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ABSTRACT

For more than a decade William H. Sewell and his associates have based their stratification research on a multivariate social psychological model of achievement. The model--first developed and estimated in the Wisconsin Longitudinal Study--posits that the influence of socioeconomic origins on educational, occupational, and economic attainment is largely mediated by academic performance, social influences, and aspirations in secondary schooling. The model, which has come to be known as the "Wisconsin model," has been widely replicated, elaborated, and criticized. The present analysis asks how powerful this model might be in accounting for social influences, aspirations, and attainments. It tests a number of hypotheses about the specification of the structural model and about the quality of the indicators on which the model is based. There are two measurements of most theoretical constructs in the model, and many of these measurements were ascertained from independent sources or as many as twenty years apart. The model identifies selected response error correlations between variables ascertained on the same occasion, from the same person, or using the same method. The model also permits retrospective reports of social influences and aspirations to be contaminated by intervening events. Thus, the analysis provides new evidence about the stratification process and about the validity of retrospective and contemporaneous reports of socioeconomic and psychological variables.

1.0 INTRODUCTION

The Sewell, Haller, and Portes (1969) paper, "The Educational and Early Occupational Attainment Process," was the first major effort to provide a social psychological elaboration of the Blau-Duncan (1967) model of occupational stratification. Using longitudinal data for farm boys who graduated from Wisconsin high schools in 1957 and were followed up in 1964, Sewell, Haller, and Portes used the block-recursive path model shown in Figure 1 to interpret the stratification process.

The model argues that socioeconomic status (X_7) and mental ability (X_8) are correlated and that each of them affects academic performance (X_6), though the effect of socioeconomic status is theoretically dubious. Socioeconomic status and academic performance affect an index of perceived influence from significant others toward college attendance (X_5). In turn that variable transmits the influence of socioeconomic status, ability, and academic performance on educational (X_4) and occupational aspirations (X_3) and, through them, to educational (X_2) and occupational (X_1) attainments. While post-secondary education is supposed to affect occupational status, there is no causal nexus between educational and occupational aspirations; however, there is correlation between their unmeasured causes (X_w and X_x). Educational aspiration affects educational, but not occupational attainment, and occupational aspiration affects occupational, but not educational attainment. Last, another possible causal link was postulated from significant others' influence to educational attainment.

The Sewell-Haller-Portes model accounted for 50 percent of the variance in post-secondary schooling and 34 percent of the variance in occupational socioeconomic status. Moreover, the model was quite parsimonious, since it postulated only 12 direct causal paths or correlations linking the 8 measured variables. The model was a modified causal chain, lacking 16 of the 26 possible causal paths conditional on the specified ordering of the variables. Excepting the debatable (and negligible) path from socioeconomic status to academic performance, each of the postulated path coefficients (shown in Figure 1) turned out to be larger than any of those excluded a priori (1969:88). At the same time, several of the excluded path coefficients were too large to ignore in further development of the model.

Sewell, Haller, and Ohlendorf (1970) reestimated the model for men from each of five size-of-place categories in the Wisconsin sample, and they revised the specification of the model to include only those path coefficients (of variables in standard form) that exceeded .15 in the total sample and in three of the five community size subsamples. As shown in Figure 2, their revisions of the original model primarily reflected a reassessment of the influence of academic performance, as measured by rank in high school class. They deleted the dubious path from socioeconomic status to academic performance, and inserted paths from mental ability to significant others' influence and from academic performance to educational aspiration, occupational aspiration, and educational attainment. Thus, of 26 possible causal links (excluding the unanalyzed correlations between X_7 and X_8 and between X_w and X_x), the revised model incorporated just 15 direct paths. While the revised model accounted for 57 percent of the variance in post-secondary schooling and 40 percent of the variance in occupational status in the total male Wisconsin sample, there were still five excluded paths whose coefficients exceeded 0.12 in unrestricted estimates of the model. Thus one might quarrel with the liberal rule used by Sewell, Haller, and Ohlendorf to "trim" coefficients from their model and, in that way, to retain the imagery of a modified causal chain (Heise 1969).

These two papers of Sewell, Haller, and their colleagues proved to be influential, and other investigators sought to replicate, compare, and elaborate their findings. What has come to be known as the "Wisconsin model" has been used in comparisons of stratification processes between men and women, between blacks and whites, and between adolescents in differing societies and at different times. Numerous elaborations of the model have sought to establish and interpret the role of variables that were not included in the initial formulations: additional familial, ethno-religious, and residential background variables; high school counseling and curricula; aggregate features of high schools and colleges; earnings; labor market structures; and aspects of marriage and family formation. These developments have been reviewed comprehensively by Sewell and Hauser (1980).

2.0 PURPOSES OF THE ANALYSIS

The extensive research uses of the Wisconsin model have, with few exceptions (Haller and Portes 1973, Haller 1982), tended to ignore theoretical predictions that certain path coefficients could be excluded from the model. Rather, researchers have tended to estimate all of the potential coefficients in the model and to use it as a baseline or maintained hypothesis against which to test some novel effect. That is, researchers have tended to accept the evidence of ordinary regression analysis in preference to theory, and they have tended to elaborate, rather than to pare the model.

In contrast, the main purpose of this paper is to return to the original hypothesis of Sewell, Haller, and Portes that the stratification process is a modified causal chain. We begin with the limited set of theoretical constructs in the initial formulation of the model--though we use several more variables to represent those constructs--and we seek to reduce the direct paths in the model to those which are both theoretically plausible and empirically necessary to account for the data.

Our analysis is based upon the same Wisconsin men studied by Sewell and his colleagues, but their data have been supplemented by observations from a new follow-up survey conducted in 1975 (Clarridge, Sheehy, and Hauser 1977, Sewell, Hauser, and Wolf 1980). The methodological basis of our revised analysis of the Wisconsin data is that we have obtained two measurements of most theoretical constructs; that is, we attempt to purge response variability from estimated coefficients of the model. We address several analytic questions beyond the validity of the causal chain hypothesis. Just how powerful is the model in accounting for intervening variables and outcomes of the stratification process? How valid and reliable are the survey (and other) data on which this and other stratification models have been based? What are the major sources of invalidity and unreliability? What are the more (and less) plausible causal specifications of the structure of socioeconomic background, academic performance, significant others' influence, and ambition? Under what specifications might we claim to have "explained" ambition or social influences on aspiration? We elaborate these questions as we address them in the course of the analysis.

3.0 RESPONSE ERROR IN STRATIFICATION MODELS

Fortunately, it is no longer possible to state that response errors are routinely ignored in research on the stratification process. Bowles' suggestion (1972; also, see Bowles and Nelson 1974, Bowles and Gintis 1976) that retrospective proxy reports of parents' status characteristics are especially prone to error have stimulated several validation studies. These have vastly increased our knowledge about response error, but provided little support for Bowles' ideas. Borus and Nestel (1973) ascertained correlations between father's and son's reports of the father's educational attainment ($r = .95$, $N = 913$) and father's occupational status ($r = .89$, $N = 661$) among father-son pairs in overlapping panels of the 1966 National Longitudinal Surveys. Featherman (1980) ascertained correlations between son's report and matched U.S. Census report (presumably made by a parent) of father's educational attainment ($r = .76$, $N = 125$), father's occupational status ($r = .78$, $N = 283$), and family income ($r = .28$, $N = 127$) for Wisconsin men who responded in the 1973 Wisconsin Occupational Changes in a Generation Survey and whose fathers could be located in records of the U.S. Census nearest the son's 16th birthday. In neither of these studies was it possible to apportion response variability between fathers and sons.

In a study of white boys in the 6th, 9th, and 12th grades in Fort Wayne, Indiana, Mare and Mason (1980) found that the reliability of reports of father's educational attainment (r = .894), mother's educational attainment (r = .873), and father's occupational status (r = .918) was as high among sons by the 12th grade as among parents (see, also, Mason et al. 1976). Similarly, in the Panel Study of Income Dynamics, for a sample of about 500 young adults who had left home within 8 years, Corcoran (1980) found that men's reports of father's educational attainment (r = .801) and occupational status (r = .817) were as reliable as those of their fathers, whereas men's reports of mother's educational attainment (r = .779) were less reliable than those of their mothers (r = .887). Corcoran found no differences in the quality of reports between daughters and parents.

Broom et al. (1978) found discrepancies between intergenerational status correlations based upon reports by sons and by fathers in two Australian samples of the same cohorts, and they speculated that correlated errors between variables might account for this anomaly. However, Massagli and Hauser (1981) found no evidence of such correlated errors in a subsample of Wisconsin men for whom status variables had been reported in two generations by fathers and by sons.

In terms of its coverage of the socioeconomic life cycle, the 1973 Occupational Changes in a Generation (OCG) survey incorporated the broadest effort to date to-assess and adjust for response variability in a model of the stratification process. Bielby, Hauser, and Featherman (1977a, 1977b; also, see Bielby and Hauser 1977) merged data on mens' and parents' socioeconomic characteristics from the March 1973 Current

Population Survey (CPS), the April CPS Reinterview Program, the August/September OCG supplement, and OCG reinterviews carried out 3 to 4 weeks later, in order to estimate a multiple-indicator model of the stratification process among 578 nonblack U.S. men aged 20 to 64. They obtained reports of educational attainment and of current occupational status from the OCG respondents and (in most cases) from their wives, and they obtained repeated measurements of socioeconomic background characteristics and of occupations at labor-market entry from the primary OCG respondents. As several researchers have noted, Bielby, Hauser, and Featherman (1977a, 1977b) were able to correct the effects of socioeconomic background only for unreliability, not for invalidity. The distinction lies in the possibility that positively correlated reporting errors--over the short OCG reinterview period--may have contributed to reliability and, hence, to under-correction for response variability in the background variables (Broom et al. 1978, Jencks et al. 1978, Heyns 1978, Hope, Graham, and Schwartz 1979, Dwyer and Phelan 1979). This analytic weakness of the OCG studies is partly compensated by the similarity of its findings with those of the validation studies cited above (notably excepting the invalidity of retrospective proxy reports of parents' income).

While the psychometric properties of ability and achievement tests are well established, and there is also a research literature on the measurement of aspirations (Haller and Miller 1971), there has been no systematic effort to integrate corrections for response variability into a stratification model as extensive as that proposed by Sewell, Haller, and Portes. We here exclude the significant effort of Crouse et al.

(1979) to compare latent-variable specifications (of socioeconomic background, significant others' influence, and ambition) in the Wisconsin model across the Project Talent, Wisconsin, and EEO samples (also, see Hauser 1970, 1972). While Crouse et al. (1979:349) motivate their analysis with reference to problems of accuracy in measurement, their analysis focuses on the possible structural relations between (perfectly measured) variables and unitary constructs that the variables cause and/or reflect. Those structural relations are important, but they are empirically distinct from the problem of response error in the variables.

Aside from the long-standing interest of researchers in correctly specifying the influence of social background and schooling on economic success, several other issues in stratification research might be clarified by a more comprehensive treatment of measurement error. A dozen years ago, Duncan (1969, 1970) constructed a model of motivational influences on socioeconomic achievement that was based upon indirect and retrospective measurements (also, see Duncan and Featherman 1972); that pioneering work anticipated many unresolved conceptual and analytic issues. For example, in a critique of the use of educational plans in stratification models, Alexander and Cook (1979:202) offer the interesting hypothesis that "senior year measures of educational goals often are quite contaminated by prior knowledge of one's actual prospects for college." The same researchers (Cook and Alexander 1980) have pointed to significant empirical differences between cross-sectional and longitudinal specifications of school-process models; these might be resolved by explicit modelling of response variability (as well as by recognition that stratification is a developmental process).

Last, serious questions have been raised about the measurement of significant others' influence in the Wisconsin model. Sewell, Haller, and Portes (1969) based their index of significant others' influence on students' perceptions of parents' and teachers' encouragement to attend college and of the proportion of their friends who were planning to attend college. Several researchers have asked whether a student's report of such variables merely indicates "that adolescents tend to project their own goals onto their significant others" (Kerckhoff 1976:370; also, see Kerckhoff and Huff 1974). Similarly, Davies and Kandel (1981:363) argue that "perceptual measures inflate estimates of interpersonal influence," and, earlier, Hauser (1971:124) attempted to quantify the notion that "students' reports of their parents' aspirations are affected by their own aspirations." However, these studies did not distinguish the contamination of perceptions of others' goals by own goals from other manifestations of response error.

4.0 A BASELINE MODEL OF THE STRATIFICATION PROCESS

The path diagram in Figure 3 depicts major structural features of the model that is used as a baseline in the present analysis. This is not our preferred model, and we specify a number of alternative models that are either more or less restrictive than that of Figure 3. Following Hauser (1972), the model has been disaggregated to show the components of socioeconomic background and of significant others' influence, and the model has been extended to include occupational status at two stages of the career. The model of Figure 3 is not fully recursive. Not only does it postulate 3 unobservable composites (η_5, η_8, and η_{12}), but some potential direct paths have been omitted from the diagram, for example, that from η_{15} to η_{17}. Later, we explain the reasons for these selective omissions. At the same time, we regard the model of Figure 3 as "full" in the sense that it includes all of the coefficients that we think might possibly enter a preferred model. Later, we drop several of the direct paths that appear in Figure 3.

The measurement model is not shown in Figure 3. There are two measurements of each variable in the model except for mental ability and rank in high school class, each of which has only one measurement. Further, the measurement model specifies numerous correlations between errors in indicators. These aspects of the model are discussed in section 4.2.

The model is specified and estimated within the LISREL framework (Jöreskog 1973, Jöreskog and Sörbom 1978). The structural model is

(1) $$\underset{\sim}{\beta}\underset{\sim}{\eta} = \underset{\sim}{\zeta},$$

and the measurement model is

(2) $$\underset{\sim}{y} = \underset{\sim}{\Lambda}_y\underset{\sim}{\eta} + \underset{\sim}{\varepsilon}$$

where β and Λ_y are coefficient matrices, the η are unobserved or latent constructs, the ζ are disturbances in structural equations, the ε are errors in measurement equations, and the y are observables. Note that we have not used the full LISREL specification here; that is, formally, there are neither exogenous variables nor indicators of such variables in the model. This permits us to specify correlations between measurement errors in background variables and in variables that appear later in the model; at the same time, it requires us to specify correlations among the (substantively) exogenous variables as correlations among the disturbances of (formally) endogenous variables.

