaneously.

Third, it is not clear that effective vocational education should be measured by economic advantages that accrue to individuals who take vocational courses. Theory of markets indicates that wage differentials will reduce to zero in the long run (Gustman and Steinmeier 1982a; Meyer 1981). Alternatively, in imperfect markets, wage differentials might persist due to queuing effects (Thurow 1975), leaving little or no net economic benefits in the aggregate. Individuals may be well served by vocational training, but they simply replace individuals who would otherwise be trained on the job. In these instances no net gain accrues to society. According to this argument, credential effects simply serve to change the distribution of goods and services and provide lit' or no impact on productivity or total production.

Economists argue that effective vocational training in high school does not necessarily produce post high school labor market advantages for individuals who have taken high school vocational courses. Meyer (1982), for example, argues that any initial advantages that might go to former vocational students can be expected to disappear eventually, as the supply of vocational graduates increases, because of the enticement of that wage advantage. As the supply increases, the wage advantage should gradually disappear until equilibrium is reached. Given this argument, persistent advantages for vocational graduates would occur only if the supply of vocational graduates were restricted. Restriction could occur by limiting enrollments in vocational courses.

Gustman and Steinmeier (1982a) specify a more elaborate version of this argument. For expository purposes they divide high school curricula into two types--vocational and other--and the labor market into two corresponding types--those requiring vocational training and other. With this conceptualization they postulate that earnings differentials between vocational and nonvocational graduates depend on the degree to which access to high school vocational education is restricted. The differential remains positive but narrows as the size of the vocational training program (number of graduates) increases. The differential diminishes to zero at the point where there is unrestricted access. Gustman and Steinmeier (1982a) therefore conclude that the size of the vocational program one attended should be included in the specification of earnings differentials between vocational and nonvocational graduates. The functional form may not be linear. Thus, careful attention should be addressed to setting the specification. They do not give the functional form.

One of the fascinating implications of the Gustman and Steinmeier paper is that the combined earnings of vocational and nonvocational graduates are higher than would be the case for nonvocational graduates if vocational training were eliminated. Implications of the theory would be impossible to test by studying earnings differentials between vocational and nonvocational graduates using the usual atheoretical specifications.

It is concluded from this line of reasoning that adequate assessment of the impact of vocational education depends not only on the availability of detailed data but also on careful formulation of concepts and theory. Based on the limited theorizing to date, prevailing methods of evaluating vocational education indicate a positive effect only if the supply of vocational graduates is restricted. Consequently, an important aspect of the continuing research on the economic impact of vocational education is careful attention to the theoretical basis of the empirical research. The following three central questions must be addressed:

- How should earnings differentials between vocational and nonvocational graduates be interpreted? Does the absence of such differences necessarily imply that vocational training in high school is ineffective?

- Does the presence of strong vocational programs in high schools improve the earnings of nonvocational graduates as well as vocational graduates? If so, by how much?

- What variables should be included in equations designed to measure the labor market effects of vocational training, and what functional form should be used?

Daymont and Rumberger (1982) suggest an interesting issue with respect to differentials between vocational students and other students in wage and employment outcomes (first question above). They include (1) vocational credits, (2) academic credits, and (3) credits in other courses as predictors of wage and employment. They find that vocational and academic coursework contribute about equally to hourly wage, hours worked per week, and unemployment (with negative sign). Only if one requires that vocational education be superior to academic education can these data be interpreted as establishing that vocational education is not effective.

The linear specifications used by Daymont and Rumberger (and nearly all other assessments of vocational education) imply that academic and vocational courses can be substituted for each other. In this case, if the coefficient on one type of course is slightly larger than the other, the rational individual will take all courses in the area for which the larger coefficient occurs. Yet, this conclusion is not sensible. For example, it surely would not be advantageous to limit one's course of study to all vocational courses in high school. The market value of vocational courses should be enhanced by a knowledge of math and reading, for example, and vice versa. This line of reasoning implies a nonlinear specification that contains the product of vocational and academic credits. With the inclusion of the product and a constraint on the maximum number of total credits that can be taken in high school, the optimum proportion of vocational credits to academic credits falls somewhere in the middle range between zero and one. It must be anticipated, however, that effective estimation of an equation containing the interaction (product) between academic and vocational credits remains difficult. One of the reasons for this difficulty is that a slight departure from linearity may shroud the true relationship. Other reasons include, but are not limited to, measurement error (see, for example, Cronbach and Snow [1977]). A proper understanding of the role and effectiveness of vocational education requires extending the existing knowledge base of appropriate analytic technique and the theory that supports it.

Approach

This research project extended accumulated work conducted at the National Center. Specific models of the effects of vocational training in high school on post high school labor market outcomes were developed and tested using major national databases, including NLS-Youth, HS&B, and the U.S. Census.

The broad framework for the study (see Figure 2) combines primary insights from status attainment research and human capital theory. Status attainment research represents one of two major branches of stratification research in sociology (see Campbell [1983] for a review). The basic conception in this work is that the status of one's parents and one's personal characteristics such as race, ethnicity, and gender are translated into socioeconomic outcomes in ways that do not always reflect "merit." Schooling acts as the major conduit of status transmission between generations (Blau and Duncan 1967; Hauser, Tsai, and Sewell 1983). However, a major determinant of the amount of schooling is parental educational expectations of their children, which translate into the youths' own personal educational goals (Sewell and Hauser 1975; Hauser, Tsai and Sewell 1983). This literature sensitizes one to the need for including extensive controls for status background, attitudinal, and scholastic achievement variables.

Human capital theory (Becker 1975) views education as an investment in future earnings. Lifetime discounted earnings, rather than current wage or short-term earnings, ought to be conceived as the primary outcome variable. Lifetime earnings profiles differ in shape according to one's investment in education and training. Therefore, a comparison of earnings differentials at any given time is an inadequate indication of the full impact of training, especially in view of the fact that age-earnings profiles of different occupations occasionally intersect.

It is important to be cognizant of newly developing theory in sociology and the economics of segmented labor markets (see Hodson and Kaufman [1982] and Cain [1976] for reviews). Although the distinction between primary and secondary markets of internal and competitive markets (Doerringer and Piore 1971) is not well specified, it is clear that individuals do not face a single competitive labor market. Markets vary according to geography, occupation, and industry. Some theoretical discussions explicitly note the importance of segmented markets (e.g., Gustman and Steinmeier 1982a), but no adequate treatment of the implications

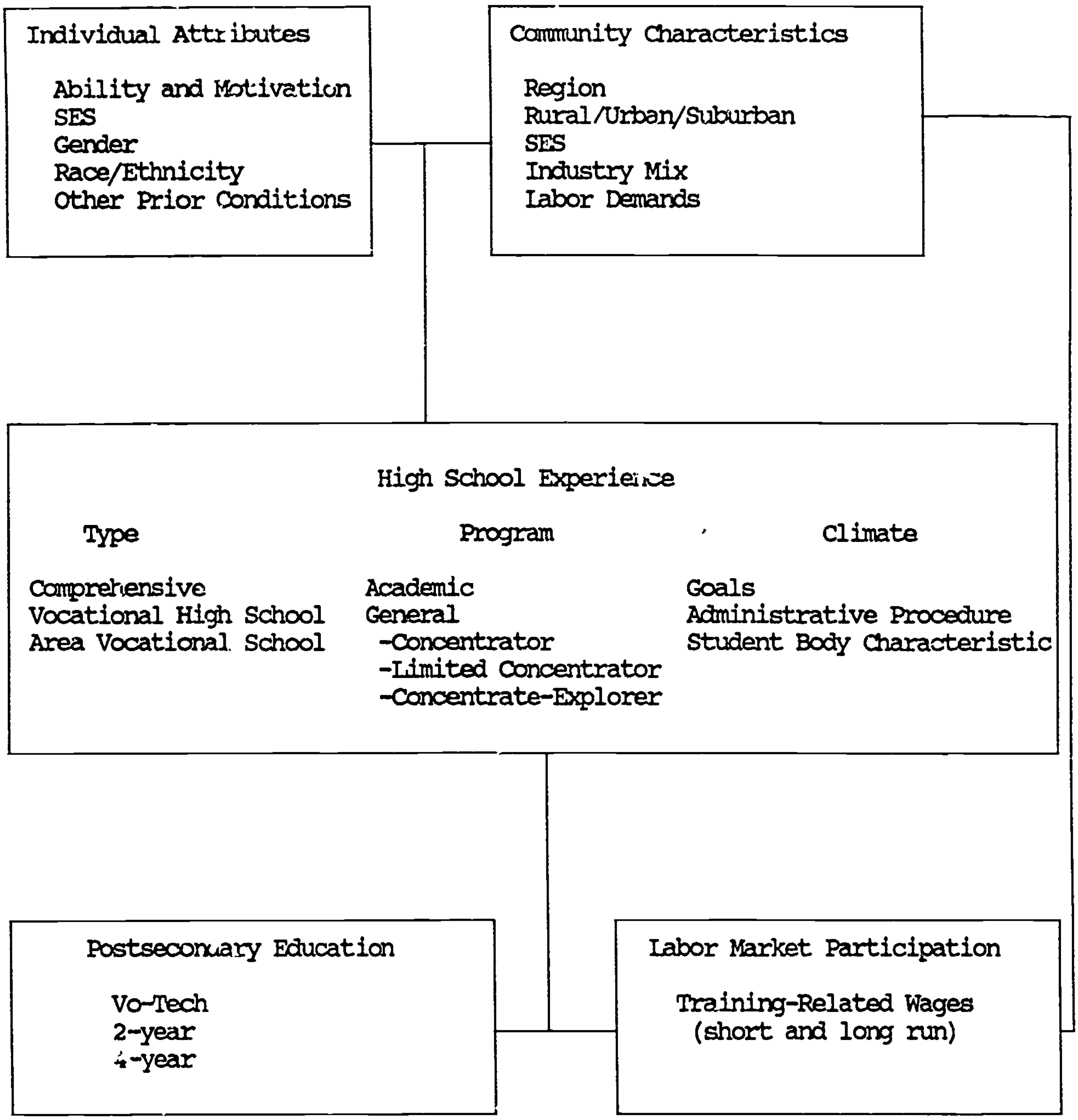

Figure 2. Conceptual framework for examining labor market effects of vocational education.

of market segmentation on vocational education effects has appeared. Development of a thorough treatment of this matter is beyond the scope of this research. Nevertheless, potential impacts of market segmentation must be kept in mind as a backdrop for interpreting findings and suggesting revision of an existing theory.

Objectives

The three objectives for this study are the following:

- To examine the changing impacts of high school vocational education over time
- To examine the combined effects of training-related placement and vocational specialty on economic outcomes
- To provide a summary of the results of an investigation of the theoretical basis for distinguishing between the wage advantage of individuals who take vocational courses in high school and the contribution of vocational education programs to the general economic welfare

CHAPTER 2

METHODOLOGY

Procedures

There are two important phases to this research. The first concerns the extension of theoretical models to guide the conduct and interpretation of the data analysis. The second consists of data analysis.

Study design. The primary emphasis of this research focused on an analysis of the changing effects of high school vocational training on labor market outcomes as time elapses. Variants of standard models of vocational education effect were employed. Two reasons for this focus exist. First, changing effects are a critical substantive issue, and theory clearly predicts a decline in the economic advantage for vocational graduates as time passes. Second, the technology and conceptualization for conducting this type of inquiry is readily accessible. This work incorporated analyses designed to investigate the combined effects of vocational specialty and training-related placement.

The application of two strategies assessed the dynamics of vocational education effects. The primary strategy examined changes in effect estimates in the NLS-Youth and HS&B data as time since leaving high school elapses. Alternative specifications were also evaluated with the HS&B data. A secondary strategy utilized cross-sectional data for different age groups to estimate age-earning curves for each detailed occupation in the U.S. Census. From this data, the present value of the expected lifetime income for each occupation was estimated. (These estimates were subject to the usual assumptions of synthetic cohorts, namely, the estimates were based on the assumption that periodic changes for one cohort were well estimated by age differences in cross section.) These present values were employed as dependent variables in the analyses.

Primary reliance for defining participation in vocational education was placed on the patterns of participation developed by Campbell and his coworkers at the National Center (Campbell, Orth, and Seitz 1981). Other operational procedures for defining vocational training, such as the number of credits earned (Daymont and Rumberger 1982), were also tried.