4.1 Structure

The first substantive equation of the model is

$$\eta_5 = \beta_{5,1}\eta_1 + \beta_{5,2}\eta_2 + \beta_{5,3}\eta_3 + \beta_{5,4}\eta_4. \quad (3)$$

This says that socioeconomic background (η_5) is a linear composite of father's educational attainment (η_1), mother's educational attainment (η_2), father's occupational status (η_3), and parents' income (η_4). Since no paths lead directly from η_1, η_2, η_3, or η_4 to later variables in the model, this equation imposes a proportionality constraint on the effects of the socioeconomic background variables on subsequent variables in the model (Hauser and Goldberger 1971, Hauser 1972). The disturbances of the four socioeconomic background variables are freely correlated. There is an indeterminacy in the absolute magnitudes of the βs in equation 3, and we resolve this by the normalizing assumption that $\beta_{5,1} = 1$. Also, there is no disturbance in equation 3; the model says that the four background variables exhaust the concept of socioeconomic background.

Mental ability (η_6), like socioeconomic background, is predetermined in the model; its disturbance is for this reason freely correlated with the disturbances of the four socioeconomic background variables. By the same token, η_6 is not subject to the proportionality constraint imposed by equation 3. Rank in high school class (η_7) is potentially affected by ability and socioeconomic background

$$(4) \qquad \eta_7 = \beta_{7,5}\eta_5 + \beta_{7,6}\eta_6 + \zeta_7,$$

and mental ability (η_6) and rank in high school class (η_7) jointly compose academic performance (η_8):

$$(5) \qquad \eta_8 = \beta_{8,6}\eta_6 + \beta_{8,7}\eta_7.$$

We choose the normalizing constraint $\beta_{8,6} = 1$. As in the case of socioeconomic background, η_5, there is no stochastic disturbance in academic performance, η_8; the model says that mental ability and grades exhaust the concept of academic performance. We believe that this specification of academic performance is novel, and it closes questions about the relative influence of ability and rank in high school class upon one or another consequent with the response that their relative influence can be described by a single coefficient of proportionality. Presumably this specification contradicts both the Sewell-Haller-Portes and Sewell-Haller-Ohlendorf models of educational and occupational attainment. In the former model, ability affects only rank in high school class, and in the latter it affects only rank in high school class and significant others' influence.

The next three equations of the model pertain to respondents' perceptions of parents' encouragement to attend college (η_9), teachers' encouragement to attend college (η_{10}), and friends' plans to attend college (η_{11}):

(6) $$\eta_9 = \beta_{9,5}\eta_5 + \beta_{9,8}\eta_8 + \zeta_9,$$

(7) $$\eta_{10} = \beta_{10,5}\eta_5 + \beta_{10,8}\eta_8 + \zeta_{10}$$

and

(8) $$\eta_{11} = \beta_{11,5}\eta_5 + \beta_{11,8}\eta_8 + \zeta_{11}$$

As shown in Figure 3, no causal order is specified among the components of significant others' influence, so the disturbances of equations 6, 7, and 8 are freely intercorrelated. These three components form a construct,

(9) $$\eta_{12} = \beta_{12,9}\eta_9 + \beta_{12,10}\eta_{10} + \beta_{12,11}\eta_{11}$$

with the normalizing constraint $\beta_{12,9} = 1$. As with the two prior composites, the model says that perceptions of parents, teachers, and friends exhaust the sources of significant others' influence. In a sample of 90 Wisconsin high school students who were asked to nominate their significant others, Woelfel (1972) found that 65 percent were parents, friends, and teachers or counselors; the remainder were siblings, other relatives, and other adult acquaintances. There is a constraint of proportionality on the effects of the three components of significant others' influence on later variables in the model. Note that the model of Figure 3 does not constrain the relative effects of ability and social background on the components of significant others' influence, so ability and socioeconomic background may differentially stimulate these sources of social influence.

Educational aspiration (η_{13}) and occupational aspiration (η_{14}) are each affected directly by the three composites:

(10) $$\eta_{13} = \beta_{13,5}\eta_5 + \beta_{13,8}\eta_8 + \beta_{13,12}\eta_{12} + \zeta_{13}$$

(11) $$\eta_{14} = \beta_{14,5}\eta_5 + \beta_{14,8}\eta_8 + \beta_{14,12}\eta_{12} + \zeta_{14}$$

As in the original formulations of the Wisconsin model (but not Hauser [1972]), the disturbances in equations 10 and 11 are freely intercorrelated.

In the equation for educational attainment (η_{15}),

(12) $$\eta_{15} = \beta_{15,5}\eta_5 + \beta_{15,8}\eta_8 + \beta_{15,13}\eta_{13} + \beta_{15,14}\eta_{14} + \zeta_{15},$$

the significant others' construct (η_{12}) does not appear. The path from significant others' influence to educational attainment was regarded as "theoretically debatable" in the initial statement of the Wisconsin model (Sewell, Haller, and Portes 1969:86), and it was added to the model when a substantial coefficient appeared in the regression equation for educational attainment. After the components of significant others' influence were corrected for response error, we found that this variable (η_{12}) was so highly collinear with educational aspiration (η_{13}) that no plausible estimates could be obtained when η_{12} was entered into the equations for educational attainment and occupational status. We do not think the very high intercorrelation of η_{12} and η_{13} is necessarily a technical problem, but that it may reflect the theoretical power of the original formulation of the model.

The final two equations of the model permit occupational status in the early career (η_{16}) and at mid-life (η_{17}) to depend upon prior variables:

$$(13) \qquad \eta_{16} = \beta_{16,5}\eta_5 + \beta_{16,8}\eta_8 + \beta_{16,13}\eta_{13} + \beta_{16,14}\eta_{14} + \beta_{16,15}\eta_{15} + \zeta_{16}$$

and

$$(14) \qquad \eta_{17} = \beta_{17,5}\eta_5 + \beta_{17,8}\eta_8 + \beta_{17,13}\eta_{13} + \beta_{17,14}\eta_{14} + \beta_{17,16}\eta_{16} + \zeta_{17}$$

As noted above, significant others' influence, η_{12}, does not appear in either of these equations, and, in addition, educational attainment, η_{15}, does not appear in the equation for occupational status at mid-life, η_{17}. When both educational attainment and early occupational status (η_{16}) were entered in this equation, the slope of schooling became negative, while that of early occupational status exceeded unity. We resolved this problem--which may result from ambiguities in the temporal referents of occupational status indicators--by dropping educational attainment, η_{15}, from equation 14. Some other specification of measurement or structure in the occupational status equations may well prove more satisfactory.

In summary, the baseline model consists of 12 equations that specify the structural dependencies among 17 unobservable constructs.

Three of these constructs are composites of others, and all save two of the remaining 14 constructs are measured by two indicators apiece. With three significant exceptions, the model is fully recursive. First, it does not purport to account for the correlations among the components of significant others' influence nor those between educational plans and occupational aspirations. Second, components of socioeconomic background, academic performance, and significant others' influence are constrained to influence subsequent variables through composite variables. Third, several coefficients were eliminated from the model in preliminary analyses because their inclusion yielded grossly implausible results.

4.2 Measurement

This analysis is based upon a sample of nearly 5000 Wisconsin men who have been followed from the senior year of high school in 1957 through 1975, when they were about 36 years old. Most of the statistical findings here pertain to 2038 men for whom data were available on all (but one) of 26 measured variables used in the analysis, but the main findings have also been verified using pairwise-present moments for the much larger share of the sample (usually about 3500 men) in which each moment could be estimated. The data were obtained from several sources over the years: a statewide survey of high school seniors in 1957, high school records, the State Testing Service, State Tax Records for 1957 to 1960, a 1964 postcard and telephone survey of parents of the respondents, and a 1975 telephone survey of the original respondents. In addition, some results of a 1977 survey of siblings of the 1975 respondents have been used in the present study. With two exceptions, mental ability and rank in high school class, two measures have been obtained of each variable in the model.

The source of each measurement is given in Table 1. The typical measurement assumptions of the model are well illustrated in the case of father's education and mother's education, which were reported by the primary respondent in both the 1957 and 1975 surveys. In the case of father's education,

$$y_{X1} = \lambda_{X1,1}\eta_1 + \varepsilon_{X1} \tag{15}$$

and

$$y_{X2} = \lambda_{X2,1}\eta_1 + \varepsilon_{X2} \tag{16}$$

where the ys are observables, λs are regression coefficients, ηs are true values of the variables, and εs are errors of measurement. The metric of the unobservable (η_1) is underdetermined, and we specify it by the normalizing restriction $\lambda_{X2,1} = 1$ (see Bielby, Hauser, and Featherman 1977b); a similar restriction is imposed on each pair of measurement equations. We specify that the errors (ε) are uncorrelated with their respective true values (η), but non-unit slopes (λ) capture relative floor and ceiling effects and regression toward the mean. Unreliability is represented by the ratio of the variance in ε to that in y.

While X1 and X2 were ascertained about 18 years apart, they were also both reported by the same person; thus we should like to specify a (presumably positive) correlation between ε_{X1} and ε_{X2}. This correlation and other similar, within-variable, between-occasion error correlations are not identified within the present model. Fortunately, in 1977 we obtained an independent third report of father's educational attainment from a brother of the primary respondent in a subsample of 553 men. In the subsample, we estimated a correlation of about .15 between errors in the 1957 and 1975 reports of father's educational attainment, and we applied this estimate of correlated error in both paternal and maternal schooling.

Mother's educational attainment was also ascertained from the primary respondent in both the 1957 (X3) and 1975 (X4) surveys, and our specification of it exactly follows that of father's education. When we consider both parents at once, another type of error correlation arises. X1 and X3 were both ascertained from the primary respondent in 1957, and X2 and X4 were both reported by him in 1975 (though with greater separation in the survey instrument in the latter year). That is, we may suspect that respondents over- or understated the consistency between the schooling of their parents on each measurement occasion. This between-variable, within-occasion correlated error is identified with two indicators per unmeasured variable, and we permit all such error correlations to enter the baseline model.

Parents' incomes were ascertained from records of the Wisconsin Department of Revenue for all available years, 1957 to 1960. Unfortunately, the annual observations were not all retained, but we were able to recover income in the first available year and the average of incomes in the remaining years. We used the logs of these two variables as indicators of parents' income. With only two indicators we were unable to specify a correlation between errors, and this may have led to an underestimate of the influence of parents' income. We do have two other variables that may be said to reflect parents' income, a statement of the standing of the students' family from the 1957 survey "in terms of income or wealth of families in my community" (Sewell and Hauser 1975:195) and a retrospective open-ended report of parents' income when the respondent was a senior in high school from the 1975 survey. The latter item was often not reported, and we were unable to develop a convincing measurement model that included both additional items; with at least one independent estimate of parents' income, we could have estimated the correlation between errors in the tax reports.

Mental ability was ascertained from the Henmon-Nelson (1954) test, which was administered to all Wisconsin high school juniors. We have not attempted to correct for unreliability in the measurement of this variable in the present analysis. All available evidence suggests that the test is highly reliable in this large and diverse sample (on which the test was normed). For example, Henmon and Nelson (1954:6) report a split-half reliability at grade 11 (corrected with the Spearman-Brown formula) of $r = .887$ with $s = 12.9$ and $N = 100$. Thus, the error variance is $(1 - .887)12.9^2 = 18.80$. Among all men in the Wisconsin sample, the variance in IQ is 223.20, and this implies a reliability of $r = .916$. Similarly, with $N = 356$ at grade 11, Henmon and Nelson report an alternate forms reliability of $r = .89$, and this implies a reliability of $r = .953$ in the (more heterogeneous) Wisconsin sample. Yet another indication of the very high reliability of Q lies in the regression of rank in high school class on ability and socioeconomic background, where the estimated regression of rank on background is slightly negative. If the sign of that slope were reversed, it would be straightforward to postulate that the true slope is zero in the population, while ability is subject to random error. With a negative regression of rank in high school class on socioeconomic background, that error specification will not work; it implies negative error variance in ability. Thus, unless one is willing to believe that the regression of rank in class on socioeconomic background is negative in the population, one must conclude that ability is measured with very high reliability. Of course, these observations are indirect and conjectural. We are presently locating freshman-year IQ scores for a subsample of respondents, and we plan to use these to estimate the reliability of the 11th grade tests.

In the case of rank in high school class, we have only the reports of school officials on which to rely. Since these are based on records of students' grades in all courses taken during the high school years, we believe that the only source of error would be of a clerical nature and would be small. We would like to have had the actual reports of grades in required courses, but such reports not only would have been very difficult to obtain, but also to standardize between schools. The ranks were converted first to percentiles and then to normal deviates. The absence of additional indicators of academic potential and performance has stimulated our efforts to build an academic performance construct.

The next five pairs of indicators—parents' encouragement to attend college, teachers' encouragement to attend college, friends' plans to attend college, college plans, and occupational status aspirations—were each ascertained in both the 1957 and 1975 surveys. The section of the 1975 questionnaire containing these items was introduced with the phrase, "Now I would like you to think back to the spring of your senior year in high school." This was followed by the original items with the wording changed to the past tense (Sewell and Hauser 1975:194-197).

Our measurement model depends critically on the untestable assumption that errors are not correlated between the reports of each of these variables obtained 18 years apart from the primary respondents. To the extent that such error correlations are positive, we have undercorrected moments among the underlying structural variables; to the extent that such error correlations are negative, we have overcorrected moments among the underlying structural variables. We think the former problem is more likely than the latter, but we have been encouraged by the very small within-variable error correlations estimated for parents' schooling. That is, we think it less plausible that errors in reports of perceptions of others' encouragement or of own aspirations are correlated over an 18 year period than that errors would be correlated in reports of parents' socioeconomic characteristics.

We originally regarded the use of the retrospective social psychological indicators as the major design weakness of our analysis, and in presenting these materials the senior author has had to contend with titters from several audiences. We do not believe these retrospective items are free of error, but then we do not believe that any of the indicators in the model are free of error. We do think that the model is strong enough to tell us how good the items are and flexible enough to permit specification of plausible patterns of random and nonrandom response error.

Our analysis of the first four pairs of social psychological indicators is defective because each of these is a dichotomy, while the LISREL program obtains maximum likelihood estimates under the assumption of multivariate normality. We have chosen to ignore this problem. Although work is under way on the development of latent variable models and estimation procedures for mixtures of qualitative and quantitative variables (Winship and Mare 1982, Avery and Hotz 1981, Muthen 1981), we know of no available program that can estimate a model as large and complex as ours. Moreover, our data do not permit the use of tetrachoric or biserial correlations as substitutes for point correlations involving dichotomous variables.

None of the dichotomous variables in the analysis is highly skewed, so we doubt that our brute-force estimation procedures have led us too far astray in interpreting the data. We believe that the effect of this defect in our analysis is a slight understatement of the importance of these 4 constructs in the model. Further, on the assumption that the true variables are continous, the use of dichotomous indicators leads to an understatement of validity and reliability. That is, our estimates of the reliability of the pairs of dichotomous indicators incorporate effects of aggregation or shift in functional form as well as effects of inconsistency in reporting between occasions.