The theoretical and conceptual aspects of the research were developed during consultations with knowledgeable scholars outside the National Center. The logic of developing a model that shows how to assess the contribution of vocational training to the general economic welfare--as opposed to economic advantages that go only to those with vocational training--is exceedingly complex. Economists have given more thought to the market mechanisms that operate in this context than have other social scientists; therefore, it remains important to draw on economic thought and on scholars with economic background in this work. Because the work envisioned here ventures into relatively uncharted territory, it was difficult to anticipate results. Adequate assessment of the outcomes of vocational training depends critically on the results.

Data. The primary data for this research came from the NLS-Youth and HS&B surveys. The NLS-Youth database had two additional years of labor market experience accumulated by the time this project began. They replicated previous studies, but incorporated more recent data and separate age cohorts. Thus, it was possible to examine the trends of vocational education's effects over time. New data from the 1986 HS&B survey were not available at the time of analysis. Consequently, the overall wages and earnings equations were estimated for the HS&B sophomore sample. Comparisons were limited, however, because the HS&B cohort respondents had the opportunity for no more than two years of labor market experience after high school.

Census data providing age-earning profiles for each 1970 3-digit census occupation code were assembled. These data were used in conjunction with occupation data on the NLS-Youth and HS&B files. Using the census data as a basis, present value estimates were associated with the occupation for each job reported by respondents.

Data analysis. Multivariate analyses were conducted using well-known multivariate statistical methods such as OLS regression, which was employed in most instances. On technical grounds, however, OLS is not always the preferred method. However, conclusions based on OLS are seldom qualitatively different from those based on the more refined methods (see, for example, Cohen and Cohen 1983).

Equations were run for both the NLS-Youth and the HS&B data. For the latter, a larger number of control variables were available, such as school climate and individual behavior (discipline, absenteeism).

All multivariate analyses began with the fitting of an ordinary least squares (OLS) equation. The general form of the OLS equations was as follows:

$$Y=a + b_{1-n}X_{1-n} + c_{1-n}G_{1-n} + d_{1-n}HC_{1-n} + f_{1-n}PS_{1-n} + k_{1-n}Z_{1-n} + E$$

where X = a vector of control variables
G = a vector defining membership in special groups
HC = a vector of high school curricula

PS = a vector describing the nature and extent of postsecondary education

Z = a variable included to account for the interaction effect of different combinations of academic and vocational credits on hourly earnings

E = error term

The Z variable is not necessarily implied by the model shown in figure 2, although the need for such variables is suggested by that framework

Variables

For analytic purposes it is convenient to classify the variables in this report into three categories--dependent variables, primary independent variables, and control variables. Dependent variables include hourly wages, monthly earnings, and discounted lifetime earnings. The independent variables consist of curriculum and special group characteristics. Control variables include personal and parental characteristics, region of residence, and location (rural, urban) of residence. A detailed description of the variables follows.

Dependent Variables

The three dependent variables were defined as follows:

- Hourly wages--log of reported hourly rate of pay
- Monthly earnings--log of reported monthly rate of pay
- Lifetime earnings--present value of projected future earnings

The latter variable was estimated from the 1980 Census of Population and Housing in the following manner: Age-earnings curves were generated for clusters of occupations; the sample size is too small to permit this procedure to be applied to each 1980 3-digit occupation code. Occupations were assigned Duncan SEI scores and sorted in ascending order by the SEI.[2] Ten-year age intervals were imposed on the data, starting with age 21 and ending with age 70. Occupational clusters were defined by combining adjacent occupations, starting with the lowest SEI, until no age interval contained less than 30 cases. Fifty-nine clusters were formed in this manner. A present value with discount rate = 6 percent was calculated for each cluster. This variable, therefore, is properly interpreted as consisting of occupational clusters with age-earnings curves summarized by a present value calculation. Individuals were assigned these

2 1970 SEIs were used with a crosswalk to the 1980 occupation code.

present values according to the occupational cluster that contained their occupation.

Independent Variables

To explore the effects of secondary vocational education and to ascertain whether these differ among selected subsets of the population requires a set of variables representing high school curriculum and a set representing the special groups.

High school curriculum. Three broad curriculum types were utilized: vocational, academic, and general. The general group contained all cases not otherwise classified, and served as the reference group in the analyses.

- o Vocational education curriculum pattern-- Concentrator, Limited Concentrator, and Concentrator/Explorer. (Concentrator/Explorer = reference group). The three categories were based on credits from transcript data and the intensity, diversity, continuity, and persistence in vocational course-taking patterns.

- o Academic curriculum pattern.

- o Self-report vocational or academic curriculum.

Concentrators were those students who, on the average, had six or more credits in their vocational education specialty area. They frequently had an additional credit in another service area, and occasionally this credit could be judged as supportive of their specialty. They averaged 3 years of courses taken in the specialty service area and nearly always took courses in both the 11th and 12th grades.

Limited Concentrators averaged a little more than 3 credits in a service area and tended to take their specialty courses in only 2 years. They took their specialty courses in both eleventh and twelfth grades a little less often than the Concentrators did. They also took more courses outside their specialty area, but only occasionally were those judged to be supportive.

Concentrator/Explorers averaged almost a full credit (0.9) less than Limited Concentrators in a specialty. They tended to spend fewer than 2 years pursuing a specialty and did not frequently take specialty courses in the twelfth grade. Many of them sampled at least two service areas, but rarely were those judged to be supportive of their specialty.

The academic category was assigned to those students who had completed three or more credits of English, three or more credits of math, and two credits each of science and social studies. If a student had completed two or more credits in a foreign language, the math requirement was dropped to two credits. The general curriculum was assigned to all students who were not classifiable into one of the other categories. The Explorers, (vocational course but no specialization) and the Incidental/Personals (very limited specialization) do not have a significant investment in marketable vocational skills. Therefore, for the regression analyses they were reclassified as academic or general, for whichever they qualified, according to their qualifications.

Transcripts were not available for all respondents in either database. There were, however, self-report data available that permitted a more gross classification than the transcripts provided. Although preliminary tabular analysis had documented that self-report curriculum data were only marginally reliable (i.e., self-report does not coincide with courses shown on the transcript), categories based on these data were used for those students for whom transcript classification was not possible.

Thus, the high school curriculum variable used in the regressions includes 10 categories. They are Concentrators, Limited Concentrators, Concentrator/Explorers, Concentrators in training-related jobs (see description on next page), Limited Concentrators in training-related jobs, Concentrator/Explorers in training-related jobs, the academic curriculum, self-reported vocational and academic curriculum, and the general curriculum. For all regressions the omitted reference group consists of those in the general curriculum. All of the other categories are coded in dummy variable form, with the value one indicating membership in the category and zero, otherwise.

This set of categories was used in the regression equations with one further refinement. It has been established that vocational course work shows its significant labor market effects when the vocational graduate works in a training-related job (Campbell and Basinger 1985; Gardner 1984). Therefore, respondents in the vocational groups were further subdivided into those who were in such jobs and those who were not.

- Training-related (TR)--A person's occupation and industry area were determined based on the Census Bureau's 3-digit code for occupation. If that person's vocational specialty matched the occupation area or a combination of occupation and industry, the person was designated as being in a training-related area of work.

<u>Special groups</u>. The subsets of the population whose postsecondary education and labor market experience are differentiated in the analyses are based upon gender, ethnicity, and language proficiency.

- Race/ethnicity--defined as white, black, Hispanic, Native Americans, or other (majority white = reference group).

- Gender--defined as male or female (male = reference group).

- Limited English Proficiency (NLS-Youth)--A person is classified as limited English proficient if one of the following is true: (LEP = 1)

  (1) In the 1979 interview, the respondent reported having trouble getting a good job because of a problem with English; or

  (2) The respondent was administered the interview in a language other than English in 1979 or 1980.

- Limited English Proficiency (HS&B)--A person is classified as limited English proficient if one of the following is true: (LEP = 1)

  (1) The student had taken the base-year questionnaire in Spanish; or

  (2) The student reported the first language spoken was one other than English, and
  --reported taking an English course for non-English-speaking students (in grades 10 - 12); or
  --reported taking a reading and writing course in the first language spoken (not English) in grades 10 - 12; or
  --reported taking other subjects (math, science) taught at least in part in their first language spoken (other than English) in grades 10 - 12. (LEP = 1)

Control Variables

In specifying the models represented by the OLS equation, the most basic problem is the need to avoid biased results by including all those variables that may be correlated with the dependent variable and the explanatory variable of central concern--in this case, participation in secondary vocational education. It is well known that there are significant differences among the students in the several secondary school curricula. Students who enroll in the vocational curriculum, for example, on average come from lower socioeconomic strata of the population and do less well on scholastic aptitude tests than those who follow the other curricula. These same characteristics are, of course, influences on both the nature and extent of postsecondary education and on success in the labor market. If one is interested in ascertaining the independent influence of the high school curriculum on subsequent educational or labor market experience, one must control for such characteristics.

It is important to note that the factors that increase the likelihood of enrollment in vocational education tend to be negatively related both to the extent of further education and to success in the labor market. Hence, failure to control fully for such factors would have the effect of concealing or understating whatever positive effect vocational education might have on these outcomes. It follows that any positive effects that are detected are conservative estimates of the true impact of the programs.

Fortunately, the richness of the HS&B and NLS-Youth databases permit one to be reasonably confident that the problem of selectivity bias has been adequately met. A preliminary analysis of factors hypothesized to influence participation was carried out, and those variables showing significant influence were added to the control variables. The control variables that are used in the analyses and the reasons for their inclusion are as follows:

- Ability (NLS-Youth)--Armed Forces Qualification Test (AFQT) score.

- Ability (HS&B)--Composite of reading, vocabulary, and math scores from tests administered with survey.

- Sophomore year grade point average--Course credit for each course in the 10th grade was multiplied by the grade received for that course as follows:

  A = 4.0; A- = 3.7; B+ = 3.3; B = 3.0;
  B- = 2.7; C+ = 2.3; C = 2.0; C- = 1.7; D+ = 1.3;
  D = 1.0; D- = 0.7

  These numbers were added together, then divided by the total number of credits for all 10th-grade courses taken.

As previously mentioned, there is a clear association between ability scores and curriculum, and the evidence of an association between wages and ability makes it necessary to include a control for this variable to avoid the bias that would exist in the simple relationship between curriculum and measures of labor market success, especially wages.

- Socioeconomic status (SES)--a created index for respondents at age 14 based on parents' occupation, education, and ownership of selected household items.

At age 14, or when sophomores, simple frequency counts indicate that more vocational students fall into lower SES quartiles than their proportions in the population would suggest. Status attainment theory suggests that SES may influence wages in addition to educational selectivity.

- o Self-esteem--An additive score of various self-esteem questions asked of students in the 10th grade in HS&B and in 1981 in NLS-Youth. High values correspond with high self-esteem.

- o Postsecondary Education (NLS-Youth)--<u>Currently enrolled AND one of the following:</u>

  --Completed 0 years
  --Completed 1 year
  --Completed 2 years
  --Completed 3 years
  --Completed 4 or more years

  <u>Not currently enrolled AND one of the following:</u>

  --Completed 0 years
  --Completed 1 year
  --Completed 2 years
  --Completed 3 years
  --Completed 4 or more years

  (never enrolled = reference group)

- o Postsecondary Education Current Enrollment Status (HS&B)--Currently enrolled, not currently enrolled (never enrolled = reference group)

- o Postsecondary Education: Years Completed (HS&B)
  --Completed 0 years
  --Completed 1 year
  --Completed 2 years
  --Completed 3 years
  --Completed 4 or more years

  (never enrolled = reference group)

The well-established positive relationship between earnings and postsecondary education requires that this be controlled unless the population is restricted to only those who do not go on to further schooling. Because the majority of high school graduates do go on, such a restriction would introduce a serious problem of selectivity bias and sample generalizability.

- o Region--Northeast, North Central, South, West (North Central = reference group)

This variable serves as a proxy for differing labor market conditions (e.g., growth or decline, industry mix). There are regional patterns in vocational participation as well.

o Area of residence--rural, suburban, or urban. (suburban = reference group).