One last problem with this set of variables is that no codable response to the retrospective occupational aspiration item (J75) was obtained in about one third of the cases (see Appendix Table A). We thought of dropping this indicator from the model and positing that the two indicators of educational aspiration, as well as the 1957 measure of occupational aspiration, reflected an unobservable aspiration construct (Duncan, Haller, and Portes 1968). As we show in a later section, this specification is unsatisfactory, and we decided to use pairwise-present moments involving this variable, but no other pairs of indicators in the model.

Educational attainment was coded in years from educational information supplied by a parent in the 1964 survey (ED64) and by the primary respondent in the 1975 survey (ED75). No doubt, there was real change in educational attainment of some respondents over the 11-year period between surveys, primarily in the upper tail of the educational distribution. For this reason, and because we were doubtful that the effects of schooling were linear beyond the college degree, we followed Census practice and truncated the educational attainment distribution at 17 years. Still, "error" in educational attainment reflects educational mobility as well as response variability.

There is some temporal ambiguity in our selection of indicators of occupational status early in the career and at mid-life. Of Wisconsin men who had ever held a full-time civilian job after leaving school (roughly 95 percent of the sample), 83 percent had done so by 1964, and 96 percent had done so by 1969. Thus, in 4 percent of the cases, the first, full-time civilian job was entered after 1970, which is the year of our first indicator of occupation at mid-life (Hauser 1982). Moreover, neither for early or mid-life occupations do the indicators purport to refer to the same occupation, held at the same time; mobility as well as error is contained in response variability of those four indicators. Thus, the early and mid-life occupational status constructs might be said to represent "semi-permanent" levels of occupational attainment.

Three of the four indicators of occupational status were ascertained in the 1975 survey, and for this reason we wanted to anticipate the possibility of correlated response errors among them. Of course, the error covariance between the two indicators of mid-life occupation was not identified, but we specified that error covariance to be equal to those between each of the mid-life indicators and the error in status of first occupation, which were identified in the model. In the 1975 survey, every effort was made to code occupations independently; that is, occupation coding was carried out one occupation line at a time for a batch of questionnaires, and coders were not permitted to refer to other occupational descriptions unless the interviewer had noted that the respondent said the two occupational descriptions pertained to the same job (Sheehy, Netkin, and Grant 1975). Thus, we think that any correlated response errors between these occupation reports must be a function of the original responses and not of the coding process.

In summary, the baseline measurement model includes two indicators of every variable in the structural model except mental ability and rank in high school class. In the cases of fathers' and mothers' educational attainments and of occupational status at mid-life, we use auxiliary information to specify correlation between pairs of indicators of the same variable. Otherwise, we specify independence between errors in reporting indicators of each variable. In some cases this assumption of independent measurement is fully justified by the manner of data collection, but it is less defensible in the measurement of parents' income, of significant others' influence, and of aspirations. The model does identify correlated response errors between measurements of different variables on the same occasion or from the same source: the 1957 survey, the 1964 survey, the 1975 survey, or state tax records.

Appendix Table A reports means and standard deviations of all of the indicator variables in the listwise-present analysis sample and for all men covered in both the 1964 and 1975 surveys. Appendix Table B reports listwise-present and pairwise-present correlations. Mean differences between measurements on different occasions play no role in the model, but there do appear to be some significant differences. For example, reports of father's education were lower in 1975 than in 1957, while reports of mother's education were higher in 1975 than in 1957. Retrospective reports of father's occupational status were higher than those obtained from the tax data. In both of these cases, the mean difference may be a function of the instrument, rather than of the respondent. Educational attainment levels were grouped into closed categories in the 1957 questionnaire, but the corresponding questions were open-ended in the 1975 survey. Further, the queries about mother's and father's education were adjacent in the 1957 questionnaire, but not in the 1975 survey. In coding from the tax data, only the one-line occupation descriptions on the state income tax form were available, plus name of employer, but the 1975 survey used a 5-item (occupation-industry-class of worker) question borrowed from the 1973 OCG survey. Retrospective reports of encouragement to attend college were slightly lower than the original reports, but the same percentage of men reported planning to attend college in the 1975 as in the 1957 survey. Retrospective reports of occupational status aspirations appear to be significantly higher than the original reports, and this may be a function of differential nonresponse in the 1975 survey. Last, there appears to be a modest restriction in the variance of several of the indicators between the pairwise-present cases and the full sample.

5.0 PARAMETERS OF THE BASELINE MODEL

5.1 Structural Coefficients

Table 2 shows estimated structural parameters of the baseline model. Several features of these estimates stand out. First, relative to earlier estimates of similar models in the Wisconsin data, this baseline model is far more powerful in accounting for the variability in significant others' influence, aspiration, and educational and occupational attainment. For example, Hauser's (1972:166) disaggregated model accounted for just over 20 percent of the variance in perceived encouragement from significant others, while the baseline model accounts for 35 to 45 percent of the variance in those perceptions. Hauser's model accounted for roughly 45 percent of the variance in educational and in occupational aspirations, but the baseline model accounts for 77 percent of the variance in educational aspiration and 73 percent of the variance in occupational aspiration. Hauser's disaggregated model accounted for 56 percent of the variance in educational attainment, compared to 68 percent for the present baseline model. Similarly, the Sewell-Haller-Ohlendorf model (1970:1021) accounted for 40 percent of the variance in occupational status in the total male Wisconsin sample, but the baseline model here accounts for 77 percent of the variance in early occupational status and 71 percent of the variance in occupational status at mid-life.

Second, several of the estimated structural coefficients of the model take on negligible and statistically insignificant values. For example, there is a nonsignificant negative effect of socioeconomic background on rank in high school class. Likewise, there are minute and nonsignificant effects of socioeconomic background on educational aspiration, occupational aspiration, and occupational attainment. Further, the effects of academic performance on occupational attainment are virtually zero. In this sense, the baseline model appears to be more successful than, for example, the Sewell-Haller-Ohlendorf model (1970:1021) in explaining the effects of socioeconomic background and ability on later variables.

Third, there are interesting patterns in the relative effects of components of the three composite variables. In the case of socioeconomic background, the effects of father's education (the reference variable) and mother's education are almost the same. Father's occupational status and parents' income are not in the same metric, but it is evident from the standardized coefficients that father's occupational status is a relatively more powerful determinant of socioeconomic background than the other three variables.

The two components of academic performance are in the same metric; each is based on percentile ranks converted to normal deviates. The effect of rank in high school class is almost 2.5 times larger than that of ability in the composite, yet ability does make a significant contribution. One may suspect that our failure to correct for unreliability has led to an understatement of the relative importance of mental ability.

Despite--as shown below--large corrections for error in the measurement of perceived encouragement to attend college, the relative importance of parents, teachers, and friends appears to be much the same here as in earlier estimates based on the Wisconsin data. Parents' encouragement is of primary importance, followed by the example set by friends, while the perceived encouragement of teachers is only about half as important as that of parents or friends (Hauser 1972:173). The baseline model also provides similar estimates of the effects of socioeconomic background and academic performance on perceptions of significant others; academic performance carries far more weight in determining teachers' encouragement than does socioeconomic background, whereas the weights are more nearly equal in the cases of parents' encouragement and friends' plans.

Fourth, there are large, statistically significant, and anomalous negative effects of educational aspiration upon occupational status in the early career and at mid-life. We know of no theoretical rationale for such effects. We would simply regard them as a manifestation of collinearity between educational and occupational aspirations, except they appear to be stable and significant features of the Wisconsin data. The appearance of these effects is not an artifact of our adjustments for response error. A negative path (-.10) from educational aspiration to occupational status appeared in the Sewell-Haller-Portes analysis of attainment among farm boys (1969:88), and it appeared in 4 of 5 residence categories as well as in the total male sample in the Sewell-Haller-Ohlendorf analysis (1970:1021; also, see Sewell and Hauser 1975:100). The same finding appears for women as for men (Sewell, Hauser, and Wolf 1980:567). Not only does the finding appear in these several subsamples, but it appears regardless of which indicators of educational aspiration (in 1957 or in 1975) or occupational status (first job, 1964, 1970, or 1975) is used. We are not aware of similar findings elsewhere, except in Duncan's (1969:104) synthetic estimates of the effect of ambition on current occupational status. These results present us with a genuine quandary, which we have not been able to resolve in any satisfying way. For the present, we have retained the two anomalous coefficients in the baseline model, but deleted them from two alternative models that are presented in a later section. Deletion of these two coefficients appreciably reduces the goodness of fit of the model. The baseline model yields a likelihood ratio chi-square statistic of 341.8 with 165 degrees of freedom. This is clearly statistically significant, but well within the range considered acceptable in practice. The test statistic increases by nearly 100 points when the paths from educational aspiration to occupational statuses are deleted.

The baseline model posits correlations among the four socioeconomic background variables, between those variables and ability, among disturbances in the components of significant others' influence, and between disturbances in educational and occupational aspirations. These correlations are shown in Table 3. The most important feature of the table is the substantial correlation within the two sets of endogenous disturbances. Clearly, the baseline model does not account for the similarity in perceptions of significant others' encouragement nor in educational and occupational aspirations. At the same time, the residual correlations are slightly misleading about the success of the model in this respect. The model accounts for roughly 60 percent of the covariances among the components of significant others' influence and for almost 90 percent of the covariance between educational and occupational aspirations. There is reason to expect the present model to be more powerful in explaining these correlations than were earlier models based on the Wisconsin data, like that of Hauser (1972), for correlations between reporting errors in variables measured on the same occasion are specified in the measurement model and thereby excluded from the structural estimates in Table 3. Later, we show that error correlation contributed substantially to the observed correlation between educational and occupational aspirations, as coded from the 1957 survey data.

5.2 Reliability

Table 4 shows estimates of response error under the baseline model. Many of the variables in the model have rather low reliabilities or test-retest correlations. It is even more striking that there is a great deal of variability in the reliability across variables, which is not necessarily related to seemingly obvious hypotheses about reporting error. For example, the 1975 reports of parents' schooling were each less reliable (and had larger error variance components) than the 1957 reports. The major difference between these two pairs of items was that the 1975 schedule was open-ended, so respondents could "err" by reporting detail within the major schooling groups recognized in the 1957 questionnaire. In the case of father's occupational status, the retrospective reports from the 1975 survey may have been of higher quality than the (presumed) self-reports from the tax records. We think the more detailed questions in the 1975 questionnaire are probably responsible for this.

Father's schooling and occupational status have much lower reliability here than in the OCG remeasurements, and it is worth considering the possible reasons for this. We contrast findings from the 1975 Wisconsin survey with those from the OCG supplement; the items are virtually identical (Bielby, Hauser, and Featherman 1977a:725-732). It would be instructive to compare true and error variance components in these variables among other studies as well, but that is beyond the scope of the present analysis.

The error variance in father's schooling was more than twice as large in the Wisconsin survey (3.138) as in the OCG survey (1.25). Had the Wisconsin error variance estimate, rather than that from the OCG survey, been used to correct the observed variance of father's schooling among all U.S. men (16.32), the reliability would have been .81 rather than .92. The reliability estimate based on the 1975 measure was much lower in the Wisconsin sample (.683) because the true variance in father's education was much lower there (6.749) than it would have been in the OCG sample, conditional on the Wisconsin response variability (16.32 - 3.14 = 13.18). The true variance in father's education was much larger in the national sample because it covered many cohorts of men (Hauser and Featherman 1976) and because it covered men at all levels of completed schooling.

As in the case of father's education, the error variance in father's occupational status was larger in the 1975 Wisconsin survey (131.8) than in the OCG survey (87.8). Had the Wisconsin estimate been used to correct the observed variance in father's occupational status among all U.S. men (524.4), the reliability would have been .75 rather than .83. Unlike the case of father's educational attainment, the lower reliability of father's occupational status is strictly a function of a larger estimated error variance in the Wisconsin sample. The true variances are similar: 386.3 in Wisconsin and 392.6 in the U.S. sample.

The components of significant others' influence appear disappointingly unreliable. Recall that these were based upon single dichotomous items. In this context the choice of some earlier investigators simply to add these three items seems laudable (Sewell, Haller, and Portes 1969, Sewell, Haller and Ohlendorf 1970), even though the items are not homogeneous in their relationships with prior causal factors (Hauser 1972). As one might expect, the retrospective measures of those three variables are less reliable than the contemporaneous measures.

As noted earlier, the low reliabilities of the dichotomous items must be interpreted with care, for they incorporate errors of aggregation as well as effects of disagreement between occasions. For example, the tetrachoric correlations of the indicators between occasions are .737 in the case of parental encouragement, .555 in the case of teachers' encouragement, .707 in the case of friends' plans, and .909 in the case of educational plans. The tetrachoric correlations are based on the assumption that the point correlations are each based on a four-fold aggregation of the bivariate normal distribution.

Relative both to the components of significant others' influence and to the socioeconomic background variables, the reliability of educational and occupational aspirations is surprisingly high. Moreover, there is no substantial difference between reliabilities of contemporaneous and retrospective measurements of these two items.

Educational attainments were reported with acceptable reliability by parents in 1964 and with still greater reliability in 1975. In the case of early occupational status, the reliability appears rather low. For example, the error variance in the 1975 Wisconsin report of first occupation is about twice that in the virtually identical OCG item (compare Bielby, Hauser, and Featherman 1977a:728). However, it should be recalled that "errors" in early occupational status presumably include a substantial component of true mobility. As noted above, there may be a gap of several years between the temporal referents of first occupation and occupation in 1964. Moreover, it is likely that a great deal of occupational mobility did occur in the early years after high school. It is somewhat reassuring that the later occupational status variable is more reliable. The error variances in its indicators are quite comparable to those estimated in the OCG remeasurement survey, which in most cases obtained reports of occupation in March 1973 and at the reinterview date from two different persons (Bielby, Hauser, and Featherman 1977a:725,728).

5.3 Correlated Response Errors

The baseline model includes 88 distinct parameters for correlations among response errors. All possible within-occasion, between-variable error correlations have been specified within the four major sources of data (1957 survey, tax records, 1964 survey, and 1975 survey). Table 5 shows and contrasts the fit of several models that exclude specific categories of error correlations. Line A1 reports the fit of the baseline model, where the ratio of the test statistic to its degrees of freedom is 2.07. All but one of the models and contrasts reported in Table 5 are statistically significant, and we focus our discussion on the ratios of likelihood-ratio chi-square statistics to their degrees of freedom. If we delete all correlated errors (line A2), the fit deteriorates markedly, by 753.9 with 88 degrees of freedom (line B1). Obviously, there are significant correlations between response errors in the baseline model.