This variable is included because there is evidence that wage rates are likely to be lower in rural areas than in suburban or urban areas, and because vocational education appears to be more popular in rural areas.

o Tenure--The number of months (NLS-Youth) or weeks (HS&B) a person has worked at current or most recent job.

o Labor Market Experience (NLS-Youth)--Number of weeks worked since age 16.

o Labor Market Experience (HS&B)--Number of weeks worked since graduation from high school or, if no graduation date was available, from the date of 18th birthday.

Labor market experience reflects the expected increase in wages as a function of higher productivity or of the employer's expectation of higher productivity. Persons selecting a vocational curriculum might be expected to start labor force participation earlier, and therefore have a longer period of time on the job at the time of the survey. Failure to include labor market experience as a control variable would tend to overstate a positive effect of the vocational curriculum on earnings.

o Full-time Employment--A person worked an average of 30 hours or more per week; includes students.

o Part-time Employment--A person worked at least 5 hours per week, but less than 30.

Because graduates of the high school vocational education curriculum have a lower probability of long-term postsecondary education as compared with students in the other two curricula, they are more likely to hold full-time jobs in the immediate years after graduation, when the labor market success variables were measured. The variable is therefore included in regressions where hourly earnings is the dependent variable.

CHAPTER 3

FINDINGS AND CONCLUSIONS

This chapter begins with descriptive background information on the participants in vocational education in high school. Their distributions across curriculum patterns, socioeconomic status quartiles, vocational specialties, and racial and ethnic groups are presented in tabular form.

Findings

The entries in tables 1 and 2 represent the enrollment percentages by participation patterns for HS&B and NLS, respectively. Looking at the incidence of Concentrators in the three major population groups (black, Hispanic, and white,) it is interesting to note that women are just as likely, or more likely to concentrate as men. Total percentages for the Concentrators through the Incidental/Personals demonstrate the high incidence of taking at least one vocational course in high school. For NLS-Youth, this percentage is approximately 61 percent, for HS&B, 58 percent. Table 3 presents the distribution of racial and ethnic groups across vocational specialties for the NLS-Youth and HS&B sample questions. It is evident that two specialties, Business and Trade and Industry, enroll the most students and, further, that there is a high degree of gender segregation within each program.

Socioeconomic status and curriculum patterns are examined in table 4. Those students who obtain more in-depth training in a specific area (i.e., Concentrators and Limited Concentrators) are more likely to come from homes in the low SES quartile. In both surveys, these two groups comprise approximately 28 percent of the total percentage in the low quartile. For those who are Concentrators there is a sharper distinction between the lower and higher quartiles than for those in the Limited Concentrator group.

The distribution of students according to SES and vocational specialty is illustrated in table 5. Again, the high participation rates for the Business and Trade and Industry programs is evident. Students tend to be fairly evenly distributed among the four quartiles in both of these programs; however, the NLS-Youth data for Trade and Industry show the percentage of low SES students to be twice as large as the percentage in the high quartile.

With the general picture of the high school vocational graduate in mind, we turn to a comparison of the earnings outcomes from jobs held by the NLS-Youth respondents at the time of the 1983 interview with those held at the time of the 1985 interview. Table 6 shows the results of a regression on hourly and monthly earnings as of 1983, and table 7 shows the results for virtually

TABLE 1

CURRICULUM PATTERN BY RACE/ETHNICITY AND GENDER
FOR ALL RESPONDENTS
Percentage Distributions
HS&B

Curriculum Pattern	Total		White		Black		Hispanic		Native American		Asian		Other	
	n	%	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Concentrator	1490	9.56	8.76	9.97	7.53	9.39	11.12	10.87	20.78	7.06	5.23	3.27	18.20	22.92
Limited Concentrator	2038	12.74	13.73	10.52	14.09	14.27	16.92	12.57	23.27	12.09	17.32	15.54	8.13	9.26
Concentrator/Explorer	1343	8.11	6.70	8.47	10.20	8.53	8.19	10.02	7.65	19.54	19.08	12.19	10.77	6.94
Explorer	1127	6.85	5.94	7.01	5.08	7.63	8.17	9.67	13.14	11.65	5.43	10.18	6.39	16.33
Incidental/Personal	3239	20.07	19.25	20.55	20.61	20.00	18.65	19.77	15.60	22.52	32.55	35.13	24.01	33.35
Vocational Self-Report	6766	21.72	23.61	22.77	18.26	19.09	17.97	18.93	13.23	18.87	5.54	5.33	6.78	3.51
Academic	114	0.77	1.21	0.67	0.59	0.08	0.31	0.10	0.78	0.00	1.53	1.40	0.00	0.00
Academic Self-Report	1629	5.26	6.44	5.54	4.41	4.89	1.94	1.82	0.91	0.00	4.17	3.82	1.57	1.84
General	316	1.92	1.72	1.54	2.48	2.09	2.77	2.74	0.82	0.54	3.75	2.29	18.66	0.00
General Self-Report	4225	13.01	12.65	12.97	16.75	13.94	13.96	13.51	3.82	7.75	5.40	10.84	5.50	5.85
Total		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total n	22287		7325	7599	1294	1580	1994	1787	119	104	177	174	82	52
Total Row Percent		100.00	36.38	37.90	5.23	6.46	6.19	5.01	0.53	0.37	0.56	0.49	0.55	0.34

SOURCE: Paul B. Campbell et al. Outcomes of Vocational Education for Women, Minorities, the Handicapped, and the Poor. Columbus: The National Center for Research in Vocational Education, The Ohio State University, 1986.

NOTE: Percentages are weighted; numbers are unweighted.

TABLE 2

CURRICULUM PATTERN BY RACE/ETHNICITY AND GENDER
FOR ALL RESPONDENTS
Percentage Distributions
NLS

Curriculum Pattern	Total		White		Black		Hispanic		Native American		Other	
	n	%	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Concentrator	699	9.08	7.17	12.08	7.48	7.13	3.92	10.26	12.57	9.46	4.90	10.73
Limited Concentrator	1100	13.81	12.43	15.85	10.94	15.39	10.02	15.24	19.22	24.60	7.68	11.88
Concentrator/Explorer	636	7.73	5.62	9.44	5.19	8.89	4.79	8.86	7.17	14.21	6.33	9.60
Explorer	137	1.68	2.14	1.35	0.97	1.75	2.55	0.98	2.23	3.38	1.67	0.90
Incidental/Personal	2072	28.17	31.40	27.89	23.43	20.84	28.47	24.14	21.82	18.27	30.28	30.35
Vocational Self-Report	366	3.99	3.47	3.72	6.01	6.17	4.47	6.91	4.74	4.52	3.49	2.83
Academic	384	5.99	8.12	5.22	4.33	3.59	5.93	2.56	8.92	1.74	8.20	3.55
Academic Self-Report	691	8.08	7.91	6.99	11.12	11.75	8.83	7.60	2.43	3.66	10.21	9.57
General	1609	19.13	20.26	15.01	27.76	21.08	27.39	19.32	18.26	18.86	24.59	17.50
General Self-Report	191	2.03	1.47	2.03	2.41	3.03	2.79	3.70	1.50	1.03	2.25	2.79
Unclassifiable	30	0.30	0.02	0.43	0.36	0.40	0.87	0.42	1.14	0.27	0.40	0.30
Total		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total n	7915		1805	2037	849	1048	482	593	129	171	388	413
Total Row Percent		100.00	31.71	33.32	5.26	6.51	2.26	2.89	1.94	2.66	6.79	6.68

SOURCE: Paul B. Campbell et al. Outcomes of Vocational Education for Women, Minorities, the Handicapped, and the Poor. Columbus: The National Center for Research in Vocational Education, The Ohio State University, 1986.

NOTE: Percentages are weighted; numbers are unweighted.

TABLE 3

SPECIALTY BY RACE/ETHNICITY AND GENDER
FOR VOCATIONAL RESPONDENTS
Percentage Distributions

Specialty	Total n	Total %	White Male	White Female	Black Male	Black Female	Hispanic Male	Hispanic Female	Native American Male	Native American Female	Asian Male	Asian Female	Other Male	Other Female
HS&B														
Agriculture	232	3.88	7.89	0.99	1.85	1.59	6.48	0.32	2.08	0.00	4.16	0.00	7.21	0.00
Business	3642	54.74	30.70	82.38	27.06	72.46	20.89	75.05	18.78	79.90	29.10	63.02	23.94	82.78
Health Care	73	0.98	0.45	1.18	0.70	3.54	0.68	0.80	0.00	0.89	0.00	1.33	0.00	0.00
Trade & Industry	2433	35.09	56.35	9.85	65.92	15.96	66.64	15.14	79.13	10.72	64.97	24.63	68.85	17.22
Home Economics	223	3.02	2.52	3.44	1.10	3.54	1.66	6.56	0.00	6.80	1.78	9.41	0.00	0.00
Distributive Education	166	2.29	2.10	2.15	3.36	2.91	3.63	2.12	0.00	1.70	0.00	1.60	0.00	0.00
Total		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total n	6769		1891	2026	453	536	816	677	58	59	98	97	38	20
Total Row Percent		100.00	40.07	41.32	42.60	44.63	47.10	43.46	61.37	54.86	60.06	51.84	48.79	44.61
NLS														
Agriculture	222	5.59	11.35	1.71	9.30	0.83	8.39	1.40	14.07	5.14	--	--	9.42	1.91
Business	2539	67.96	45.95	85.67	39.39	74.72	52.41	89.97	37.13	74.75	--	--	46.89	85.25
Health Care	63	1.58	0.16	2.46	0.57	3.33	0.54	1.19	0.00	5.97	--	--	0.19	1.44
Trade & Industry	661	17.53	35.38	4.51	40.42	6.68	34.80	2.56	36.21	4.01	--	--	35.62	3.16
Home Economics	112	2.32	0.92	1.62	4.39	9.18	0.63	2.15	1.69	4.68	--	--	3.26	3.76
Distributive Education	182	5.01	6.23	4.02	5.92	5.24	3.22	2.76	10.90	5.44	--	--	4.62	4.48
Total		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	--	--	100.00	100.00
Total n	3779		804	1141	351	489	178	310	68	98	--	--	139	201
Total Row Percent		100.00	43.33	57.38	40.52	44.43	36.69	51.14	52.09	59.14	--	--	36.83	50.86

SOURCE: Paul B. Campbell et al. Outcomes of Vocational Education for Women, Minorities, the Handicapped, and the Poor. Columbus: The National Center for Research in Vocational Education, The Ohio State University, 1986.

NOTE: Percentages are weighted; numbers are unweighted.

TABLE 4

SOCIOECONOMIC STATUS BY CURRICULUM PATTERN
FOR ALL RESPONDENTS
Percentage Distributions

SES Quartile	Total n	Total Column %	Total	Concen-trator	Limited Concentrator	Concentrator/ Explorer	Explorer	Incidental/ Personal	Self-Report Vocational	Academic	Self-Report Academic	General	Self-Report General	Unclassi-fiable
							HS&B							
Low	6180	25.45	100.00	13.13	14.30	8.32	6.51	17.21	22.65	.30	2.84	1.64	13.11	...
2nd	5552	26.14	100.00	10.93	12.82	8.67	6.77	16.82	25.15	.55	3.58	1.60	13.12	...
3rd	5238	25.07	100.00	8.45	12.43	8.21	7.72	19.78	22.93	.79	4.95	1.68	13.07	...
High	4794	23.34	100.00	4.28	11.41	6.97	5.91	26.19	17.21	1.58	10.47	2.29	13.69	...
Total n	21764			1424	1982	1301	1084	3127	6675	113	1607	297	4154	...
Total Percent		100.00	100.00	9.32	12.77	8.07	6.74	19.85	22.11	.79	5.34	1.79	13.24	...
								NLS						
Low	1449	11.27	100.00	12.30	16.56	9.62	1.82	19.73	6.31	2.92	6.30	21.49	2.49	0.46
2nd	1754	20.73	100.00	11.52	15.87	7.87	1.68	26.43	5.29	2.82	6.22	19.89	2.04	0.37
3rd	2150	28.89	100.00	11.50	15.71	9.16	2.12	26.13	4.26	2.90	6.29	19.35	2.28	0.31
High	2562	39.11	100.00	5.08	10.52	6.05	1.32	33.02	2.44	10.85	10.90	17.88	1.17	0.22
Total n	7915			699	1100	636	137	2072	366	384	691	1609	191	30
Total Percent		100.00	100.00	9.08	13.81	7.73	1.68	28.17	3.99	5.99	8.08	19.13	2.03	0.30

SOURCE: Paul B. Campbell et al. Outcomes of Vocational Education for Women, Minorities, the Handicapped, and the Poor. Columbus: The National Center for Research in Vocational Education, The Ohio State University, 1986.