The successive lines of Panel A in Table 5 report the fit of models from which one group of error correlations has been deleted; in Panel B these models are contrasted with the baseline model that includes all within-occasion, between-variable error correlations. Line A3 shows that the test statistic is 596.4 with 186 degrees of freedom when all error correlations are included, except those within the 1957 survey; Line B2 shows that the error correlations within the 1957 survey yield a test statistic of 254.6 with 21 degrees of freedom. Clearly, this source of error correlation is highly significant, and it is only matched in importance by correlations among response errors in socioeconomic variables within the 1975 survey (Line B6). The social psychological variables in the 1975 survey are a third important source of correlated error, but the ratio of the test statistic to its degrees of freedom is about half as large here as in the two prior cases. Three other sources of correlated error are less important: between socioeconomic and psychological variables in the 1975 survey (Line B8), within tax records (Line B3), and within the 1964 survey (Line B4).

The estimates of correlations among response errors in the baseline model are shown below the main diagonal of Table 6; the parenthetic entries are ratios of the corresponding error covariances to their standard errors. The entries above the diagonal identify the groups of error correlations to which the corresponding below-diagonal entries belong.

In the 1957 survey and in the 1975 survey, there were positive correlations between reporting errors in mother's education and father's education; in the 1975 survey there were smaller, but significant correlations between response errors in father's occupational status and in parents' educational attainments. Without taking account of these correlated response errors, we would tend to overestimate the correlations among the background variables and thus possibly underestimate their influence on later variables. That is, the positive, between-variable error correlations tend to counterbalance effects of simple unreliability.

There were also positively correlated response errors between the report of father's occupational status from tax data and the two measures of parents' income from the same source. Occupation coders may have been influenced by income reports as these data were collected;

this finding leaves us uncomfortable with the specification that errors in the two reports of parents' incomes are uncorrelated.

While errors in reports of socioeconomic background variables were moderately intercorrelated, there is no consistent evidence that errors in those variables are correlated with errors in retrospective or contemporaneous reports of significant others' influence or of aspirations. However, there are small, but significant correlations between errors in the 1975 report of occupational aspiration and in the 1975 reports of mother's education and father's occupational status. Similarly, there is no substantial or consistent pattern of correlation between errors in the 1975 reports of socioeconomic background variables and of the respondent's educational and occupational attainments.

In both the 1957 survey and the 1975 survey we had expected to find large, positive correlations among response errors in the social psychological variables: parents' encouragement, teachers' encouragement, friends' plans, educational aspiration, and occupational aspiration. For example, we thought that in retrospect, respondents might not draw any meaningful distinctions among sources of encouragement to attend college; their responses might be haloed by recollection of supportive or unsupportive social environments in the high school years. Further, we expected to find evidence of the projection of own goals on perceived expectations of others in the correlations between errors in reports of aspirations and of encouragement by significant others as suggested by others (Kerckhoff and Huff 1974, Davies and Kandel 1981, Hauser 1971). We thought that such projection might be even greater in retrospective reports than in those obtained during the senior year of high school.

Last, we thought that the respondent's knowledge of appropriate education-job combinations might lead to positively correlated response error between educational aspiration and occupational aspiration on each measurement occasion.

Although there is one very large correlation between response errors in the social psychological variables—that between educational and occupational aspiration in the 1957 survey—on the whole the evidence only weakly supports our expectations. The 1957 reports of educational and occupational aspirations were coded jointly, and this appears to account for the very large correlation (.515) between errors in those two indicators. There is also a significant positive correlation between errors in aspirations in the 1975 survey (.112), consistent with our expectation. There are significant correlations among response errors in the components of significant others' influence in the 1957 survey, but these are quite small. In the 1975 survey, where our expectation of correlated error was even stronger, only the correlation between errors in parents' encouragement and teachers' encouragement (.147) was statistically significant. Most interestingly, there is very little evidence of correlated error between aspirations and the components of significant others' influence. Of 12 correlations of this form, four are negative; only two of the positive correlations are statistically significant, and the largest of these is .08. While response error obviously presents problems in the Wisconsin data, the projection of respondents' aspirations upon reports of others' encouragement does not appear to be one of them.

With one set of exceptions, response errors in the social psychological variables are uncorrelated with errors in the reports of socioeconomic attainments. The exception is the intriguing set of correlations between the 1975 report of occupational aspiration and the contemporaneous reports of education and of occupational statuses. The response error correlation is significantly negative in the case of educational attainment, and the correlations with errors in occupational status are significant (in two cases) and positive. The latter correlations suggest the hypothesis that retrospections of occupational aspirations are colored by recent attainments; later, we test this idea directly.

There is only one significant correlation among errors in reports of educational and occupational attainments in the 1975 survey. There is a large correlation (.416) between errors in reports of educational attainment and status of first occupation in the 1975 survey. It is curious to us that this same error correlation was identified, but was not statistically significant among nonblack men in the OCG remeasurement survey (Bielby, Hauser, and Featherman 1977a:727-729). The same error correlation was statistically significant, but much smaller among black men in the OCG remeasurement survey (.15) than in the present analysis (Bielby, Hauser, and Featherman 1977b:1260). If it is real, this error correlation presents a methodological paradox. The 1975 Wisconsin survey followed the 1973 OCG survey in placing the query about first occupations just after questions about educational attainment and the date of school completion. The questionnaires were written in this way in order to circumvent a well-documented problem in the 1962 OCG survey, where men reported ages at first jobs that were manifestly inconsistent with their highest levels of educational attainment (Duncan, Featherman, and Duncan 1972:210-224). It now seems possible that the redesigned questionnaire may have contributed spurious correlation between educational attainment and status of first occupation.

6.0 DO ATTAINMENTS CAUSE ASPIRATIONS?

Alexander and Cook (1979:202) have questioned the causal relevance of senior year aspirations on a number of grounds, chief among which is the proposition "that senior year measures of educational goals often are quite contaminated by prior knowledge of one's actual prospects for college." In our view, their analyses of two sets of survey data are substantially irrelevant to this hypothesis, if one acknowledges, first, that reports of aspirations, like other variables, are subject to response error, and, second, that the formation of aspirations is a developmental process. We think that the present model permits a straightforward and appropriate test of their hypothesis. Contrary to fact, we suppose that members of the sample know their "true" ultimate levels of educational attainment, and we permit the report of educational aspiration in 1957 to load upon the latent variable for educational attainment as well as upon that purporting to represent educational aspiration. When this revision is incorporated into the baseline model, we obtain an insignificant positive loading of 1957 plan on true educational attainment, .067. The chi-square statistic associated with this coefficient is 1.90 with 1 degree of freedom. Thus, we find no evidence that 1957 reports of educational plans are contaminated by actual levels of educational attainment.

In using retrospective reports of aspirations and significant others' influence, we have been more concerned with another type of contamination: that the retrospective reports are colored by intervening and contemporaneous events. With this in mind, we revised the model to permit 1975 reports as well as 1957 reports of educational aspiration to load upon true educational attainment. In this case, there was a large improvement in the fit of the model; the test statistic declined by 40.8 with 2 degrees of freedom. However, both loadings of reported aspirations on true attainments were negative. We can think of no theoretical rationale for this result, which does not conform to our expectations, nor--we think--to those of Alexander and Cook.

We estimated several other models that permitted 1975 reports of significant others' encouragement and of aspirations to load upon educational or occupational attainments, and we found limited evidence that such effects occurred. The effect of educational attainment on 1975 report of educational aspiration was consistently significant, but negative. Neither educational nor occupational attainments affected the retrospections of significant others' encouragement. The one consistent and significant positive effect of attainment upon 1975 report of aspiration occurred in the case of occupational status, where we estimated loadings of .074 on early occupational status and .080 on occupational status at mid-life. These two coefficients are associated with a test statistic of 11.2 on one degree of freedom relative to the baseline model. The contrast uses only 1 degree of freedom because we constrained the two coefficients to be equal in metric form; otherwise, they would not both have been identified. This contamination effect was not large enough to alter estimates in the structural model, and we did not incorporate it in subsequent analyses.

7.0 COMPOSITES AND FACTORS IN THE BASELINE MODEL

While the model in Figure 3 is the baseline for our analysis, several alternative specifications of socioeconomic background, academic performance, significant others' influence, and ambition were evaluated. In this section, we report comparisons between some of these alternatives and the baseline model. Without taking account of response error, Crouse et al. (1979) carried out similar, but less detailed analyses of a subsample of Wisconsin men. First, we test the proportionality constraints implicit in the construction of composites for socioeconomic background, academic performance, and significant others' influence. Second, we test the additional constraints imposed by the hypothesis that each of those constructs is a latent factor. Third, we test the hypothesis that a latent ambition factor underlies educational and occupational aspirations. The results of these tests are shown in Table 7.

Line 1 of Table 7 reports the fit of the baseline model, including all within-occasion, between-variable error correlations. Each subsequent line in the table reports the fit of an alternative model that is either more or less restrictive than the baseline model and can be contrasted with it.

7.1 Proportionality Constraints In The Baseline Model

There is a statistically significant improvement in fit when the socioeconomic background composite (η_5) is eliminated, and each background variable is permitted to affect other variables in the model directly. However, the reduction in the test statistic, 39.9, is actually smaller in relation to its degrees of freedom, 24, than is the test statistic of the baseline model. A significant share of the departure from the proportionality constraints can be represented by retaining the socioeconomic composite, but letting father's occupational status (η_3) affect occupational status aspiration (η_{14}) and early occupational status (η_{16}). The (standardized) coefficients of these two effects are .087 and .106, respectively; the test statistic is reduced by 10.9 with 2 degrees of freedom when they are added to the model. The remaining departures from proportionality in the effects of social background variables yield a test statistic of 29.0 with 22 degrees of freedom, which is not statistically significant. Thus, our analysis suggests that there is occupational status persistence in aspirations and attainments that is not adequately represented by the general socioeconomic effects of occupational origins. Sewell and Hauser (1975) suggest there is a similar income-specific disparity in the effects of background, but we are not able to test that here. Interestingly, even when the unique effects of father's occupational status are added to the model, the (standardized) weight of father's occupational status remains twice that of each other component of the socioeconomic background composite.

When the academic performance construct (η_8) is deleted, so ability (η_6) and rank in high school class (η_7) are permitted to affect later variables directly, the fit of the model improves significantly. The test statistic is 23.3 with 7 degrees of freedom. Thus, it is arguable that the notion of an academic performance construct is inconsistent with the data. Much of the inconsistency can be removed if we retain the academic performance construct, but permit mental ability (η_6) to affect occupational aspiration (η_{14}) directly. Relative to the baseline, this model yields a test statistic of 9.2 with 1 degree of freedom; the remaining departures from proportionality in the effects of mental ability and rank in high school class yield a test statistic of 14.1 with 6 degrees of freedom, which is nominally significant at the .05 probability level. The unique effect of ability on occupational aspiration is small; the standardized coefficient is .073. We conclude that departures from proportionality in the effects of mental ability and rank in high school class are not very important.

There is essentially no improvement in the fit of the model when the composite of significant others' influence (η_{12}) is deleted and its components are permitted to affect educational and occupational aspirations directly. (Recall that significant others' influence is not permitted to affect other variables in the baseline model.) The test statistic for the baseline model is reduced only by 0.7 with 2 degrees of freedom when the composite is deleted, so there is no reason to consider any relaxation of the proportionality constraints imposed by it.

7.2 Constraints in the Factor Model

We have equivocated about statistically significant violations of proportionality constraints in the baseline model; we do not believe that any of them is extremely large or important. We need not equivocate in rejecting the factor specifications of socioeconomic background, academic performance, or significant others' influence. None of them fits the data acceptably.

Hauser (1972:170) has argued that "socioeconomic background" should not be construed as a latent factor because that would not permit "a causal analysis of parental achievements . . . consistent with our causal interpretation of sons' achievements. The reflective [factor] model does not permit such an analysis because it says that socioeconomic status is the only variable which causes parental achievements." In addition to the constraints of the baseline model, the factor model specifies that socioeconomic status accounts for the correlations among its indicators (the four parental statuses) and between its indicators and other variables in the model. It places 8 additional constraints on the data, which are associated with the highly significant test statistic, 116.2 (Line 5 of Table 7). We conclude that the factor specification of socioeconomic background is unacceptable.

It is more plausible to conceive of academic performance as a factor underlying mental ability and rank in high school class. The factor model was initially developed as a tool of psychometrics, and one might think that rank in high school class is something like another mental test. In fact, we have seen that mental ability and rank in high school class are reasonably homogenous in their effects, which are in nearly the same proportion across outcomes. This constraint is also imposed by the factor model. Since there are only two indicators of academic performance, the relationship between them does not constrain the fit of the factor model. Thus, one might expect the factor model to fit acceptably. On the contrary it does not fit well; it yields a test statistic of 85.6 on one degree of freedom relative to the baseline model (Line 6 of Table 7). One way to describe the reason for the poor fit is that the factor model posits that the correlations between the indicators of academic performance and socioeconomic background are in the same proportion as the correlations between the indicators of academic performance and later variables in the model. This constraint is not imposed in the baseline model. In fact, each background variable is more highly correlated with mental ability than with rank in high school class, while we have seen that rank in high school class has larger effects than mental ability on later variables in the model.

The factor specification also is appealing in the case of perceived encouragement from significant others. First, it is attractive because the perceived encouragement items pertain to selected categories of others; they cannot be said to exhaust the important sources of social support. Second, one might argue that the items merely tap a global perception of social support for college attendance, rather than the perception of support from specific, named sources. Thus, there is both a sampling argument and a perceptual argument for the factor specification of significant others' influence. At the same time, this specification yields a poor fit to the data; the test statistic is 172.9 with 6 degrees of freedom (Line 7 of Table 7). We think there are two reasons for the unacceptable fit. First, if we simply extract a common factor from the three perceived encouragement items, the three loadings are just identified. They are .878, .776, and .709 for parents' encouragement, teachers' encouragement, and friends' plans, respectively. These loadings are not in the same proportion to one another as are the effects of the three items on educational and occupational aspirations, where teachers' encouragement is of lesser importance. This violates the factor model. Second, we noted in Section 5.1 that there is heterogeneity in the relative effects of socioeconomic background and academic ability on the three components of significant others' influence; this, too, violates the factor model.

7.3 Ambition as a Latent Factor

Several models of the stratification process specify that a latent "ambition" construct underlies educational and occupational aspirations (Turner 1964, Duncan, Haller, and Portes 1968, Hauser 1971). This seems particularly appealing because it is difficult to specify a causal relationship, either unidirectional or reciprocal, between educational and occupational aspirations (Hauser 1972). The specification was particularly successful in the Duncan-Haller-Portes model of peer influence (also, see Williams 1981) on aspirations, which did not include other outcomes of secondary schooling.

We have tested the ambition model in two stages. First we specify that an ambition factor mediates the effects of prior variables on educational and occupational aspirations, while the latter variables (but not ambition) continue to affect educational and occupational outcomes directly. This model fits moderately well; relative to the baseline model, it yields a test statistic of 10.7 with 2 degrees of freedom (Line 8a of Table 7). Second, we eliminate the paths from educational and occupational aspirations to later variables and specify that ambition affects those variables directly. Here, the fit deteriorates; relative to the first stage of the factor model, the test statistic is 144.5 with 3 degrees of freedom (Line 8b of Table 7). Almost the same test statistic is obtained when we postulate that educational and occupational aspirations form an ambition composite (not shown in Table 7). These specifications fail because educational and occupational aspirations have heterogeneous effects. Educational aspiration primarily affects educational attainment, and occupational aspiration primarily affects occupational attainment.