NOTE: Percentages are weighted; numbers are unweighted.

TABLE 5

SOCIOECONOMIC STATUS BY SPECIALTY
FOR VOCATIONAL RESPONDENTS
Percentage Distributions

SES Quartile	Total n	Total Column %	Total	Agriculture	Business	Health Care	Trade & Industry	Home Economics	Distributive Education
					HS&B				
Low	2228	27.60	100.00	4.23	53.46	0.95	36.31	2.74	2.30
2nd	1637	26.54	100.00	4.04	54.84	0.92	35.52	2.34	2.34
3rd	1455	24.66	100.00	4.69	56.04	1.44	33.24	2.54	2.05
High	1227	21.20	100.00	2.17	57.94	0.63	31.96	4.86	2.43
Total n	6547			224	3555	71	2319	218	160
Total Percent		100.0	100.00	3.86	55.40	1.01	34.42	3.02	2.28
					NLS				
Low	710	11.92	100.00	6.18	61.85	1.88	23.52	3.17	3.40
2nd	888	22.27	100.00	7.32	60.07	1.89	21.06	3.27	6.37
3rd	1097	31.51	100.00	5.35	66.35	1.94	18.46	2.28	5.61
High	1084	34.30	100.00	4.48	76.69	0.93	12.32	1.45	4.12
Total n	3779			222	2539	63	661	112	182
Total Percent		100.0	100.00	5.59	67.96	1.58	17.53	2.32	5.01

SOURCE: Paul B. Campbell et al. Outcomes of Vocational Education for Women, Minorities, the Handicapped, and the Poor. Columbus: The National Center for Research in Vocational Education, The Ohio State University, 1986.

NOTE: Percentages are weighted; numbers are unweighted.

TABLE 6

LOG HOURLY AND MONTHLY PAY
NLS-YOUTH

1983

Variable	Hourly Parameter Estimate	Hourly t-value	Monthly Parameter Estimate	Monthly t-value	n
Intercept	0.8180	15.693	5.6958	75.163	6053
Socioeconomic status	0.0025*	3.549	0.0030*	2.839	6053
Northeastern region	0.0856*	5.614	0.1168*	5.066	1199
Southern region	0.0532*	3.965	0.1457*	7.207	2199
Western region	0.1209*	7.711	0.1935*	8.174	1134
Rural	-0.0512*	-3.389	-0.0710*	-3.108	774
MD rural	0.0004	0.009	0.0673	0.945	66
English is a second language	0.0079	0.316	-0.0012	-0.031	247
Hispanic male	0.0187	0.795	-0.0145	-0.410	373
Black male	0.0019	0.093	-0.0250	-0.796	563
Native American male	0.0197	0.489	-0.0037	-0.060	96
Other male	-0.0335	-1.418	-0.0364	-1.020	313
Hispanic female	-0.0828*	-3.738	-0.1736*	-5.197	455
Black female	-0.0922*	-4.69[illegible]	-0.2392*	-8.107	689
Native American female	-0.1435*	-4.239	-0.2584*	-5.055	140
White female	-0.1468*	-10.500	-0.2804*	-13.420	1593
Other female	-0.1312*	- 5.659	-0.2737*	- 7.835	336
Armed forces qualifying test	0.0029*	7.422	0.0036*	6.064	5838
MD AFQT	0.0367	1.315	0.0276	0.654	215
Tenth grade G.P.A.	-0.0068	-0.823	-0.0240	-1.914	4947
MD tenth grade G.P.A.	0.0027	0.175	-0.0049	-0.205	1106
Concentrator training-related	0.0813*	2.849	0.1717*	3.983	196
Concentrator	-0.0283	-1.311	-0.0142	-0.436	371
Lim. Concentrator training-rel.	0.0525*	1.974	0.0818*	2.033	226
Limited Concentrator	-0.0101	-0.587	-0.0257	-0.987	641
Conc/Explorer training-rel.	0.0027	0.071	0.0486	0.838	103
Concentrator/Explorer	0.0234	1.100	-0.0008	-0.024	378
Academic student	-0.0059	-0.348	-0.0377	-1.464	752
Self-report vocational	0.0177	0.680	0.0262	0.665	256
Self-report academic	0.0221	1.083	0.0350	1.135	512
Labor market experience	0.0013*	19.682	0.0020*	21.114	6053
Months on job	0.0130*	11.184	0.0187*	10.626	6053
Parttime job	0.0025*	5.462			6053
Self-esteem	0.0051*	3.866	0.0080*	3.980	5884
Not enrolled-no postsec. credit	0.0436*	2.218	0.0244	0.821	452
Not enrolled-1 year postsec.	0.0322	1.672	0.0565	1.942	491
Not enrolled-2 years postsec.	0.0463*	2.170	0.0409	1.269	396
Not enrolled-3 years postsec.	0.0677	1.796	0.0588	1.032	110
Not enrolled-4 or more postsec.	0.1851*	9.477	0.2102*	7.122	637
Enrolled-0 year complete	-0.0550*	-2.643	-0.4357*	-14.136	461
Enrolled-1 year complete	-0.0789*	-3.560	-0.4747*	-14.465	393
Enrolled-2 years complete	-0.0874*	-3.574	-0.4834*	-13.285	315
Enrolled-3 years complete	0.0690*	-2.539	-0.4905*	-12.109	250
Enrolled-4 years complete	0.1367*	3.858	-0.0787	- 1.471	135

Hourly: R^2 = 0.2747; Adj. R^2 = 0.2694; F-Statistic = 51.731

Monthly: R^2 = 0.3355; Adj. R^2 = 0.3308; F-Statistic = 70.582

NOTE: MD refers to missing data, G.P.A. refers to grade point average.

* Indicates that the chance probability of an effect this large is $\leq$ .05.

identical specifications for 1985. If the theoretical expectation of convergence of earnings curves, as described in chapter 1, holds, then one would expect to see a diminution over time of differences in earnings between those who are vocationally trained and those who graduated from a general or academic curriculum. As described in chapter 2, the equations attempt to hold constant other potential influences that might have common variance between the earnings and the explanatory variables. When the variable of principal interest, vocational pattern, is examined, there is evidence that the trend supports the theory. Whereas vocational Concentrators and Limited Concentrators showed significant wage advantages in 1983, the general and academic graduates have approached them so closely in 1985 that the differences, though still favoring vocational graduates, may be due to chance. Vocational Concentrators and Limited Concentrators continue to show an advantage in monthly earnings in 1985, but there is evidence that suggests that it is an indirect effect. An equation (not shown) identical to that shown in table 7, except that it included a variable for hours worked per week was evaluated. There is an obvious and direct association between hours worked and earnings accumulated in a month, requiring no explanation. However, when this variable was included, the two vocational pattern variables lost their significance. Earlier analysis (Gardner, Campbell, and Seitz 1982) has demonstrated that Concentrators and Limited Concentrators tend to have more employment and work longer hours. Therefore, although wages have approached equality, a labor market advantage still remains for those who concentrate in a vocational specialty. Information about the persistence of this advantage awaits the analysis of data reflecting a further accumulation of labor market experience. The subsequent discussion of discounted lifetime earnings provides some information on this topic.

Another question that was addressed concerned the relative contribution of academic and vocational courses. In chapter 1, the implication of the linear specification that vocational and academic courses can be substituted for each other was challenged. To test the effect of different combinations of academic and vocational courses, a variable representing the ratio of academic to vocational credits was created and included as an independent variable in the earnings equations. Otherwise, the specifications of the equations remained the same. The results suggest that the vocational and academic profiles capture most of the association that differing ratios of academic and vocational courses might have with earnings, either hourly or monthly. The vocational-academic ratios did not approach significance. The t-values were substantially less than 1. With respect to this implication of substitutability, the definition used in the equations shown in the tables appears adequate to provide reasonable estimates of curriculum effects. The patterns may be a nonlinear combination of academic and vocational courses or there may be some other explanation of the nonsignificant results. Two possibilities are suggested. First, the patterns combine the elements in a manner that is conditional rather than additive. That is, to be a

TABLE 7

LOG HOURLY AND MONTHLY PAY

NLS-YOUTH

1985

Variable	Hourly Parameter Estimate	Hourly t-value	Monthly Parameter Estimate	Monthly t-value	n
Intercept	1.2787	23.486	5.8006	62.553	4763
Socioeconomic status	0.0014	1.850	0.0007	0.500	4763
Northeastern region	0.0866*	5.121	0.1158	4.003	895
Southern region	0.0417*	2.828	0.1324	5.249	1826
Western region	0.1074*	6.065	0.1663	5.493	828
Rural	-0.0644*	-4.004	-0.0698	-2.539	702
MD rural	-0.1508	-1.836	-0.0467	-0.332	21
English is a second language	0.0255	0.985	0.0634	1.432	227
Hispanic male	0.0317	1.262	0.0411	0.956	335
Black male	-0.0232	-1.044	-0.0738	-1.943	525
Native American male	0 0406	0.945	0.0428	0.582	83
Other male	0 0140	0.500	0.0170	0.355	218
Hispanic female	-0.1433*	-5.942	-0.3110	-7.561	387
Black female	-0.1572*	-7.477	-0.3481	-9.719	635
Native American female	-0.1310*	-3.414	-0.3076	-4.688	107
White female	-0.1683*	-10.445	-0.3538	-12.884	1165
Other female	-0.1189*	-4.397	-0.3246	-7.027	238
Armed forces qualifying test score	0.0039*	9.748	0.0051	7.416	4763
MD AFQT	0.0483	1.576	0.1044	1.991	183
Tenth grade G.P.A.	-0.0069	-0.760	-0.0141	-0.900	4763
MD tenth grade G.P.A.	-0.0019	-0.115	-0.0222	-0.785	1004
Concentrator training-related	0.0362	1.426	0.1162	2.678	293
Concentrator	-0.0261	-0.796	-0.0798	-1.426	153
Lim. Concentrator training-rel.	0.0471*	2.042	0.1043	2.641	365
Limited Concentrator	-0.0258	-1.065	-0.0437	-1.054	323
Conc/Explorer training-related	0.0155	0.503	0.0213	0.404	175
Concentrator/Explorer	0.0107	0.373	-0.0169	-0.344	210
Academic student	0.0050	0.293	0.0025	0.087	1096
Self-report vocational	0.0414	1.632	0.0702	1.619	270
Self-report academic	0.0247	1.244	0.0462	1.360	536
Labor market experience	0.0072*	6.480	0.0106	5.555	4763
Months on the job	-0.0023*	-2.279	-0.0029	-1.708	4763
Self-esteem	0.0078*	5.285	0.0148	5.843	4763
MD self-esteem	-0.0086	-0.259	0.0071	0.125	155
Parttime job	-0.0840*	-5.508			821
Not enrolled, no postsecondary	0.0175	1.137	0.0581	2.207	1027
Not enrolled, 1 year postsec.	-0.0111	-0.450	0.0521	1.23[illegible]	286
Not enrolled, 2 year postsec.	0.0889*	3.216	0.1412	2.988	226
Not enrolled, 3 years postsec.	0.0862	1.920	0.1323	1.723	75
Not enrolled, 4 or more postsec.	0.2498*	10.179	0.3614	8.612	368
Enrolled, not completed a year	-0.0130	-0.534	0.0391	0.942	290
Enrolled, completed 1 year	-0.0373	-1.299	-0.1640	-3.344	202
Enrolled, completed 2 years	-0.1019*	-4.218	-0.4416	-10.865	347
Enrolled, completed 3 years	-0.0872*	-2.923	-0 5078	-10.084	203
Enrolled, completed 4 year	0.0877*	3.267	0.0440	0.960	280

Hourly: R^2 = 0.2625; Adj. R^2 = 0.2556; F-Statistic = 38.174

Monthly: R^2 = 0.2523; Adj. R^2 = 0.2455; F-Statistic = 37.042

NOTE: MD refers to missing data, G.P.A. refers to grade point average.
*Indicates that the chance probability of an effect this large is ≤ .05.