It would not be grossly inconsistent with the data to accept the first part of the ambition factor model while rejecting the second, but we see little sociological rationale for that specification. Moreover, two of the significant departures from proportionality constraints in the baseline model--the effects of father's occupational status and of mental ability on occupational aspiration--are suggestive of heterogeneity in the first part of the ambition specification. We suspect that the appeal of this model rests in part on the fact that it was developed in ignorance of post-high school attainments.

In summary, we have tested proportionality constraints imposed by the specification of composite variables in the baseline model. These tests reveal minor departures from the baseline model in effects of socioeconomic background and academic performance. In the first case, father's occupational status has unique effects on occupational aspiration and early occupational attainment. In the second case, mental ability has a unique effect on occupational aspiration. None of these effects is very large. We find no evidence that proportionality constraints on effects of the perceived encouragement of significant others have been violated in the baseline model. With one minor exception--homogeneity in the causes of educational and occupational aspirations--we find strong evidence that factor specifications of socioeconomic background, academic performance, significant others' influence, and ambition are inconsistent with the data. This is not, of course, to argue that there is anything generically wrong with factor specifications; they just do not work well here. The results of these tests increase our confidence in the specification of Figure 3 as the basis for further development of the model.

8.0 TRIMMING THE MODEL

Early in the paper, we proposed a return to the specification of the stratification process as a modified causal chain. To reduce the model, we retain all of the measurement assumptions of the baseline model and look at a hierarchy of models ranging from an (almost) fully recursive specification to a slightly modified version of the Sewell-Haller-Portes model. At the parsimonious end of the hierarchy, we modify the Sewell-Haller-Portes and Sewell-Haller-Ohlendorf models to render them consistent with the blocking of variables into composites. Thus, we let the academic performance composite (η_8) enter the model wherever Sewell-Haller-Portes or Sewell-Haller-Ohlendorf let rank in high school class enter the model. For example, we regress each of the components of significant others' influence on both the socioeconomic and academic performance composites, even though Sewell-Haller-Portes do not specify a path from mental ability to significant others' influence.

Table 8 displays the hierarchical relationships among the structural models. The display is interpreted as follows: The entries of 1 show the location of structural coefficients in the modified Sewell-Haller-Portes model. The combination of entries of 1 and 5 locates coefficients in the modified Sewell-Haller-Ohlendorf model. The combination of entries 1, 4, and 5 locates coefficients in a preferred model, which we describe later. The combination of entries 1, 3, 4, and 5 pertains to a (revised) baseline model, which excludes paths from significant others' influence or educational aspiration to occupational status in the early career or at mid-life; this also differs from the baseline model of the preceding analysis in permitting significant others' influence to affect educational attainment. The full set of structural coefficients in the display of Table 8 specifies a model that is fully recursive, excluding only a direct effect of educational attainment upon occupational status at mid-life.

Table 9 shows the results of goodness-of-fit tests for models in the hierarchy and contrasts adjacent models. Lines 2 to 5 of the table are numbered to correspond with the display in Table 8. For example, relative to the fully recursive model, the model of Line 2 deletes the coefficients denoted by entries of 2 in Table 8. The fully recursive model (Line 1) fits slightly better than the earlier baseline model;

unfortunately, we were unable to use it in the preceding analysis. We have already discussed the anomalous effects of educational aspiration (η_{13}) on occupational status, and we delete these at the first stage of model selection. After entering the theoretically plausible path from significant others' influence to educational attainment ($\beta_{15,12}$; see Sewell, Haller, and Portes 1969:86) and deleting the anomalous effects of educational aspiration on occupational status, we find large and implausible negative effects of significant others' influence on occupational status. For this reason we also delete the effects of significant others' influence on occupational status at this step. The deterioration of fit is greater here than at any other stage of model selection, but the reduced model does have the virtue of including only theoretically plausible (or relatively small) effects. In the next step of model selection, we eliminate 9 coefficients that are less than twice their standard errors (Line 3). While the overall loss in fit is statistically significant, it is far less in relation to the number of parameters deleted than is the loss in the preceding step. Moreover, the ratio of the test statistic to its degrees of freedom (2.62) is little more than that of the reduced model (2.46). Thus, we believe there is ample justification for this revision of the model.

When we place the modified Sewell-Haller-Ohlendorf model into the hierarchy (Line 4), only one parameter distinguishes it from the preceding, empirically reduced model. The difference lies in the highly significant effect of socioeconomic background on early occupational status. We are very impressed with the similarity between our reduced model and that of Sewell, Haller, and Ohlendorf. Of course, both specifications were obtained empirically, and both are based upon the same data. At the same time, the present treatment of the data is so different that we would not have been surprised to find much larger differences in results.

Finally, we compare the modified Sewell-Haller-Ohlendorf model with the more restrictive Sewell-Haller-Portes model. The two models differ because the former permits academic performance to affect educational and occupational aspirations and educational attainment. As in the preceding step, the difference in fit is highly significant. We agree with Sewell, Haller, and Ohlendorf that the original model substantially underestimated the importance of academic performance in the transition from secondary schooling to higher education or the labor market.

9.0 PARAMETERS OF THE TRIMMED MODEL

Table 10 presents (standardized) structural and reduced form coefficients of the trimmed model. Perhaps their most striking feature is similarity to those in Table 2. In particular, there is little reduction in the capacity of the model to account for variation in outcomes at every stage of the achievement process. Moreover, as shown in the reduced form equations for significant others' influence, η_{12}, and subsequent variables, socioeconomic background and academic performance alone explain a substantial fraction of the variance. Indeed, those two variables explain 35 percent or more of the variance in every variable in the model except occupational status at mid-life, where they account for 27 percent of the variance. There are two important changes in the structure of the model, relative to that of Table 2. First, the structural equation for educational attainment is substantially altered by the entry of significant others' influence, which reduces the coefficient of educational aspiration in the earlier model by about one third (from .577 to .426). Second, in the revised model only occupational status in the early career enters the equation for occupational status at mid-life. That is, with respect to occupational standing--but not necessarily other dimensions of achievement--the influence of social background and of the adolescent experiences represented in the model are exhausted at entry into the occupational career.

Our discussion of this model would not be complete without some reference to omitted-variable bias in the relationship between schooling and occupational status. Along with the parallel issue of bias in earning-schooling relationships, this has long been of interest to sociologists and economists of education. The corrected estimate of the correlation between education and occupational status in the early career is .821, and the corrected correlation between education and occupational status at mid-life is .683. In each case the (reduced form) coefficients of schooling are 68.5 percent as large as the zero-order relationships. This estimate of bias is larger than that for status of first occupation, but less than that for current occupation in an uncorrected analysis of occupational attainment in the Wisconsin sample (Sewell, Hauser, and Wolf 1980). No more than Bielby, Hauser, and Featherman (1977a), do we see any reason to conclude that errors in variables are responsible for a significant understatement of the influence of schooling on occupational achievement (compare Bowles 1972, Bowles and Gintis 1976, Dwyer and Phelan 1979). In fact, the reduced form coefficients of schooling in our baseline model, 8.33 and 7.41, are larger than corresponding coefficients in the uncorrected analysis of Sewell, Hauser, and Wolf (1980:570), 7.22 and 3.76; this comparison of coefficients is legitimate because the metric of the true variables in the present analysis has been specified as that of the observed variables in the analysis of Sewell, Hauser, and Wolf.

Moreover, even after our substantial corrections for measurement error, more than half of the variance in educational attainment is unrelated to socioeconomic background or academic performance, which account for 42.5 percent of the variance in schooling in the reduced form equation. To put the matter yet more strongly, the correlation between socioeconomic background and schooling is .419, which implies that 82.5 percent of the variance in schooling is unrelated, causally or coincidentally, to socioeconomic background. Most of the effect of schooling on occupational status is not due to its role in transmitting the influence of socioeconomic background, but to the outcomes of other social and psychological processes, including, but not limited to those represented explicitly in the model.

Last, we think it important to point out that the model does succeed to a substantial degree in explaining the effects of socioeconomic background and of academic performance on ultimate educational attainment and occupational status. Socioeconomic background does not enter the structural equations for educational attainment or occupational status at mid-life, and the direct effect of background on early occupational status is only 20 percent of the total influence of that variable. About 30 percent of the influence of academic performance on educational attainment is direct, that is, unmediated by the intervening variables in the model, but none of the influence of academic performance on occupational status is direct.

10.0 STOCHASTIC SPECIFICATIONS OF THE COMPOSITE VARIABLES

As a further test of the power of the model to explain intervening variables and--coincidentally--to account for relationships between socioeconomic origins and destinations, we have experimented with specifications of socioeconomic background, academic performance, and significant others' influence that combine features of the composite and factor models (Jöreskog and Goldberger 1975). As in the baseline model, we assume that the latent constructs are produced by their components, but as in the factor model, we assume that the specified components do not exhaust the content of the latent construct (compare Crouse, et al. 1979). Formally, this requires two types of changes in the structural model. First, it adds stochastic disturbances to each of the composites:

(17) $$\eta_5 = \beta_{5,1}\eta_1 + \beta_{5,2}\eta_2 + \beta_{5,3}\eta_3 + \beta_{5,4}\eta_4 + \zeta_5$$

(18) $$\eta_8 = \beta_{8,6}\eta_6 + \beta_{8,7}\eta_7 + \zeta_8$$

(19) $$\eta_{12} = \beta_{12,9}\eta_9 + \beta_{12,10}\eta_{10} + \beta_{12,11}\eta_{11} + \zeta_{12}$$

where ζ_5, ζ_8, and ζ_{12} are independent of the components of the construct they affect and of other disturbances in the model. Second, in order to identify the variances of the disturbances, we specify that the model accounts for selected covariances among structural disturbances. That is, ζ_5, ζ_8, and ζ_{12} are latent factors, and they act through the composites to explain covariances among subsequent variables. Specifically, the revised model accounts for the covariances between friends' plans and teachers' encouragement, $\psi_{11,10}$, between friends' plans and parents' encouragement, $\psi_{11,9}$, and between educational and occupational aspirations, $\psi_{13,14}$. There were four free covariances among disturbances in the earlier models, including that between parents' encouragement and teachers' encouragement, $\psi_{9,10}$. We were unable to obtain plausible estimates with any model that explained that covariance, so we left it free. That is another indication that the factor model of significant others' influence does not work.

We have experimented with a number of structural models under this specification. We have found that results are very sensitive to minor changes in the structural model because of the high degree of collinearity among the latent variables, especially significant others' influence and educational aspiration.

Under the stochastic specification of the three composites, the modified Sewell-Haller-Portes model yielded a test statistic of 495.4 with 179 degrees of freedom, and the modified Sewell-Haller-Ohlendorf model yielded a test statistic of 459.8 with 176 degrees of freedom. As in the models with no stochastic disturbances in the composites, the fit of the modified Sewell-Haller-Ohlendorf model was significantly better. Recall that the difference between the two models lies in the effects of academic performance on aspirations and on educational attainment that are posited in the latter. With one minor exception, neither the Sewell-Haller-Portes model nor the Sewell-Haller-Ohlendorf model yielded any grossly implausible parameter estimates. Under several other specifications that we thought reasonable, fit was improved, but one or another coefficient took on impermissible values. However, under the Sewell-Haller-Ohlendorf model the estimated variance of the disturbance in academic performance was (nonsignificantly) negative, so we fixed it at zero and estimated the model again. That is, we eliminated the stochastic disturbance in academic performance, but did not alter the model in any other way. This respecification increased the test statistic trivially, to 459.9. While none of the coefficients of this model were grossly implausible, we did find one feature of the estimates unacceptable. The (standardized) effect of significant others' influence on educational attainment (.492) was about twice that of educational aspiration (.251); we thought that unreasonable in light of the weaker theoretical expectation regarding the former effect.

Because of the high degree of collinearity between significant others' influence and educational aspiration under this class of specifications, we looked for models that excluded the debatable path from significant others' influence to educational attainment (as well as occupational status). Table 11 presents the (standardized) structural and reduced form coefficients of our preferred model under this specification. The model fits substantially better than does the modified Sewell-Haller-Ohlendorf model. The test statistic is 433.0 with 175 degrees of freedom; however, the model is not hierarchical relative to the modified Sewell-Haller-Ohlendorf specification, so no direct contrast between the two is possible.

The trimmed stochastic model of Table 11 posits that significant others' influence accounts completely for the effects of socioeconomic background and academic performance on educational aspiration. In this respect, it is closer to the Sewell-Haller-Portes model than to that of Sewell, Haller, and Ohlendorf. At the same time, the model posits two effects of academic performance--on occupational aspiration and educational attainment--that were added to the Sewell-Haller-Portes model by Sewell, Haller, and Ohlendorf. Further, the model of Table 11 adds direct effects of socioeconomic background on occupational aspiration, educational attainment, and occupational status in the early career that were not specified in the Sewell-Haller-Ohlendorf model. Recall that only the last of these was included in the model of Table 10. We find it useful to think of the differences between the models of Table 10 and Table 11 in the following way. The latter model increases the explanatory power of socioeconomic background and academic performance by introducing common factors of significant others' influence into each of them, but this also strengthens the relationships of background and performance with later variables in the model.

The estimates in Table 11 have several interesting features. First, there is a great deal of stochastic variance in the composites, especially in the case of socioeconomic background. More than half of the variance in socioeconomic background, according to the model, is independent of parents' education, father's occupational status, and parents' income, even when those variables have been purged of response error. We find this result implausible, although it may be less so to some critics of the present line of stratification research. One possible interpretation of this finding, we think, is that it may be unreasonable to demand that the similarity in levels of social support from parents, teachers, and peers is simply a function of social background and academic performance. Other social structural and personality factors are at work, but we have forced the appearance that they are orthogonal components of socioeconomic background and academic performance. Thus, we think that the estimates in Table 11 are better interpreted as consequences of an extreme set of assumptions than as expressions of our best guesses about the functioning of the stratification system. The findings are far more plausible in the cases of academic performance and significant others' influence, where 20.3 percent and 15.8 percent of the respective variances are attributable to the stochastic disturbances.

A second important feature of the findings, which follows immediately from the first, is that the model now accounts for even higher proportions of the variance in the components of significant others' influence and in educational and occupational aspirations. The model accounts for 60 percent or more of the variance in the components of significant others' influence, for 93 percent of the variance in educational aspiration, and for 79 percent of the variance in occupational aspiration.

Third, although the power of the model to account for variation in educational attainment and occupational status is not much affected by the stochastic specification of the composite variables (compare

Table 11 with Table 2 or Table 10), the explanatory power of the reduced form equations is substantially larger here. Socioeconomic background and academic performance together account for 63 percent of the variance in educational attainment, for 56 percent of the variance in occupational status in the early career, and for 39 percent of the variance in occupational status at mid-life.

Fourth, despite these several increases in the explanatory power of the model, it has not been necessary to introduce additional paths from socioeconomic background or performance to occupational status in the early career or at mid-life. There is a small and significant direct effect of socioeconomic background on early occupational status, but that path was also included in the model of Table 10. Even with the extreme assumptions of the present model, we find that the influences of social background and academic performance on occupational standing occur primarily through adolescent socialization processes and schooling and that those influences are exhausted upon entry into the occupational career. To put the same observation in a slightly different way, we find that the reduced form effects of schooling in the equations for occupational status are 67 percent as large as the zero-order regressions in the model of Table 11, compared with 69 percent in the model of Table 10. Our extreme assumptions about the stochastic disturbances in social background and other variables have had virtually no effect upon omitted variable bias in the schooling coefficient. Moreover, we still find that most of the variance in schooling is unrelated to socioeconomic background. The respecification of the model increases the correlation between socioeconomic background and schooling to .571; no less than 67.4 percent of the variance in schooling must be due to factors other than socioeconomic background, including those represented explicitly in the model.

11.0 CONCLUSION

Using multiple observations of almost all of the variables in the well-known Wisconsin model of educational and occupational attainment, we have found compelling evidence that the data on which the model was first estimated are subject to large random and nonrandom response errors. In particular, our validation of student reports of socioeconomic background variables has yielded larger estimates of response variability than earlier studies using either test-retest or parent-child validation methods. It will be important to work out the implications of these findings for models of the stratification process in national samples. At the same time, several of our worst fears about correlated response errors were not supported by the analysis. For example, we did not find that students' reports of encouragement by others are merely a reflection of the students' own goals, nor did we find consistent or strong evidence that reports of aspirations are contaminated by (subsequent) achievements.

Using structural models that take account of plausible patterns of response error, we have tested a number of specifications of the stratification process. We find that the data are quite inconsistent with multiple-indicator (factor) representations of socioeconomic background, academic performance, significant others' influence, or aspirations, but they are consistent with multiple-cause (composite) representations of those constructs. By identifying stochastic disturbances in the multiple-cause models, we have been able to capture some of the desirable features of the factor model without sacrificing fit.

In the original formulations of the Wisconsin model, it was said to be a modified causal chain, but this notion has been forgotten in numerous replications and elaborations of the model. We have evaluated the Sewell-Haller-Portes and Sewell-Haller-Ohlendorf specifications in the context of our structural model. We find that the Sewell-Haller-Portes model substantially underestimated the importance of mental ability and rank in high school class in the stratification process, but this was less true in the Sewell-Haller-Ohlendorf model. While we did trim a number of coefficients from the structural model--so it can be said to explain much of the influence of social background and academic performance on educational and occupational attainments--we did find it necessary to posit a lagged effect of socioeconomic background on occupational status in the early career.

Despite our substantial adjustments for response error, we have been impressed with the degree to which major features of the original formulations of the Wisconsin model have persisted in the present analysis. Beyond points already mentioned, we think that our findings with respect to the relative importance of encouragement from parents, teachers, and friends and with respect to omitted variable bias in the schooling coefficient are both important and robust. At the same time, the present findings are sufficiently different from those in previous analyses of the Wisconsin data--especially with regard to the predictive power of the model-- that we are even more inclined than in the past to discourage comparative analyses that are not based upon well-calibrated measurements with known error structures.

We are dissatisfied with some of the analyses presented here. For example, we have glossed over serious problems of levels of measurement and of missing data. At the same time, we think our analyses do illustrate a manageable analytic framework for further model development. In future work, we hope to extend the present model in several ways: to include multiple measurements of earnings, to compare processes of stratification between men and women, and to account for differences and similarities among siblings.

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Table 1. Sources and Descriptions of Variables

Variable	Indicator	Source	Description
Father's education (η_1)	X1	1957 survey	Years of school completed
	X2	1975 survey	Years of school completed
Mother's education (η_2)	X3	1957 survey	Years of school completed
	X4	1975 survey	Years of school completed
Father's occupational status (η_3)	X5	Wisconsin tax records	Duncan SEI of detailed Census occupation in 1957 or closest year available
	X6	1975 survey	Duncan SEI of detailed Census occupation of head of household in 1957
Parents' income (η_4)	X7	Wisconsin tax records	Log of parents' income in 1957 or first year avalable
	X8	Wisconsin tax records	Log of average parents' income for years following the first available, 1957-60
Mental ability (η_6)	Q	Wisconsin Testing Service	IQ based on Henmon-Nelson test given in grade 11
High school rank (η_7)	G	School records	Based on average of grades in high school, ranked and normalized
Parents' encouragement (η_9)	P57	1957 survey	Scored 1 if R reported parental encouragement to attend college; scored 0 otherwise
	P75	1975 survey	Scored 1 if R reported parental encouragement to attend college; scored 0 otherwise
Teachers' encouragement (η_{10})	T57	1957 survey	Scored 1 if R reported teacher's encouragement to attend college; scored 0 otherwise
	T75	1975 survey	Scored 1 if R reported teacher's encouragement to attend college; scored 0 otherwise

Table 1, continued

Variable	Indicator	Source	Description
Friends' college plans (η_{11})	F57	1957 survey	Scored 1 if R reported most friends were planning to attend college; scored 0 otherwise
	F75	1975 survey	Scored 1 if R reported most friends were planning to attend college; scored 0 otherwise
College plans (η_{13})	E57	1957 survey	Scored 1 if R planned to attend a college or university; scored 0 otherwise
	E75	1975 survey	Scored 1 if R planned to attend a college or university; scored 0 otherwise
Occupational status aspiration (η_{14})	J57	1957 survey	Duncan SEI of occupation R hoped eventually to enter
	J75	1975 survey	Duncan SEI of occupation R hoped eventually to enter
Educational attainment (η_{15})	ED64	1964 survey	Years of school completed by 1964; truncated at 17
	ED75	1975 survey	Years of regular schooling completed; truncated at 17
Early occupational status (η_{16})	OC64	1964 survey	Duncan SEI of detailed Census occupation held in 1964
	OC1	1975 survey	Duncan SEI of detailed Census occupation: first full-time civilian job held after completing grade of regular schooling
Occupational status at mid-life (η_{17})	OC70	1975 survey	Duncan SEI of detailed Census occupation held in 1970
	OCCR	1975 survey	Duncan SEI of detailed Census occupation held at survey date or of last occupation held within the preceding five years

Table 2. Structural Coefficients of Full Model with No Stochastic Disturbances in η_5, η_8, η_{12}: Male Wisconsin High School Graduates (N = 2038 listwise present)

Dependent variable	Predetermined Variable η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	η_9	η_{10}	η_{11}	η_{12}	η_{13}	η_{14}	η_{15}	η_{16}	Variance of disturbance	Coefficient of determination
η_5	1.000 — [.238]	1.084 (.489) [.211]	3.159 (1.144) [.570]	3.733 (1.252) [.225]													0.000	1.000
η_7	—	—	—	—	-.0043 (.0028) [-.035]	.532 (.018) [.568]											1.234 (.039)	.313
η_8	—	—	—	—	—	1.000 — [.335]	2.468 (.325) [.774]										0.000	1.000
η_9	—	—	—	—	.01478 (.00419) [.446]	—	—	.03377 (.00393) [.400]									.0747 (.0055)	.427
η_{10}	—	—	—	—	.00524 (.00170) [.171]	—	—	.04865 (.00533) [.622]									.0606 (.0064)	.457
η_{11}	—	—	—	—	.01426 (.00405) [.450]	—	—	.02475 (.00320) [.306]									.0774 (.0060)	.350
η_{12}	—	—	—	—	—	—	—	—	1.000 — [.531]	.437 (.163) [.215]	.784 (.134) [.398]						0.000	1.000
η_{13}	—	—	—	—	-.0019 (.0012) [-.050]	—	—	.0105 (.0031) [.110]	—	—	—	.504 (.054) [.839]					.0376 (.0036)	.774
η_{14}	—	—	—	—	.0044 (.0059) [.021]	—	—	.0862 (.0181) [.164]	—	—	—	2.445 (.269) [.740]					1.375 (.120)	.727
η_{15}	—	—	—	—	.0164 (.0055) [.102]	—	—	.0675 (.0108) [.164]	—	—	—	—[a]	2.484 (.184) [.577]	.087 (.034) [.111]			.971 (.050)	.685
η_{16}	—	—	—	—	.0115 (.0050) [.059]	—	—	.0000 (.0102) [.000]	—	—	—	—[a]	-1.643 (.261) [-.315]	.476 (.043) [.503]	.833 (.045) [.689]		1.040 (.076)	.770
η_{17}	—	—	—	—	.0057 (.0046) [.029]	—	—	-.0001 (.0113) [-.000]	—	—	—	—[a]	-.798 (.233) [-.150]	.072 (.056) [.074]	—[a]	.889 (.048) [.872]	1.355 (.090)	.711

Note: Entries are structural coefficient, (standard error), [standardized coefficient]. The scales of occupational status variables (η_3, η_{14}, η_{16}, η_{17}) and academic performance variables (η_6, η_7) have been shrunk by a factor of 10 for convenience in presentation. Variables are η_1 = father's educational attainment, η_2 = mother's educational attainment, η_3 = father's occupational status, η_4 = parents' income, η_5 = socioeconomic status of family of orientation, η_6 = mental ability, η_7 = rank in high school class, η_8 = academic performance, η_9 = parents' encouragement to attend college, η_{10} = teacher's encouragement to attend college, η_{11} = friends' plans to attend college, η_{12} = significant others' influence on college attendance, η_{13} = educational aspiration, η_{14} = occupational status aspiration, η_{15} = educational attainment, η_{16} = early occupational status, η_{17} = mid-life occupational status. This model yields the likelihood-ratio chi-square L^2 = 341.8 with 165 degrees of freedom.

[a]Coefficient fixed at zero; see text for explanation.

Table 3. Standardized Ψ Matrix of Full Model with No Stochastic Disturbances in η_5, η_8, η_{12}: Male Wisconsin High School Graduates N = 2038 listwise present)

	η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	η_9	η_{10}	η_{11}	η_{12}	η_{13}	η_{14}	η_{15}	η_{16}	η_{17}
η_1	1.000																
η_2	.555	1.000															
η_3	.643	.395	1.000														
η_4	.357	.263	.522	1.000													
η_5	-----	-----	-----	-----	.000												
η_6	.264	.226	.243	.151	-----	1.000											
η_7	-----	-----	-----	-----	-----	-----	1.000										
η_8	-----	-----	-----	-----	-----	-----	-----	.000									
η_9	-----	-----	-----	-----	-----	-----	-----	-----	1.000								
η_{10}	-----	-----	-----	-----	-----	-----	-----	-----	.520	1.000							
η_{11}	-----	-----	-----	-----	-----	-----	-----	-----	.390	.369	1.000						
η_{12}	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	.000					
η_{13}	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.000				
η_{14}	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	.371	1.000			
η_{15}	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.000		
η_{16}	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.000	
η_{17}	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.000

Note: Variables are η_1 = father's educational attainment, η_2 = mother's educational attainment, η_3 = father's occupational status, η_4 = parents' income, η_5 = socioeconomic status of family of orientation, η_6 = mental ability, η_7 = rank in high school class, η_8 = academic performance, η_9 = parents' encouragement to attend college, η_{10} = teacher's encouragement to attend college, η_{11} = friends' plans to attend college, η_{12} = significant others' influence on college attendance, η_{13} = educational aspiration, η_{14} = occupational status aspiration, η_{15} = educational attainment, η_{16} = early occupational status, η_{17} = mid-life occupational status.

Table 4. Estimated Parameters of the Measurement Model, Full Model with No Stochastic Disturbances in η_5, η_8 or η_{12}: Male Wisconsin High School Graduates (N = 2038 listwise present)

Variable	Indicator	Error variance	True variance	Relative slope	Reliability	Test-retest correlation
η_1	X1	2.030 (.185)	6.749	1.012 (.030)	.773	.767
	X2	3.138 (.193)	6.749	1.000	.683	——
η_2	X3	2.068 (.265)	4.500	1.186 (.051)	.754	.733
	X4	2.733 (.199)	4.500	1.000	.622	——
η_3	X5	1.622 (.096)	3.863	.894 (.029)	.656	.701
	X6	1.319 (.110)	3.863	1.000	.746	——
η_4	X7	.0303 (.0105)	.4322	1.000	.935	.846
	X8	.1114 (.0095)	.4322	.919 (.025)	.767	——
η_9	P57	.1094 (.0054)	.1304	1.000	.546	.518
	P75	.1257 (.0057)	.1304	.980 (.038)	.497	——
η_{10}	T57	.1380 (.0071)	.1116	1.000	.448	.371
	T75	.1735 (.0067)	.1116	.828 (.045)	.306	——
η_{11}	F57	.1020 (.0058)	.1190	1.000	.538	.478
	F75	.1212 (.0053)	.1190	.872 (.041)	.427	——
η_{13}	E57	.0621 (.0034)	.1663	1.000	.730	.718
	E75	.0731 (.0036)	.1663	.974 (.024)	.683	——
η_{14}	J57	2.344 (.117)	5.046	1.000	.681	.681
	J75	2.404 (.122)	5.046	.998 (.026)	.677	——
η_{15}	ED64	.6792 (.0385)	3.086	.956 (.017)	.806	.845
	ED75	.4463 (.0376)	3.086	1.000	.875	——
η_{16}	OC64	1.599 (.091)	4.515	.949 (.025)	.718	.685
	OC1	2.140 (.108)	4.515	1.000	.679	——
η_{17}	OC70	.799 (.115)	4.689	1.047 (.020)	.866	.817
	OCCR	1.237 (.112)	4.689	1.000	.792	——

Note: See Table 1 for identification of indicators. The variances of occupational variables have been divided by 100 for convenience in presentation. Parenthetic entries are standard errors.