Concentrator, one must approach certain levels of intensity, continuity, and proximity (see Campbell, Ort', and Seitz 1981.) Secondly, an analysis of course taking reflected in the NLS-Youth transcript data (see Appendix) shows that most course-taking patterns reflect ratios of academic to vocational courses that nearly always favor academic courses. Thus, the existing practice of education has not permitted a sufficiently extreme pattern of course substitution to be tested, except in the case of an academic program with no vocational credits. If curvilinearity exists, it must be quite moderate within the range of course-taking patterns observed. Some further evidence on this question appears in the analysis of discounted lifetime earnings presented next.

The complexity of human interactions with formal education and the labor market can be approximated only crudely by the data available in a longitudinal database of relatively short duration--in this case, 7 years. Nevertheless, some useful and interesting results emerge that do not appear to be products of chance. Briefly, the estimate of discounted lifetime earnings was based on groupings of occupations that reflect relative homogeneity in Duncan Socioeconomic indices. The average annual earnings of persons in these occupations was obtained from Census data for persons in each decade from age 30 to 60. A discount rate of 6 percent was applied. The explanatory variables of major interest were high school curriculum patterns. Controls were in place to reflect influences on earnings that have been verified in many analyses (e.g., gender, labor market experience, and postsecondary schooling).

The results are presented in table 8. The lifetime earnings curves suggest that the overall effect of a vocational curriculum is somewhat positive if the proper blend of courses is present in the respondent's program and the respondent is in a training-related job. This conclusion is reached for the following reasons. First, a Limited Concentrator has significantly increased discounted lifetime earnings if he or she works in a training-related job, and the assumption is made that the career trajectory will remain in that job family. Limited Concentrators have a somewhat higher number of academic courses but not enough to prevent the accumulation of significant vocational courses. Concentrators, on the other hand, do not differ in discounted lifetime earnings from the control group, who are graduates of the general curriculum. In sharp contrast, academic high school graduates have significantly lower discounted lifetime earnings than the general graduates. (Recall that postsecondary attendance has been controlled, so that academic and vocational graduates who have attended college are being compared with general graduates who also have attended college. The conclusion, then, is that there is an optimum mix of vocational and academic credits that is most productive of net lifetime earnings, and it is approximated by the Limited Concentrator pattern of vocational participation.

TABLE 8

LOG OF DISCOUNTED LIFETIME EARNINGS

NLS-YOUTH

Variable	Parameter Estimate	t-value	n
Intercept	4.5841	91.223	5923
Socioeconomic status	-0.0001	-0.134	5923
Northeastern region	0.0056	0.353	1042
Southern region	0.0100	0.728	2123
Western region	-0.0069	-0.423	989
Respondent lived in a rural area	-0.0094	-0.606	797
MD rural	-0.0557*	-2.776	482
English is a second language	0.0130	0.537	279
Hispanic male	0.0275	1.168	402
Black male	-0.0368	-1.827	684
Native American male	0.0142	0.355	103
Other male	-0.0192	-0.735	264
Hispanic female	-0.1329*	-6.034	506
Black female	-0.1956*	-10.109	807
Native American female	-0.1980*	-5.521	131
White female	-0.1768*	-11.767	1437
Other female	-0.2140*	-8.356	282
Armed forces qualifying test score	0.0022*	5.958	5624
MD AFQT	-0.0222	-0.866	299
Tenth grade G.P.A.	-0.0146	-1.732	4631
MD 10th grade G.P.A.	-0.0314*	-2.067	1292
Concentrator training related	0.0194	0.808	343
Concentrator	-0.0409	-1.351	192
Lim. concentrator training related	0.0540*	2.522	455
Limited concentrator	-0.1053*	-4.602	382
Conc/explorer training related	0.0406	1.423	220
Concentrator/explorer	-0.0787*	-2.965	263
Academic student	-0.0514*	-3.261	1347
Self report vocational	0.0615*	2.687	357
Self-report academic	0.0346	1.881	657
Labor market experience	0.0022*	2.223	5923
Months on the job	-0.0003	-0.324	5923
Self-esteem	0.0037*	2.699	5684
MD self-esteem	0.0292	1.035	239
Not enrolled, no postsecondary	0.0094	0.666	1307
Not enrolled, 1 year postsec.	0.0003	0.015	367
Not enrolled, 2 years postsec.	0.0636*	2.486	279
Not enrolled, 3 years postsec.	0.0552	1.380	102
Not enrolled, 4 or more postsec.	0.2636*	11.370	425
Enrolled, not completed a year	-0.0061	-0.273	364
Enrolled, completed 1 year	-0.0387	-1.438	244
Enrolled, completed 2 years	-0.0841*	-3.718	398
Enrolled, completed 3 years	-0.0259	-0.933	243
Enrolled, completed 4 years	0.1495*	5.690	300

R^2 = 0.1396
Adj. R^2 = 0.1333
F-Statistic = 22.177

NOTE: MD refers to missing data, G.P.A. refers to grade point average.

*Indicates that the :e probability of an effect this large is $\leq$ .05.

Conclusions and Recommendations

This analysis was designed to assess the effects of a high school vocational curriculum over time as labor market experience accumulates. It also examined an alternative theoretical explanation of the net societal effects of the vocational curriculum. That will be discussed in chapter 4. The initial analysis presented here compared the effects of the vocational curriculum at two points in time, separated by two additional years of potential labor market experience. The analysis also considered the effects of high school vocational education on discounted lifetime earnings.

The results showed that the theoretical position suggested by Meyer (1982) is supported in the sense that the earnings curves of vocational and nonvocational graduates do converge. Vocational earnings were reported higher in 1983 than those of the comparison group, and about the same in 1985. There remained, however, an advantage for vocational graduates in monthly earnings when part-time work was controlled. Earlier studies (e.g., Gardner, Campbell, and Seitz 1982) had demonstrated that vocational concentration was associated with longer hours. Thus the non-chance finding of an earnings advantage for Concentrators when part-time work is controlled is consistent with the continued operation of an indirect effect of vocational concentration on earnings through hours worked. When discounted lifetime earnings are considered, the evidence supports a conclusion that the net effects of high school vocational training are positive if the vocational graduate enters a career related to the vocational education and has a sufficiently broad high school experience. The evidence speaks against an elimination of vocational training, but suggests that the effect of concentration in a vocational program at the expense of sufficient academic training may be, at best, neutral in the long term.

A researcher of integrity will always suggest the need to confirm the findings, particularly when they are contrary to popular expectations and involve complex assumptions. Accordingly, the first recommendation is that a reanalysis with alternative and subsequently available data be supported by policymakers. The second recommendation is that the current policy thrust toward greater academic requirements be tempered to prevent the loss of the opportunity for vocational training in the high school. Current policy should be focused instead upon the improvement of the quality of existing academic instructional time, particularly that which is provided to students concentrating in vocational studies. Also, it appears desirable to ensure that there is not an overconcentration in vocational courses if optimum lifetime earnings are the objective.

If the higher discounted lifetime earnings associated with being a Limited Concentrator do indeed reflect a higher level of productivity, and if the level is sufficient to offset the added costs, then there is a net societal gain for the approaches suggested by these recommendations. The functions of education that are not earnings related must continue, however, to receive careful consideration. This study did not address those issues.

CHAPTER 4

AN ALTERNATIVE THEORETICAL ASSESSMENT OF THE EFFECTS OF VOCATIONAL EDUCATION

For some time now, evaluations of vocational education program effectiveness have proceeded by comparing the post-training earnings of vocational education students with the earnings of otherwise identical individuals who have not received such training. This is a partial equilibrium approach that ignores the embeddedness of the training program within a labor market in which both participants and nonparticipants compete for some of the same jobs. Thus, labor market dynamics, in which wages adjust to equilibrate supply and demand for both program participants and nonparticipants, are also ignored.

In an important recent paper, Gustman and Steinmeier (1982a) repaired this neglect by formulating a simple general equilibrium model of the effects of a vocational training program within its local labor market. Their analysis reached two important conclusions. First, previous attempts to assess the impact of vocational education by comparing the earnings of trainees and nontrainees may have been seriously misleading. For example, a vocational education program large enough to enroll all interested students may raise the wages of both participants and nonparticipants, even while the difference between the wage levels of these groups diminishes to zero. So a finding of no difference between the earnings of trainees and nontrainees does not necessarily indicate an ineffective program. This result is important in view of the published empirical findings indicating little or no impact of vocational training on labor market outcomes (Grasso and Shea 1979; Mertens et al. 1980; Meyer and Wise 1982; Woods and Haney 1981).[3]

Second, the magnitude of vocational training effects may depend crucially upon the scarcity of vocational education training opportunities, measured by the relative size of the local program. Thus, proper estimation of such effects requires that this variable be explicitly measured and included in the analysis. This strategy was implemented by Blau and Robins (1987). Utilizing data collected for the evaluation of a program targeted to welfare and welfare eligible families in eleven states, they sought to estimate the effect of local vocational training opportunities on the economic outcomes of training program participants and nonparticipants. The effort was successful in that Blau and Robins' empirical results generally support the conjectures of Gustman and Steinmeier. However, some shortcomings of their data make their results less than fully conclusive. In particular, they utilize the Vocational Education

3 Other studies, however, do find positive individual-level effects of vocational education (see, e.g., Campbell et al. [1986] for a review and presentation of new findings).

Data System (VEDS) to measure the crucial independent variable--program size. They then find it necessary to include the disclaimer that "the VEDS data are generally considered to be highly inaccurate and the results presented in this paper should be viewed as suggestive only" (p. 118). The importance of the issues surrounding public training program effectiveness warrants a follow-up to both of these research efforts.

This paper seeks to provide such a follow-up. We begin by reviewing the conceptual issues raised first by the work of Gustman and Steinmeier and then by the work of Blau and Robins. Following these reviews, this paper reports three types of empirical evaluations of the Gustman-Steinmeier model and the empirical test of it conducted by Blau and Robins. First, we give an empirical assessment of the VEDS data. Second, we present preliminary empirical tests of two key assumptions of the model--that vocational training in secondary school commands a wage advantage in jobs related to the training, and that the supply of workers with secondary vocational training is limited. Third, the paper reports attempts to replicate the Blau-Robins results using a different sample than the one used by Blau and Robins.

Theoretical Issues

The Model

Gustman and Steinmeier's general equilibrium model is based on a two sector labor market for high school graduates. "O-type" jobs require only a traditional high school education whereas "T-type" jobs require training, which may be provided by a school-based vocational education program or by on-the-job training (OJT). Vocational education graduates can be hired into T-type jobs with no difficulty. In addition, any high school graduate who has not participated in vocational education can also be hired into a T-type job, but only by agreeing to undertake OJT. Such OJT is general rather than firm-specific and thus must be paid for by the worker. These costs--both direct (out of pocket) and indirect (lower productivity during the training period)--are paid for by the trainee's accepting a lower wage during the training period (Becker 1975). The resulting wage differential for different workers (vocational and nonvocational education program graduates) in the same T-type jobs is a key feature of the model. This is the mechanism by which "the market" (i.e., employers in a competitive situation) places a value upon the training provided by vocational education programs.

As usual, price (the wage rate) and quantity (the number employed) are jointly determined within each market (O-and T-type jobs) by the forces of demand and supply. Demand curves are downward sloping because they follow marginal revenue product curves, and with capital fixed in the short run, additional workers provide only declining marginal product. The analysis proceeds by distinguishing the two sectors, while recognizing their interdependence. This interdependence results from the two choices confronting workers. First, they must decide whether or not to take vocational training in high school. Second, those who choose not to do so must decide whether to take an O-type job or to agree to undertake OJT in order to qualify for a T-type job. We assume that each decision is based upon consideration of costs and benefits, prominent among which are the wage rates available to the particular individual within each type of employment.

For O-type jobs, there is a single (downward-sloping) demand curve. For T-type jobs, Gustman and Steinmeier draw two demand curves, one above the other. The top one is for vocational education program graduates, who can command a higher starting wage because they are already trained. The bottom curve is for those without vocational training, who must accept a lower starting wage to pay for their OJT. The wage difference (vertical distance) between the two curves "prices out" the market value of school-based vocational training.

These two demand curves for T-type jobs are to be thought of as a single demand curve, giving the wage rate offered for each type of labor at any particular value on the X-axis (total number employed in the T-type job sector). Of course, since the curves are downward sloping, the wage rate for each type of labor declines as the total number employed rises. At any particular value of this total number, the workers may be all vocational education graduates, all nongraduates, or any combination of the two. Employers hire indifferently from either of the two curves because the wage differential between them compensates for their different productivity levels.

Finally, dynamic aspects of the model are deduced by considering the two sectors side-by-side and noting that with a fixed number of high school graduates, each one who takes a T-type job is one less available to take an O-type job, and vice versa. Further, the greater the number of workers employed in any particular sector, the lower will be the wage in that sector (reflected by the downward-sloping demand curves).

There are two equilibrium conditions. First, we assume that students participate in school-based vocational education until the returns for doing so have been driven down to where they are the same as those for not doing so (i.e., the T-type wage for vocational graduates equals the O-type wage for nonvocational graduates). Of course, bringing the T-type wage all the way down to the O-type wage may require a very large school-based occupational education program--a program large enough to serve all who desire to participate. If the program is smaller than this, school-based vocational training should be regarded as scarce and opportunities to participate as rationed. Thus, program size becomes a key independent variable in the analysis.

Second, we assume that individuals who have not received school-based vocational training go into OJT on T-type jobs until the returns for doing so have been driven down to where they are the same as those for not doing so. That is, workers will sign up for OJT in the T-sector until the wage for doing so has been driven down to the O-sector wage level. (Recall that every worker appearing in the T-sector is one less in the O-sector. As fewer workers appear in the O-sector, we move leftward on its demand curve, raising the O-type wage rate.)

With these two equilibrium conditions added to the other assumptions of the model, it is possible to derive the number of students who will and will not participate in school-based vocational education, the number of O-type workers and the number of T-type workers of each sort (OJT and voc-ed trained), and their wage rates. This is worked out in great detail by Gustman and Steinmeier. The results are shown to depend upon the size of the secondary-based vocational program (that is, upon the scarcity of vocational training slots). In general, as program size increases, so do the benefits from the program, but these benefits are shared by nonparticipants as well as participants. That is, a larger program size (less scarce school-based training opportunities--a program which comes closer to meeting total demand) implies more workers qualifying for T-type jobs, which implies fewer workers (nonprogram participants) applying for O-type jobs, which raises the wage rate for nonprogram participants in O-type jobs. Thus, a larger program (more slots funded) produces larger net benefits by raising the wage level for both participants and nonparticipants.

At the same time, the larger the program, the smaller the wage differential between participants and nonparticipants. This follows from the first equilibrium condition--as program size becomes unlimited so that slots are available to all who want them, students should keep flooding into the programs until there is no net gain from doing so. So, the traditional focus on wage differentials between participants and nonparticipants is misplaced. An unlimited program (nonscarce training opportunities) would raise the wages of participants and nonparticipants over what they would receive in the absence of the program, even as it narrowed their wage differential to zero.

Discussion

The model has several attractive features. Prominent among these is the assumption that secondary-school vocational education is valuable (in a market sense) because it substitutes for OJT, and that this value is measured by the wage differential between program participants and nonparticipants when they both take T-type jobs. This is surely the correct way to conceptualize the economic value of vocational education.

A second attractive feature of the model is its general equilibrium nature--the incorporation of individual profit-seeking and labor market dynamics. The effect of this is to shift attention away from the comparison of participant to nonparticipant wages in the same local labor market and toward interlabor market comparisons of sites that vary on the extent to which school-based vocational training is a scarce good. This is consistent with the nature of the policy treatment contemplated. After all, decision makers proceed by allocating a certain funding level for vocational training slots in a particular area. All workers, both participants and nonparticipants, are subsequently affected by this decision. (For a similar approach to the evaluation of a youth training program, see Farkas, Smith and Stromsdorfer 1983.)

If Gustman and Steinmeier's analysis is correct, it is important that empirical work distinguish between equilibrium (nonrationing of secondary school vocational slots) and disequilibrium (rationing) situations. That is, program size becomes the key independent variable in any attempt to measure program effects. Thus, in equilibrium (unlimited program access), we would expect to see no differential return to vocational and academic credit hours. There would be a positive return to each, but these returns would equal one another. What, then, if the cost of school-based vocational education is higher than that of academic course offerings? One possibility would be to charge the differential cost to participants in the vocational program. This would somewhat decrease the vocational program enrollment and thus increase the returns to such enrollment, with enrollees paying a differential cost to offset their differential return.

Of course, this stylized model dramatically oversimplifies the world. Issues include (1) the possibility that vocational education functions as a signaling rather than (or in addition to) a productivity-enhancing device and (2) the realism of the two-sector model of the labor market. We discuss each of these in turn.

The signaling (or screening) explanation of the relationship between education and training, on the one hand, and earnings, on the other, has been widely explored (Spence 1973; Riley 1979a, b; Weiss 1983; Lang and Kropp 1986). It is certainly possible that participation in secondary vocational education functions largely as a signaling device for those workers possessing the native talent for T-type jobs. That is, such individuals invest in vocational education, which comes easier to them than to less talented individuals, as a signal of their talent to prospective employers. Yet in this case, much of the Gustman and Steinmeier analysis still applies. That is, such an "investment in signaling" is a productive activity in that these individuals will be better workers in T-type jobs. Thus, we will continue with the analysis without being too concerned about the share of vocational education which provides signaling as opposed to direct productivity enhancement.

As for the realism of the two sector labor market, it is obviously unrealistic. Rather, jobs exist on a continuum defined by the degree of substitutability between the OJT they typically provide and the vocational training provided by the secondary school system. However, modeling this would simply complicate the Gustman and Steinmeier scheme without substantially altering its theoretical implications.

The model depends crucially upon two assumptions. The first is that secondary vocational education does, in fact, substitute for OJT on certain (T-type) jobs. That this substitution occurs for certain jobs is empirically testable. The second assumption is that there is a limited supply of prospective employees with secondary vocational training.

Empirical Issues

Blau and Robins' Test

Blau and Robins (1987) provide the only attempt to test the Gustman and Steinmeier model. They utilize baseline data collected for the evaluation of the Employment Opportunity Pilot Projects (EOPP). Although this program was aborted, the baseline data provide a rich source of information on the employment and earnings of approximately 14,000 low- and middle-income individuals in 11 states during 1979-80.

The dependent variable is the individual's wage rate. The key independent variables are the individual's participation in any training program during this employment spell (a dummy variable denoted by T) and the size of the government training program in the individual's state during this time period (a continuous variable denoted by S). We discuss each of these in turn.

The types of training included in T are those provided by business, technical, and vocational institutes, and formal on-the-job training programs. A special strength of this data set is the availability of this measure; very few large data sets contain questions on such employment-related training. However, only 3 percent of the individuals in the sample report participating in such programs, a figure which appears low in comparison to the usual reports of vocational education enrollments.

A variable denoted "Voced" seeks to measure the scarcity of local secondary-school training opportunities. It is computed as a ratio--the numerator being state enrollments in high school vocational education programs as measured by the VEDS data, and the denominator being Census counts of the size of the state's labor force. Issues associated with the VEDS data are discussed in the following section.

Blau and Robins include trainees and nontrainees in the same calculation to predict the logarithm of the wage rate. Their specification includes T, S, and the interaction between these variables. The Gustman and Steinmeier model is tested by checking whether wages rise for both trainees and nontrainees as program size (S) increases, and whether the wage differential for trainees and nontrainees approaches zero as program size increases. Both predictions are confirmed.

Discussion

Notwithstanding the attractiveness of its measure of recent training activity, the EOPP baseline survey has a number of weaknesses as a source for testing the Gustman and Steinmeier model. To begin with, it focuses on older workers--the average male in the sample has approximately 16 years of work experience. Since the substitution of secondary vocational training for OJT is expected to occur at the beginning of the individual's career, it is difficult to understand how or why the expected effects would be visible in a data set composed largely of very experienced workers. Additionally, the T variable and S variable do not match. The T variable measures training in government training programs, not secondary vocational education, but the S variable is a measure of the size of secondary vocational training programs.

Also, the EOPP data are not nationally representative and are not even fully representative of the eleven states from which they are drawn, because they oversample low- and middle-income families. By utilizing a data set constructed from this sample selection rule for the study of midcareer workers, Blau and Robins end up with an oversampling of workers whose careers have not been particularly successful. That is, the sample overrepresents those who either received little training or, for some reason, received a low economic return on their training. Once again, this is far from an ideal basis upon which to test the general equilibrium model

Finally, the S variable, which is intended to measure the relative scarcity of local secondary-school vocational training opportunities, is not an accurate measure. This is true with regard to both the numerator and the denominator. Regarding the numerator, the VEDS data are reputed to provide a highly unreliable measure of vocational enrollment. As the denominator, the authors use the total labor force in the state, whereas the most appropriate population is surely the population of secondary-school students. In addition, state aggregated data hardly capture the true variation in local labor markets.

With all of these difficulties, the remarkable thing is that Blau and Robins achieve statistically significant results that match the predictions of the Gustman and Steinmeier model. We are unable to account for this, and cannot say whether, on the one hand, these results are entirely spurious (possibly due to correlated unmeasured variables operating across the eleven states), or, on the other hand, they reflect very powerful Gustman and Steinmeier effects, whose less powerful echo is detectable despite data difficulties. In the remainder of this paper we begin the process of exploring these possibilities.

Data and Methods

The primary source of the data used in this paper is the younger cohort of the High School and Beyond (HS&B) survey. These data consist of individuals who were enrolled as high school sophomores in U.S. high schools in 1980. Follow-up surveys of this sample were conducted in 1982, 1984, and 1986. This paper uses data from the first three waves of the survey (1980, 1982, 1984). The original sample consisted of some 30,000 individuals. Transcript data describing courses and grades are available for nearly 16,000 members of the sample, but the number of usable transcripts is only about 12,000. Additionally, the National Center purchased state identifiers for each member of the HS&B sample. These identifiers permit us to conduct approximate replications of the Blau and Robins work using the HS&B data. (See Jones et al. [1986] for a detailed description of the younger HS&B sample.)

In addition, we collected the 12-year time series of VEDS estimates of total vocational enrollment by state and the District of Columbia and census data giving the total labor force size for states and D.C. It should be emphasized that the VEDS data include secondary and postsecondary enrollment combined.[4]

In a statement accompanying VEDS data dissemination, we are informed that "readers should know that the Office of Management and Budget has acted to suspend the collection of VEDS data for 1983-84 and 1984-85. Citing 'severe problems of inaccuracy,' OMB has indicated that the suspension will remain in effect until the Department implements a plan for improving VEDS." (For additional information, contact the Center for Education Statistics.)

Two types of structural models are reported in this paper. The first is a very simple model estimated for those in T-type jobs only. This model is as follows:

$$\log(w) = a + bT + q'x + u \qquad (1)$$

where

w = wage for the first job after high school

T = training dummy

x = a (column) vector of controls

4 We also collected secondary enrollment and secondary completers data by state and the D.C. These data exhibit more erratic changes over time than total enrollment. For this reason, and because Blau and Robins used total enrollment, this paper reports results for total enrollment only.

u = disturbance, with $E(Tu) = E(x'u) = 0$

a, b = scalar constant paramaters

q = a (column) vector of constant parameters (prime means transpose)

The vectors x and q have the same number of elements. Since the sample for this model is confined to tnose in T-type jobs, the parameter b measures the veracity of the Gustman and Steinmeier assumption that high school vocational training will command a wage advantage in T-type jobs.

Of course, b is only a partial measure of this assumption because it is predicted to be positive only if the supply of workers with high school vocational training is restricted. Concomitantly to estimating equation (1), therefore, we also present evidence that the supply is, in fact, limited.

The second model is a replication of the Blau-Robins test--

$$\log(w) = a + bT + cS + dTS + gS^2 + q'x + u \qquad (2)$$

where S = vocational program size in the state of residence, c, d, and g are constants, and the other symbols are defined as in (1).

Wage is measured as self-report of respondents in the second follow-up HS&B survey. It is therefore subject to the usual errors of recall over a period just under 2 years long.

In addition to wage, there are three types of primary variables required for these analyses. These are training (T), type of job (T-type and O-type), and program size (S). Each of the primary variables is represented by more than one operational measure. Additionally, several predetermined controls (x) are included on the right side of all the models. The operational measures are defined below.