Table 5. Global Tests for Within-Occasion, Between-Variable Error Correlations in the Full Model with No Stochastic Disturbances in η_5, η_8, or η_{12}: Male Wisconsin High School Graduates (N = 2038 listwise present)

Model or contrast	L^2	df	L^2/df
A. Models			
1. Baseline (all within-occasion, between variable error correlations)	341.8	165	2.07
2. Random error (no correlated errors)	1095.7	253	4.33
3. Baseline less correlations within 1957 survey	596.4	186	3.21
4. Baseline less correlations within tax records	348.0	167	2.08
5. Baseline less correlations within 1964 survey	341.8	166	2.06
6. Baseline less all correlations within 1975 survey	684.6	229	2.99
7. Baseline less correlations among socioeconomic variables in 1975 survey	553.1	184	3.01
8. Baseline less correlations among social psychological variables in 1975 survey	396.8	175	2.27
9. Baseline less correlations between socioeconomic and social psychological variables in 1975 survey	417.1	200	2.09
B. Contrasts (source)			
1. A2 vs. A1 (all error correlations)	753.9	88	8.57
2. A3 vs. A1 (within 1957 survey)	254.6	21	12.12
3. A4 vs. A1 (within tax records)	6.2	2	3.10
4. A5 vs. A1 (within 1964 survey)	0.0	1	0.00
5. A6 vs. A1 (within 1975 survey)	342.8	64	5.36
6. A7 vs. A1 (within socioeconomic variables in 1975 survey)	211.3	19	11.12
7. A8 vs. A1 (within social psychological variables in 1975 survey)	55.0	10	5.50
8. A9 vs. A1 (between socioeconomic and social psychological variables in 1975 survey)	75.3	35	2.15

Table 6. Standardized Θ_ε Matrix of Full Model with No Stochastic Disturbances in η_5, η_8, η_{12}: Male Wisconsin High School Graduates (N = 2038 listwise present)

	X1	X2	X3	X4	X5	X6	X7	X8	P57	P75	T57	T75	F57	F75	E57	E75	J57	J75	ED64	ED75	OC64	OC1	OC70	OCCR
X1	1.000	7	1	—	—	—	—	—	1	—	1	—	1	—	1	—	1	—	—	—	—	—	—	—
X2	.147 (a)	1.000	—	4	—	4	—	—	—	6	—	6	—	6	—	6	—	6	—	4	—	4	4	4
X3	.194 (3.35)	—	1.000	7	—	—	—	—	—	—	1	—	1	—	1	—	1	—	—	—	—	—	—	—
X4	—	.271 (7.13)	.156 (a)	1.000	—	4	—	—	—	6	—	6	—	6	—	6	—	6	—	4	—	4	4	4
X5	—	—	—	—	1.000	—	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
X6	—	.084 (2.25)	—	.067 (1.97)	—	1.000	—	—	—	6	—	6	—	6	—	6	—	6	—	4	—	4	4	4
X7	—	—	—	—	.208 (1.87)	—	1.000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
X8	—	—	—	—	.145 (2.47)	—	—	1.000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P57	.004 (.11)	—	-.003 (-.08)	—	—	—	—	—	1.000	—	1	—	1	—	1	—	1	—	—	—	—	—	—	—
P75	—	.063 (2.15)	—	.020 (.69)	—	.001 (.02)	—	—	—	1.000	—	5	—	5	—	5	—	5	—	6	—	6	6	6
T57	.004 (.11)	—	-.022 (-.65)	—	—	—	—	—	.183 (5.40)	—	1.000	—	1	—	1	—	1	—	—	—	—	—	—	—
T75	—	-.014 (-.51)	—	.004 (.16)	—	.034 (1.07)	—	—	—	.147 (5.12)	—	1.000	—	5	—	5	—	5	—	6	—	6	6	6
F57	-.030 (-.84)	—	-.007 (-.19)	—	—	—	—	—	.134 (4.51)	—	.105 (3.01)	—	1.000	—	1	—	1	—	—	—	—	—	—	—
F75	—	.041 (1.42)	—	.016 (.58)	—	.067 (1.99)	—	—	—	.024 (.81)	—	.019 (.68)	—	1.000	—	5	—	5	—	6	—	6	6	6
E57	-.017 (-.44)	—	.007 (.17)	—	—	—	—	—	.065 (1.90)	—	.050 (1.54)	—	.054 (1.54)	—	1.000	—	1	—	—	—	—	—	—	—
E75	—	.018 (.59)	—	-.008 (-.25)	—	.011 (.33)	—	—	—	.066 (2.07)	—	.080 (2.76)	—	-.010 (-.33)	—	1.000	—	5	—	6	—	—	—	—
J57	-.038 (-1.05)	—	-.043 (-1.15)	—	—	—	—	—	.067 (2.04)	—	.036 (1.16)	—	.056 (1.66)	—	.515 (13.14)	—	1.000	—	—	—	—	—	—	—
J75	—	.065 (2.08)	—	.026 (.85)	—	.108 (3.01)	—	—	—	-.027 (-.84)	—	-.038 (-1.30)	—	-.049 (-1.57)	—	.112 (3.19)	—	1.000	—	6	—	6	6	6
ED64	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.000	—	3	—	—	—
ED75	—	.032 (.90)	—	-.035 (-1.03)	—	-.062 (-1.49)	—	—	—	.029 (.83)	—	-.015 (-.44)	—	.011 (.31)	—	-.033 (-.82)	—	-.130 (-3.33)	—	1.000	—	4	4	4
OC64	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.000 (-.01)	—	1.000	—	—	—
OC1	—	.044 (1.48)	—	-.051 (-1.76)	—	.075 (2.13)	—	—	—	.008 (.28)	—	-.038 (-1.35)	—	-.004 (-.15)	—	-.049 (-1.53)	—	.060 (1.79)	—	.416 (8.81)	—	1.000	4	4
OC70	—	.010 (.21)	—	.006 (.12)	—	.048 (.80)	—	—	—	.003 (.07)	—	.059 (1.28)	—	-.016 (-.34)	—	-.062 (-1.14)	—	.160 (2.71)	—	-.017 (-.24)	—	-.052[b] (-.78)	1.000	4
OCCR	—	-.014 (-.34)	—	-.018 (-.46)	—	.079 (1.59)	—	—	—	.001 (.02)	—	-.001 (-.03)	—	.026 (.65)	—	-.068 (-1.51)	—	.206 (4.24)	—	-.066 (-1.09)	—	-.042[b] (-.78)	-.069[b] (-.78)	1.000

Note: Entries below main diagonal are correlations (unit normal deviate of error covariance). See Table 1 for identification of indicators. Entries above the diagonal identify types of error correlation: 1 = within 1957 survey, 2 = within tax records, 3 = within 1964 survey, 4 = among socioeconomic variables in 1975 survey, 5 = among social psychological variables in 1975 survey, 6 = between socioeconomic and psychological variables in 1975 survey, 7 = between 1957 and 1975 reports by the same person.

[a] This coefficient is not identified in the present model; it is based on estimates in a subsample where siblings provided a third, independent observation of paternal educational attainment. See text for explanation.

[b] The correlation between errors in OC70 and OCCR is identified by setting its error covariance equal to those between OC1 and each of OC70 and OCCR; all three indicators were measured in the 1975 survey.

Table 7. Tests of Selected Alternatives to the Baseline Model (Full, No Stochastic Disturbances in η_5, η_8, η_{12}): Male Wisconsin High School Graduates (N = 2038 listwise present)

Model or contrast	L^2	df	L^2/df
1. Baseline model (including all within-occasion, between-variable error correlations)	341.8	165	2.07
2. Delete η_5(free β_{ij}, j = 1-4, i = 7,9-11, 13-17)	301.9	141	2.14
2 vs. 1	39.9	24	1.66
3. Delete η_8(free β_{ij}, j = 6,7, i = 9-11, 13-17)	318.5	158	2.02
3 vs. 1	23.3	7	3.33
4. Delete η_{12}(free β_{ij}, j = 9-11, i = 13,14)	341.1	163	2.09
4 vs. 1	0.7	2	.35
5. Make η_5 a factor (β_{5i} = 0, i = 1-4; β_{15} = 1; free β_{25}, β_{35}, β_{45}, ψ_{55}, ψ_{56}; $\psi_{12} = \psi_{13} = \psi_{14} = \psi_{23} = \psi_{24} = \psi_{34} = \psi_{16} = \psi_{26} = \psi_{36} = \psi_{46} = 0$)	458.0	173	2.65
5 vs. 1	116.2	8	14.53
6. Make η_8 a factor ($\beta_{86} = \beta_{87} = \beta_{76} = \beta_{75} = 0$; β_{68} = 1; free β_{78}, ψ_{88}; ψ_{i6} = 0, i = 1-4; free ψ_{i8}, i = 1-4)	427.4	166	2.57
6 vs. 1	85.6	1	85.60
7. Make η_{12} a factor ($\beta_{12,i} = \beta_{i5} = \beta_{i8} = 0$, i = 9-11; $\beta_{9,12}$ = 1; free $\beta_{10,12}$, $\beta_{11,12}$, $\psi_{12,12}$; $\psi_{9,10} = \psi_{9,11} = \psi_{10,11} = 0$)	514.7	171	3.01
7 vs. 1	172.9	6	28.82
8. Make ambition (η_{18}) a factor			
a. Relative to its causes ($\beta_{13,18}$ = 1; free $\beta_{14,18}$, $\beta_{18,5}$, $\beta_{18,8}$, $\beta_{18,12}$, $\psi_{18,18}$; $\psi_{13,14} = \beta_{ij} = 0$, i = 13,14, j = 5,8,12)	352.5	167	2.11
8a vs. 1	10.7	2	5.35
b. Relative to its causes and effects (same as 8a plus β_{ij} = 0, i = 15-17, j = 13,14; free $\beta_{i,18}$, i = 15-17)	497.0	170	2.92
8b vs. 8a	144.5	3	48.17

Note: See text for explanation.

Table 8. Display of Hierarchical Relationships among Models in Table 7.

Dependent variables	Predetermined variables										
	η_1–η_4	η_5	η_6	η_7	η_8	η_9–η_{11}	η_{12}	η_{13}	η_{14}	η_{15}	η_{16}
η_5	1	--									
η_6	--	--	--								
η_7	--	3	1	--							
η_8	--	--	1	1	--						
η_9–η_{11}	--	1	--	--	1	--					
η_{12}	--	--	--	--	--	1	--				
η_{13}	--	3	--	--	5	--	1	--			
η_{14}	--	3	--	--	5	--	1	--	--		
η_{15}	--	3	--	--	5	--	1	1	3	--	
η_{16}	--	4	--	--	3	--	2	2	1	1	--
η_{17}	--	3	--	--	3	--	2	2	3	--	1

Note: Entries are 1 = structural coefficients in modified Sewell-Haller-Portes model, 2 to 5 = step of deletion model hierarchy of Table 7. See text for explanation. Variables are η_1 = father's educational attainment, η_2 = mother's educational attainment, η_3 = father's occupational status, η_4 = parents' income, η_5 = socio-economic status of family of orientation, η_6 = mental ability, η_7 = rank in high school class, η_8 = academic performance, η_9 = parents' encouragement to attend college, η_{10} = teachers' encouragement to attend college, η_{11} = friends' plans to attend college, η_{12} = significant others' influence on college attendance, η_{13} = educational aspiration, η_{14} = occupational status aspiration, η_{15} = educational attainment, η_{16} = early occupational status, η_{17} = mid-life occupational status.

Table 9. A Hierarchy of Structural Models of the Stratification Process (No Stochastic Disturbances in η_5, η_8, η_{12}): Male Wisconsin High School Graduates (N = 2038 listwise present)

Model or contrast	L	df	L/df
1. Fully recursive (but delete $\beta_{17,15}$)	324.4	162	2.00
2. Delete $\beta_{16,12}$, $\beta_{16,13}$, $\beta_{17,12}$, $\beta_{17,13}$	406.6	166	2.45
2 vs. 1	82.2	4	20.55
3. Delete $\beta_{7,5}$, $\beta_{13,5}$, $\beta_{14,5}$, $\beta_{15,5}$, $\beta_{15,14}$, $\beta_{16,8}$, $\beta_{17,5}$, $\beta_{17,8}$, $\beta_{17,14}$	430.2	175	2.46
3 vs. 2	23.6	9	2.62
4. Modified Sewell-Haller-Ohlendorf model: delete $\beta_{16,5}$	444.0	176	2.52
4 vs. 3	13.8	1	13.80
5. Modified Sewell-Haller-Portes model: delete $\beta_{13,8}$, $\beta_{14,8}$, $\beta_{15,8}$	485.4	179	2.71
5 vs. 4	41.4	3	13.80

Note: All models include between-variable, within-occasion error correlations. See Figure 3 for identification of variables.

Table 10. Structural and Reduced Form Coefficients (Variables in Standard Form) of Reduced Model with No Stochastic Disturbance in η_5, η_8 or η_{12}: Male Wisconsin High School Graduates (N = 2038 listwise present)

Dependent Variable	Predetermined Variable																Coefficient of Determination
	η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	η_9	η_{10}	η_{11}	η_{12}	η_{13}	η_{14}	η_{15}	η_{16}	
η_5	.249	.211	.551	.239													1.000
η_7						.558											.311
η_8						.340	.770										1.000
η_9					.449			.399									.438
η_{10}					.174			.621									.463
η_{11}					.451			.305									.356
η_{12}					.461			.458									.514
η_{12}					—			—	.539	.188	.414						1.000
η_{13}					.359			.497									.453
η_{13}					—			.140				.779					.748
η_{14}					.340			.507									.448
η_{14}					—			.169				.738					.712
η_{15}					.307			.512									.425
η_{15}					—			.206				.667					.641
η_{15}					—			.147				.335	.426				.686
η_{16}					.349			.449									.392
η_{16}					.068			.170				.610					.573
η_{16}					.103			.095				—	.327	.379			.626
η_{16}					.068			.083				.189	.240	.318			.633
η_{16}					.068			—				—	—	.318	.563		.733
η_{17}					.290			.374									.271
η_{17}					.056			.141				.507					.396
η_{17}					.085			.079				—	.272	.315			.433
η_{17}					.056			—				—	—	.264	.468		.507
η_{17}					—			—				—	—	—	—	.832	.692

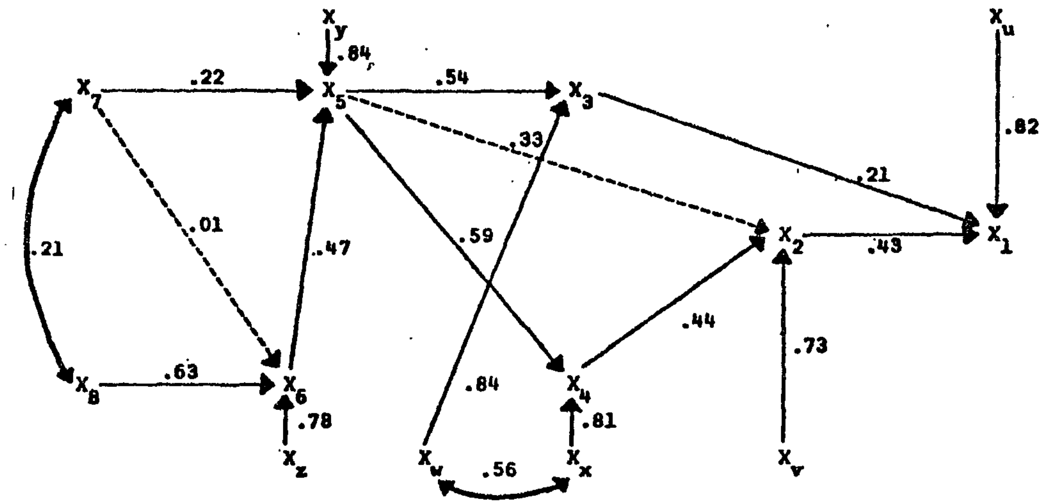
Note: All coefficients reported are at least twice their standard errors. This model yields the likelihood-ratio chi-square statistic 430.2 with 175 degrees of freedom. Variables are η_1 = father's educational attainment, η_2 = mother's educational attainment, η_3 = father's occupational status, η_4 = parents' income, η_5 = socioeconomic status of family of orientation, η_6 = mental ability, η_7 = rank in high school class, η_8 = academic performance, η_9 = parents' encouragement to attend college, η_{10} = teachers' encouragement to attend college, η_{11} = friends' plans to attend college, η_{12} = significant others' influence on college attendance, η_{13} = educational aspiration, η_{14} = occupational status aspiration, η_{15} = educational attainment, η_{16} = early occupational status, η_{17} = mid-life occupational status.