Training

There are two aspects of defining the T dummy. First, it is necessary to classify high school courses into types of vocational specialties. Second, one must determine criteria for classifying individuals as "trained" or "not trained." High school courses were classified from the HS&B transcripts file. Three dummy variables were constructed as follows:

VOC = 1 if vocational student in high school, 0 otherwise

TRNBSN = 1 if vocational business & office student in high school, 0 otherwise

TRNTI = 1 if vocational T&I student in high school, 0 otherwise

Courses were classified into one of the seven vocational service areas: agriculture, business and office (clerical, & business), health, trade and industry (T&I), occupational home economics, distributive education (marketing, retail sales), and technical. Technical and T&I were combined into a single category because of the low incidence of students in technical courses. Courses taken by respondents were classified into one of these vocational specialties by reference to the secondary curriculum classification scheme developed by the National Center for Education Statistics and used in the HS&B transcript study (see NCES 1982).

The degree of concentration in vocational curriculum is derived from a classification scheme developed by Paul Campbell and his associates at the National Center (Campbell et al. 1986). Individuals are classified into five categories. In order of degree of vocational training, these are Vocational Concentrator, Limited Concentrator, Concentrator/Explorer, Incidental/Personal, and Nonvocational. Students classified as Concentrators or Limited Concentrators were defined as vocational students for this paper.

Vocational students by this definition were coded 1 on VOC, and everyone else was coded 0. Vocational students with a specialty in business and office were coded 1 on TRNBSN, and others were coded 0. Similarly, vocational students with a T&I specialty were coded 1 on TRNTI, and others were coded 0.

The general vocational variable (VOC) is included in the analyses presented here because it is as close to the Blau and Robins measure as is available in the HS&B data. It is not a good measure for testing the Gustman and Steinmeier model, however, because individuals coded as 1 on VOC are too heterogeneous; they do not represent a cadre of individuals trained for a specific type of job (T-type) as required by the theory. The other two training measures (TRNBSN and TRNTI) identify individuals who are more nearly homogeneous with respect to their secondary vocational training. It will be informative to compare results with the alternative measures of T.

Job Type

Identification of T-type jobs was based on the 1980 3-digit census occupation codes derived from a crosswalk between the secondary vocational service areas (listed above) and the census occupations. The crosswalk was developed by the National Occupational Information Coordinating Council. Since the HS&B occupations are recorded according to the 1970 3-digit census codes, a second crosswalk between the 1970 and 1980 occupation codes also was used. We use the following two types of jobs:

JOBBSN = 1 if a business and office job, 0 otherwise

JOBTI = 1 if a T&I job, 0 otherwise

It should be noted that any given 3-digit code may be related to more than one vocational service area. Attention in this paper is confined to these two job types because they correspond to the two most emphasized and populous secondary vocational service areas.

Program Size

Two sources of estimates of program size are used. The first is the VEDS, divided by census estimates of state labor market size. The second is the HS&B. We aggregated the individual measures VOC, TRNBSN, and TRNTI up to the state level by computing state proportions for each variable. Including the VEDS measure, these procedures result in the following four operational size measures:

SIZVEDS -- measure based on the 1980 VEDS reports of total vocational enrollment and the census labor force data

SIZVOC -- state proportion for VOC

SIZBSN -- state proportion for TRNBSN

SIZTI -- state proportion for TRNTI

Predetermined Variables

In identifying a set of predetermined controls, we attempted to include those used by Blau and Robins and additional variables that are useful for the HS&B sample. These variables are as follows: eight region dummies, rural residence in 1982 dummy, urban residence in 1982 dummy (suburban omitted), binary variable for black, binary variable for Hispanic, log of family income in 1980 (as reported by sophomore respondent), an SES index for 1980, verbal test score in 1982, math test score in 1982, self-assessed ability to complete college reported in 1982, average weekly hours spent on homework in 1982, average perceived high school grades, labor market experience during high school (rough estimate), wage of current or most recent job measured at first follow-up (senior year in high school for most respondents), never worked during high school dummy, and high school dropout dummy. The wage variable was set to 0 if the respondent had never worked, and the never worked dummy was included in the specifications, operating as a missing data dummy. Complete definitions of these variables are available from the authors on request.

Accuracy of the VEDS Data

Two tests of the accuracy of the VEDS data were conducted. First, as a test of whether or not these numbers vary randomly, we regressed the VEDS report of total secondary enrollment in vocational education (the variable used in the numerator of the S variable by Blau and Robins) on its lagged value separately for each state. The results are displayed in table 9.

Across 50 states and the District of Columbia, the regression slope is positive and statistically significant in 42 out of the 51 calculations. In most cases the coefficient is quite high. Thus, these data are far from random; rather, each year's value depends strongly upon that of the previous year.

In order to test for patterns of misreporting and other sources of deviation, table 9 also reports the largest studentized residual and the year it occurred for each of the states. (The studentized residual divides the residual by its standard error, so that it becomes a t-statistic. The years are numbered from 1 to 12 beginning with 1972.)

No one of these studentized residuals stands out as being terribly large--thus, none reach the 3.0 level. There is some tendency for the largest values to occur in year 9 (1980)--19 of the 51 largest t-values values occurred for this year. Interestingly, this is one of the two years focused on by Blau and Robins. Nevertheless, there is nothing very obviously amiss in these data.

The second test is a correlation between SIZVEDS and SIZVOC. This correlation is negative (-0.188), but it is not statistically significant.[5] It is concluded that, while the VEDS data exhibit a modicum of stability over time, their accuracy as a basis for measuring program size is questionable. Of course, the low correlation between SIZVEDS and SIZVOC may be due in part to the use of total state labor force size as the denominator of the SIZVEDS measure.

Tests of Key Assumptions

This section presents results from the HS&B data to test (1) the assumption that high school vocational education commands a wage advantage in T-type jobs and (2) whether the supply of workers with secondary vocational training is limited. Since the wage advantage of former vocational students is predicted only if their supply is limited, it is useful first to determine what percentage of T-type jobs is filled by employees with related secondary vocational training. For this analysis, two T-type jobs are used, business and office and T&I. Table 10 shows the cross classifications between (1) secondary business and office training (TRNBSN) and a business and office type of job as the first job

5 The correlations between SIZVOC and the VEDS estimates of (1) secondary enrollment and (2) secondary completers are 0.003 and 0.175, respectively. Neither correlation is statistically significant.

TABLE 9

REGRESSION ANALYSIS OF VEDS DATA: ANNUAL SECONDARY SCHOOL ENROLLMENT REGRESSED ON ITSELF WITH LAG 1

State	Coeff (t)	Largest Studentized Residual/Year (1=1972)
AK	0.436 (1.4)	-2.34/9
AL	0.642 (3.9)	1.81/3
AR	0.705 (5.1)	2.33/4
AZ	0.740 (5.8)	-2.14/11
CA	1.039 (11.2)	1.71/8
CO	0.781 (4.3)	1.61/6
CT	0.202 (0.7)	-2.17/8
DC	0.511 (1.8)	2.68/9
DE	0.655 (2.8)	-2.21/9
FL	0.802 (7.2)	1.8 /9
GA	0.585 (2.8)	-1.6 /11
HI	0.709 (3.0)	-1.8 /9
IA	0.636 (3.0)	-1.8 /3
ID	0.885 (7.0)	-2.6 /9
IL	0.661 (2.9)	-2.2 /5
IN	0.466 (1.9)	-2.0 /9
KS	-0.298 (0.6)	2.1 /11
KY	0.977 (17.3)	1.8 /9
LA	0.803 (5.1)	-2.2 /10
MA	0.978 (5.7)	2.3 /9
MD	0.403 (1.8)	2.6 /8
ME	0.615 (2.7)	2.1 /5
MI	0.549 (2.5)	2.2 /5
MN	0.554 (1.7)	-2.7 /9
MO	0.800 (3.5)	-2.6 /3
MS	0.739 (5.2)	2.2 /5
MT	0.661 (2.3)	-2.1 /8
NC	0.617 (5.4)	2.3 /5
ND	0.615 (3.2)	-2.4 /9
NE	0.460 (2.2)	2.0 /6
NH	0.571 (2.0)	-1.5 /8
NJ	0.825 (4.7)	2.3 /7
NM	0.127 (0.4)	1.4 /4
NV	0.160 (0.6)	-2.4 /2
NY	0.672 (3.2)	2.5 /8
OH	0.980 (8.9)	1.6 /9
OK	0.697 (3.0)	-1.9 /10
OR	0.676 (2.9)	-1.6 /9
PA	0.785 (5.8)	-2.2 /2
RI	0.837 (5.5)	2.1 /9
SC	0.712 (4.0)	-2.1 /9
SD	0.887 (3.1)	-2.0 /11
TN	0.952 (12.0)	1.7 /7
TX	-0.145 (0.4)	-2.5 /7
UT	0.083 (0.2)	-2.2 /8
VA	0.601 (4.0)	-2.5 /9
VT	0.183 (0.6)	2.3 /4
WA	0.850 (7.2)	2.0 /9
WI	0.967 (6.4)	2.2 /9
WV	0.944 (11.1)	-1.5 /10
WY	0.050 (0.1)	-2.5 /9

TABLE 10

CROSS TABULATIONS BETWEEN TYPE OF TRAINING
AND TYPE OF 1ST JOB: BUSINESS AND OFFICE AND T&I

Business and Office 1st Job	Business and Office Training: No	Yes	Total
No	78.2%	61.7%	72.3%
Yes	21.8	38.3	27.7
Total	100.0 (6197)	100.0 (3396)	100.0 (9593)

$\phi = 0.1761$ $\phi^2 = 0.0310$ $X^2 = 297.6$ $p < 0.001$

T & I 1st Job	T & I Training: No	Yes	Total
No	69.8%	52.6%	66.3
Yes	30.2	47.4	33.7
Total	100.0 (7620)	100.0 (1973)	100.0 (9593)

$\phi = 0.1474$ $\phi^2 = 0.0217$ $X^2 = 208.4$ $p < 0.001$

NOTE: Numbers in parentheses are percentage bases.

(JOBBSN), and (2) secondary T&I training (TRNTI) and a T&I 1st job (JOBTI).

It is clear from the data that most T-type jobs, whether business and office or T&I, are not filled by secondary vocational graduates with corresponding training. In the HS&B sample, only 1,301 out of 2,654 business and office jobs were filled by vocational graduates with business and office training (49.0%). For T&I type jobs, only 936 of 3,287 T&I jobs were filled by those with secondary T&I training (28.5%). Even allowing for a wide latitude in defining training type and job type, it appears that one key condition for the Gustman and Steinmeier model to apply is, in fact, satisfied. The supply of prospective workers in T-type jobs with relevant secondary vocational education appears to be limited. Much of the reason for the limited supply, however, is not a limited number of persons trained but rather the low relationship between type of training and type of job. Less than 40 percent of those with secondary business training obtain business and office first jobs. About 47 percent of those with secondary T&I training obtain T&I first jobs.

One OLS regression was run with log(w) as the outcome and the business and office training dummy (TRNBSN) and the controls identified earlier on the right. The sample for this regression consisted of noncollege respondents in business and office type first jobs (JOBBSN=1). The second regression parallels the first except that T&I is everywhere substituted for business and office. The sample for the second regression was restricted to noncollege respondents with T&I first jobs. Table 11 reports the findings separately for males and females. The HS&B data lend no support for the presumption that secondary vocational education commands a wage advantage in T-type jobs. None of the coefficients associated with the training dummies is statistically significant, the point estimates of effects are small, and two of the four are negative, counter to theoretical expectation. It is interesting that one of the positive coefficients is for males in business and office jobs, and the other is for females in T&I jobs. This pattern suggests that the training advantage may be confined to those in occupations that are "nontraditional" for their sex.

Tests of the Blau and Robins Specification

If the wage advantage of those with secondary vocational training were small relative to the standard deviation of wage, then the relatively small samples reported in table 11 might not identify vocational education effects on wage. This section reports four types of analyses using the basic Blau and Robins model. In the first type of analysis, the VEDS estimates of program size (SIZVEDS) are used. In the second, the total vocational enrollment in HS&B (SIZVOC) replaces the VEDS data. In the third and fourth types, SIZBSN and SIZTI are used as the

TABLE 11

ESTIMATES OF JOB-SPECIFIC TRAINING EFFECTS ON LOG OF 1st WAGE: BUSINESS AND OFFICE AND T & I

	Females			Males		
Training Type	b	t	(n)	b	t	(n)
Business & Office	-0.0474	-1.319	(507)	0.0655	0.519	(133)
T & I	0.0302	0.441	(292)	-0.0029	-0.111	(933)

NOTES:

1. Entries under column labeled b are regression coefficients associated with the training type.

2. The sample for business and office effects is restricted to noncollege respondents with business and office first job. The sample for T & I effects is restricted to noncollege respondents with T & I first jobs.

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program size variables, respectively. The operational models used in the regressions are as follows:

$$\log(w) = a + b*TRNVOC + c*SIZVEDS + d*TRNVOC*SIZVEDS + g*SIZVEDS^2 + q'x + u \quad (3a)$$

$$\log(w) = a + b*TRNVOC + c*SIZVOC + d*TRNVOC*SIZVOC + g*SIZVOC^2 + q'x + u \quad (3b)$$

$$\log(w) = a + b*TRNBSN + c*SIZBSN + d*TRNBSN*SIZBSN + g*SIZBSN^2 + q'x + u \quad (3c)$$

$$\log(w) = a + b*TRNTI + c*SIZTI + d*TRNTI*SIZTI + g*SIZTI^2 + q'x + u \quad (3d)$$

The last two versions of the model probably reflect the theory better than the first two, because the training and size variables in the latter two models more nearly reflect coherent labor markets with homogeneous T-type jobs.

The findings for these four models are reported in table 12. These data lend scant support for the Gustman and Steinmeier model as specified by Blau and Robins. Few of the coefficients are statistically significant (2 out of 32 for a 2-tailed test at $p < 0.05$),[6] and the pattern of signs predicted by the theory (positive on T and S and negative on T*S and S^2) is often violated. Estimates for females with the VEDS data are closest to supporting the theory. The pattern of signs is correct, and all the t values are larger than 1 in absolute magnitude. None of the other seven sets of estimates even matches the predicted pattern. It is concluded that the Blau and Robins findings are not replicated in the HS&B data.

Summary and Commentary

This paper investigates the relationship between the wage advantage of employees with secondary vocational education and the economic value of vocational education. Gustman and Steinmeier (1982a) argue that in a competitive labor market with no restrictions on the size of secondary vocational programs, workers with secondary vocational training would receive no wage advantage, no matter how effective the vocational training. Only with a restricted supply of vocationally trained workers does a wage advantage accrue to them. Yet, given that secondary vocational training is a good substitute for OJT, the wages of all workers are improved by secondary vocational education. This occurs even though in a competitive market vocationally trained workers make the same wage as those without vocational training. This is a critical theoretical point because so much evaluation of job

6 One might argue that 1-tailed tests should be applied, in which case 4 of 32 coefficients are significant with the predicted sign.

TABLE 12

ESTIMATES OF TRAINING AND SIZE EFFECTS ON LOG OF 1ST WAGE

Independent Variables	Females b	Females t	Males b	Males t
VEDS program size data	n = 1399		n = 1814	
TRNVOC	0.081	1.036	-0.017	-0.264
SIZVEDS	1.698	1.421	0.295	0.291
TRNVOC*SIZVEDS	-0.712	-1.489	0.010	0.025
$SIZVEDS^2$	-3.869	-1.088	-0.109	-0.037
HSB/VOC program size data	n = 1399		n = 1814	
TRNVOC	-0.161	-1.427	-0.037	-0.426
SIZVOC	0.469	0.333	-0.262	-0.221
TRNVOC*SIZVEDS	0.422	1.223	0.082	0.307
$SIZVOC^2$	-1.067	-0.524	-0.078	-0.046
HSB/BSN program size data	n = 1501		n = 1944	
TRNBSN	-0.091	-1.124	-0.119	-1.063
SIZBSN	1.347	1.880	1.468	2.633
TRNBSN*SIZBSN	0.220	0.757	0.506	1.365
$SIZBSN^2$	-2.347	-1.753	-2.753	-2.660
HSB/T&I program size data	n = 1501		n = 1944	
TRNIT	0.037	0.219	-0.112	-1.737
SIZIT	-0.069	-0.144	-0.170	-0.510
TRNTI*SIZTI	-0.173	-0.311	0.251	1.139
$SIZTI^2$	0.212	0.290	-0.082	-0.167

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training, not just secondary vocational education, is based on a comparison of wages and/or earnings of those with the "treatment" and those without it.

Blau and Robins (1987) report the only empirical test to date of the Gustman and Steinmeier theory. They use Employment Opportunity Pilot Project (EOPP) data for all variables except vocational program size and they use the Vocational Education Data System (VEDS) and census labor market data to estimate program size. These data produce empirical effect estimates that match closely the theoretical predictions of the Gustman and Steinmeier model.

There remain, however, important unresolved questions about the model. First, the data used by Blau and Robins are not ideally suited to test the theoretical model. The EOPP data contain a sample of older workers rather than entry-level workers and jobs. Also, the reliability of the VEDS data is questionable. Second, two critical assumptions of the Gustman and Steinmeier theory have not been tested before now--that secondary vocational education commands a wage advantage in jobs related to the training, and that the supply of vocationally trained workers is limited. Third, secondary vocational education is heterogeneous, but the theory applies to homogeneous training suited for a relatively narrow band of T-type jobs. Finally, the vocational program size variable in the Blau and Robins study uses states and D.C. as the unit aggregation of analysis. Local labor markets would comprise much better units.

This paper reports limited steps toward answering the first three of these questions. First, we evaluate the reliability of the VEDS data. It is found that these data are relatively stable over time, but the VEDS estimates of vocational program size as a proportion of the labor market size correlates negatively, but not significantly, with a parallel measure derived by aggregation of HS&B data up to the state level. Second, we test the two key assumptions of the Gustman and Steinmeier model. The HS&B data do support the assumption that the supply of vocationally trained workers in T-type jobs is limited, but they fail to support the contention that vocationally trained workers in T-type jobs command a wage advantage. Third, the paper compares estimates of the Blau and Robins specification using the HS&B data and four different measures of program size.

The four measures are VEDS, HS&B aggregate estimates for all vocational students, HS&B aggregate estimates for business and office students, and HS&B aggregate estimates for trade and industry students. These empirical tests should be more credible than those reported by Blau and Robins because they are carried out for first jobs (after high school) of respondents, they are for a nationally representative sample, and they contain estimates for relatively homogeneous training and jobs. None of the eight sets of estimates (done by gender) support the Gustman and Steinmeier model. Only one set exhibits the expected pattern of signs on the key coefficients.

On the basis of the evidence presented here, there is little support for the Gustman and Steinmeier model. The key finding is that secondary vocational education does not bring a wage advantage in jobs related to the vocational training (T-type jobs).[7] If this effect does not hold, then the primary assumption of the model is violated. Additionally, analysis presented here adds to prior evidence of the low quality of the VEDS data used by Blau and Robins, and we are unable to replicate the Blau and Robins results using alternative measures of program size.

The present results are not conclusive, however. First, our data measuring program size are not ideal. An adequate test requires a much larger sample than the HS&B for estimating program size and more homogeneous labor markets than states. Second, the measures of vocational training and job type are rough classification schemes. Changing the classification rules might have an important impact on the conclusions. More generally, using the number of credits in specified types of courses and a profile describing the degree of relatedness of specific occupations to different types of training is conceptually preferable to reliance on essentially artificial dichotomies. Third, in confining the analysis to noncollege respondents, we introduce potential selection bias. It is conceivable that the present results would be altered if the proportion of high school graduates attending college shifted rapidly.

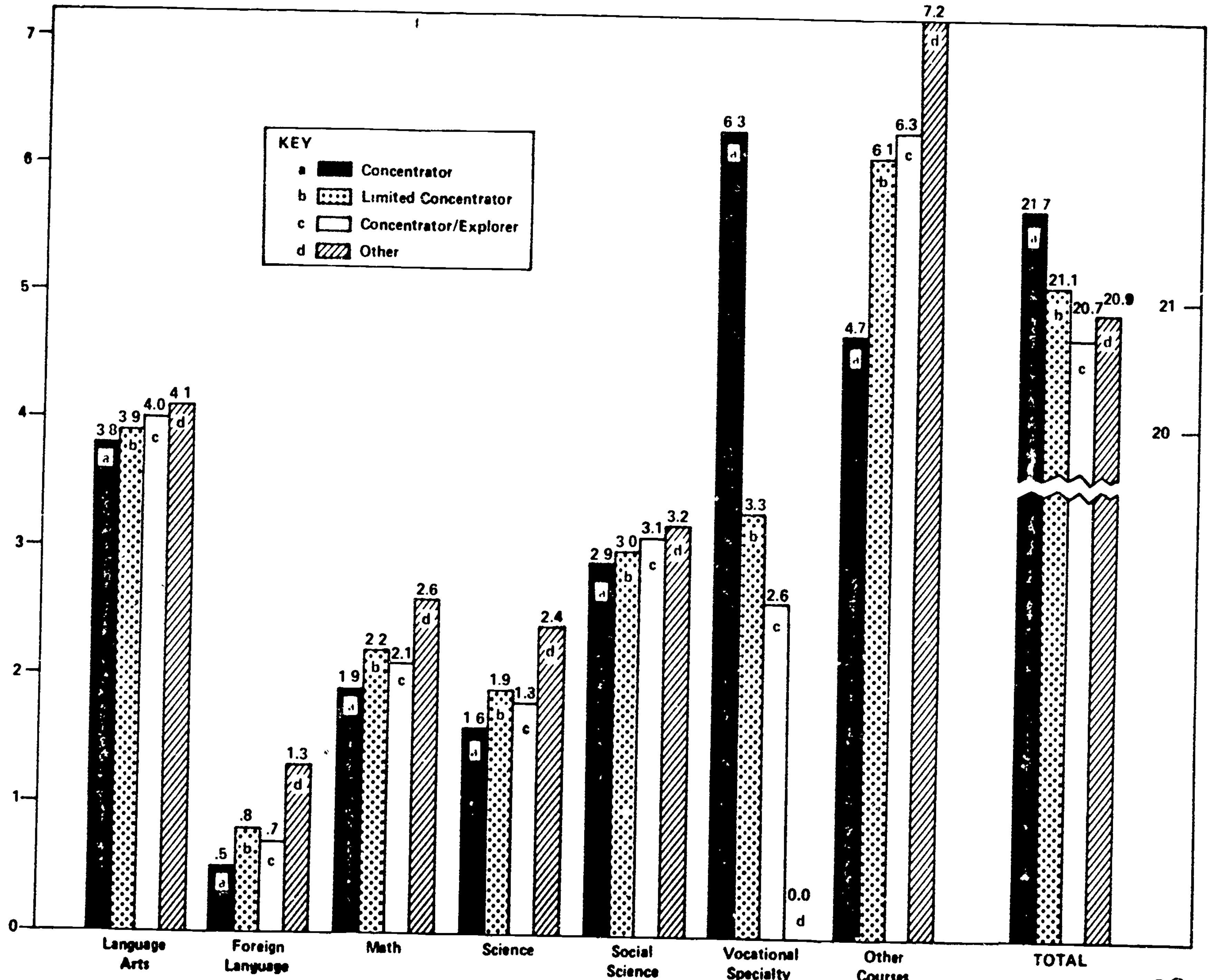
Additional regressions that were calculated from the HS&B sample but not reported in this paper show strong positive wage effects for females obtaining a business and office job and even stronger positive effects of trade and industry jobs for males. Combining these results with the positive relationships between type of training and type of job reported in table 10 suggests that secondary vocational training may bring a wage advantage indirectly, by influencing the type of job. It is also possible that vocational education influences the amount of time spent working (hours per week, weeks per year) thereby affecting earnings (see Campbell, Gardner, and Seitz 1982). It is a good hypothesis that at least part of any effects of vocational education on time spent working operates through choice of job type. An important extension of the current paper would be to combine these speculations into competing models of the influence

7 This result may appear to conflict with other findings in this report and in past conclusions by Campbell and his coworkers. Such is not the case, however. The present findings simply decompose the effects of training-related job into their components--type of training and type of job. We find that the primary reason for effects of a training-related job on wage is the type of job, not the type of training.

of secondary vocational education job outcomes and test the implications of the alternative models.[8]

8 See Schwartz (1985) for a review of the special impact of measurement error in binary (and nominal) variables. He shows that measurement error must be correlated with the "true score" for binary variables.

APPENDIX



SOURCE: National Longitudinal Survey - New Youth Cohort (1983)

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