Table 11. Structural and Reduced Form Coefficients (Variables in Standard Form) of Reduced Model with Stochastic Disturbances in η_5, η_8, and η_{12}: Male Wisconsin High School Graduates (N = 2038 listwise present)

Dependent Variable	Predetermined Variable																Coefficient of Determination
	η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	η_9	η_{10}	η_{11}	η_{12}	η_{13}	η_{14}	η_{15}	η_{16}	
η_5	.168	.156	.386	.157													.481
η_7						.558											.311
η_8						.298	.692										.797
η_9					.622			.453									.669
η_{10}					.244			.735									.647
η_{11}					.639			.358									.598
η_{12}					.515			.568									.667
η_{12}					----			----	.329	.409	.331						.842
η_{13}					.497			.548									.621
η_{13}					----			----				.965					.931
η_{14}					.524			.560									.667
η_{14}					.217			.221				.596					.786
η_{15}					.495			.560									.634
η_{15}					.278			.321				.421					.693
η_{15}					.278			.321				----	.437				.706
η_{16}					.512			.484									.564
η_{16}					.297			.246				.419					.622
η_{16}					.229			.177				----	.241	.312			.647
η_{16}					.075			----				----	----	.312	.522		.736
η_{17}					.426			.403									.390
η_{17}					.247			.205				.348					.431
η_{17}					.191			.148				----	.201	.260			.448
η_{17}					.063			----				----	----	.260	.459		.510
η_{17}					----			----				----	----	----	----	.832	.693

Note: All coefficients reported are at least twice their standard errors. This model yields the likelihood-ratio chi-square statistic 433.0 with 175 degrees of freedom. Variables are η_1 = father's educational attainment, η_2 = mother's educational attainment, η_3 = father's occupational status, η_4 = parents' income, η_5 = socioeconomic status of family of orientation, η_6 = mental ability, η_7 = rank in high school class, η_8 = academic performance, η_9 = parents' encouragement to attend college, η_{10} = teachers' encouragement to attend college, η_{11} = friends' plans to attend college, η_{12} = significant others' influence on college attendance, η_{13} = educational aspiration, η_{14} = occupational status aspiration, η_{15} = educational attainment, η_{16} = early occupational status, η_{17} = mid-life occupational status.

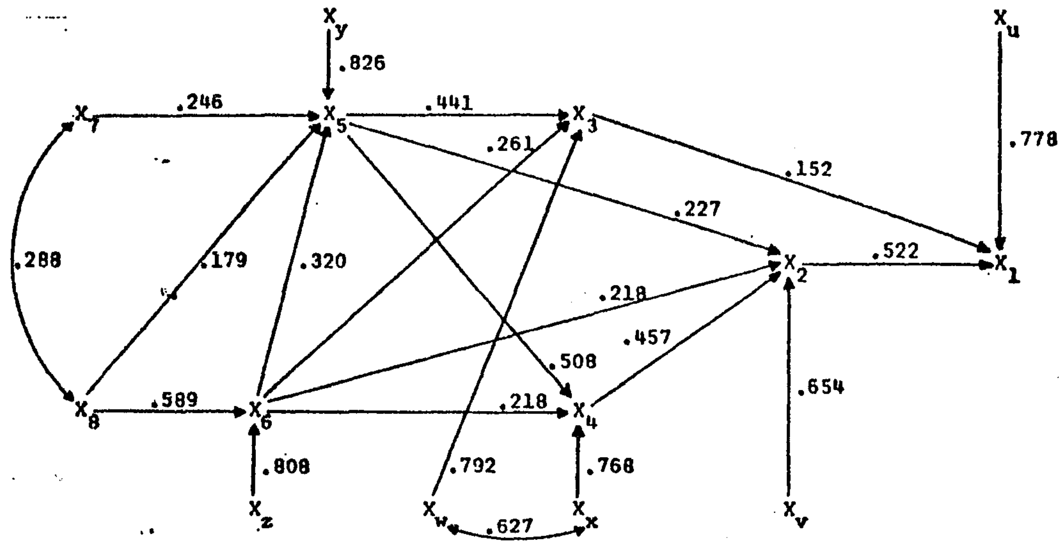
Figure 1. Sewell-Haller-Portes Model of Educational and Occupational Attainment Levels



X_1 - Occupational Attainment
X_2 - Educational Attainment
X_3 - Level of Occupational Aspiration
X_4 - Level of Educational Aspiration
X_5 - Significant Others' Influence
X_6 - Academic Performance
X_7 - Socioeconomic Status
X_8 - Mental Ability

Source: William H. Sewell, Archibald O. Haller, and Alejandro Portes "The Educational and Early Occupational Attainment Process." American Sociological Review 34 (February 1969):85.

Figure 2. Sewell-Haller-Ohlendorf Model of Educational and Occupational Attainment



X_1 - Occupational Attainment

X_2 - Educational Attainment

X_3 - Level of Occupational Aspiration

X_4 - Level of Educational Aspiration

X_5 - Significant Others' Influence

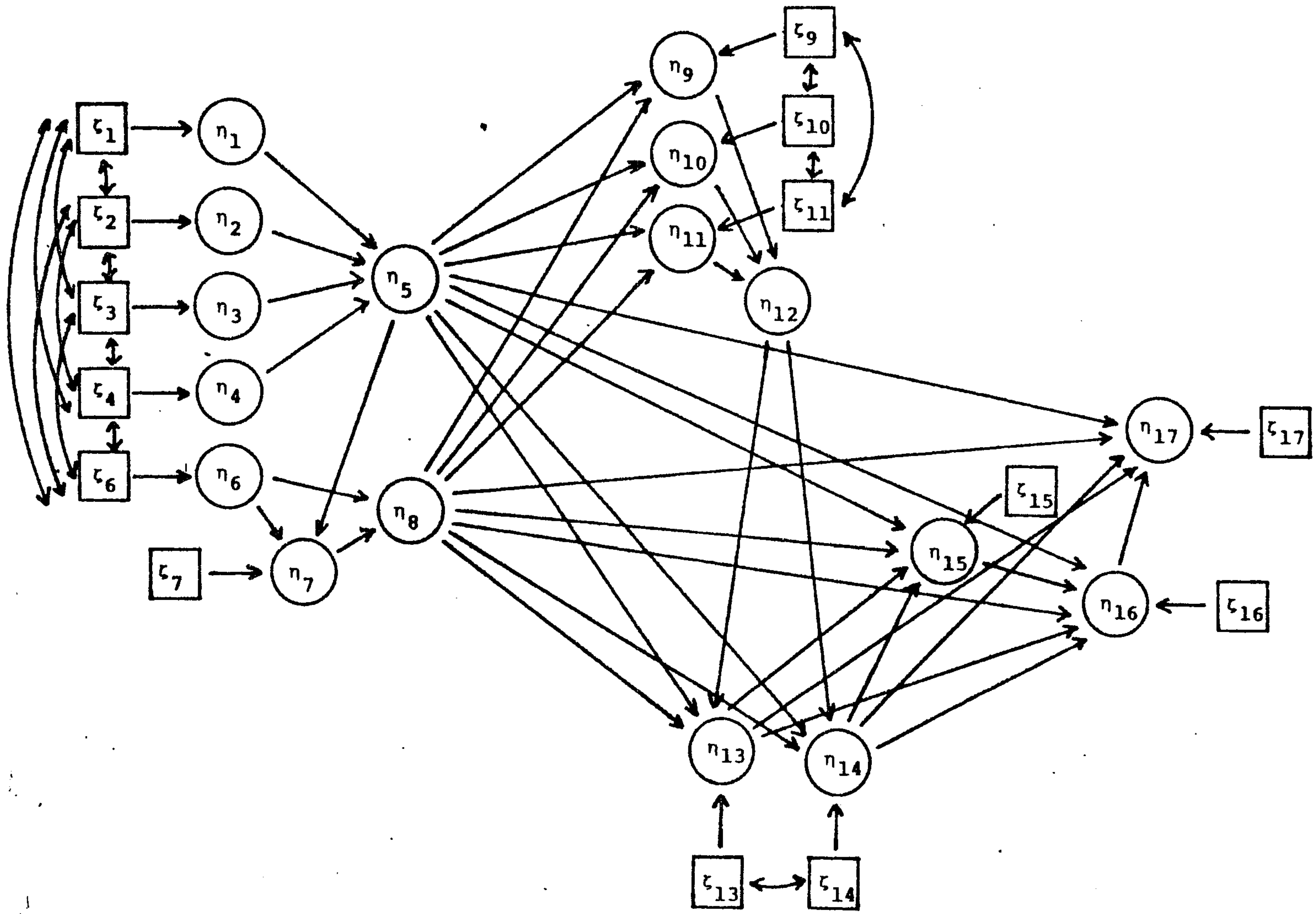
X_6 - Academic Performance

X_7 - Socioeconomic Status

X_8 - Mental Ability

Source: William H. Sewell, Archibald O. Haller, and George W. Ohlendorf "The Educational and Early Occupational Status Attainment Process: Replication and Revision." American Sociological Review 35 (December 1970): 1023.

Figure 3: Baseline Structural Model of the Stratification Process



Note: Latent variables are η_1 = father's educational attainment, η_2 = mother's educational attainment, η_3 = father's occupational status, η_4 = parents' income, η_5 = socioeconomic status of family of orientation, η_6 = mental ability, η_7 = rank in high school class, η_8 = academic performance, η_9 = parents' encouragement to attend college, η_{10} = teachers' encouragement to attend college, η_{11} = friends' plans to attend college, η_{12} = significant others' influence on college attendance, η_{13} = educational aspiration, η_{14} = occupational status aspiration, η_{15} = educational attainment, η_{16} = early occupational status, η_{17} = mid-life occupational status.

Appendix Table A. Means and Standard Deviations of Variables in the Analysis Sample and the Full Sample: Male Wisconsin High School Graduates

	Analysis sample			Full sample		
Variable	Mean	SD	N	Mean	SD	N
X1	10.02	2.99	2038	10.04	3.09	3887
X2	9.68	3.15	2038	9.77	3.30	3714
X3	10.36	2.90	2038	10.39	2.95	3887
X4	10.57	2.69	2038	10.66	2.77	3717
X5	29.62	21.68	2038	30.62	22.23	3541
X6	33.79	22.82	2038	34.66	23.30	3800
X7	5.02	0.68	2038	5.02	0.72	3540
X8	3.86	0.69	2038	3.86	0.73	3539
Q	100.74	14.33	2038	101.34	14.92	3887
G	97.10	13.39	2038	97.81	13.95	3592
P57	0.58	0.49	2038	0.59	0.49	3887
P75	0.51	0.50	2038	0.53	0.50	3887
T57	0.46	0.50	2038	0.46	0.50	3887
T75	0.43	0.50	2038	0.44	0.50	3887
F57	0.34	0.47	2038	0.36	0.48	3887
F75	0.31	0.46	2038	0.33	0.47	3887
E57	0.37	0.48	2038	0.39	0.49	3857
E75	0.37	0.48	2038	0.38	0.49	3887
J57	47.30	27.13	2038	48.81	27.48	3661
J75	54.90	27.32	1314	57.11	27.20	2416
ED64	13.62	1.87	2038	13.78	1.95	3887
ED75	13.33	1.89	2038	13.62	2.05	3887
OC64	42.69	23.82	2038	41.57	23.66	2973
OC1	38.50	25.85	2038	40.26	26.88	3698
OC70	48.06	24.39	2038	49.43	24.65	3701
OCCR	49.39	24.42	2038	50.54	24.56	3850

Note: See Table 1 for identification of variables.

Appendix Table B. Correlations Among Variables in the Listwise and Pairwise Samples: Male Wisconsin High School graduates.

	X1	X2	X3	X4	X5	X6	X7	X8	Q	G	P57	P75	T57	T75
X1	1.0000	0.7587	0.5002	0.4254	0.4878	0.5100	0.3223	0.2954	0.2529	0.1591	0.2968	0.3070	0.1686	0.1121
X2	0.7669	1.0000	0.4312	0.5003	0.4767	0.5102	0.3019	0.2731	0.2314	0.1351	0.2603	0.2942	0.1402	0.0876
X3	0.4703	0.3953	1.0000	0.7424	0.3101	0.3332	0.2369	0.2173	0.2285	0.1548	0.2713	0.2729	0.1499	0.1259
X4	0.3927	0.4581	0.7329	1.0000	0.3079	0.3337	0.2578	0.2229	0.1924	0.1144	0.2173	0.2369	0.1240	0.0924
X5	0.4609	0.4388	0.2655	0.2566	1.0000	0.7173	0.4452	0.4223	0.2254	0.1351	0.3023	0.2763	0.1455	0.0892
X6	0.4815	0.4817	0.2958	0.2982	0.7007	1.0000	0.4463	0.4055	0.2434	0.1278	0.3224	0.3001	0.1674	0.1167
X7	0.2988	0.2859	0.2100	0.2193	0.4392	0.4403	1.0000	0.8657	0.1825	0.1098	0.2671	0.2108	0.1159	0.0721
X8	0.2863	0.2731	0.2018	0.1886	0.4097	0.3929	0.8461	1.0000	0.1655	0.0814	0.2404	0.1909	0.1194	0.0628
Q	0.2335	0.2123	0.2019	0.1655	0.1917	0.2111	0.1462	0.1296	1.0000	0.5908	0.3616	0.3145	0.3440	0.2756
G	0.1172	0.0846	0.1262	0.0711	0.0946	0.0745	0.0564	0.0410	0.5581	1.0000	0.3426	0.3117	0.4394	0.3415
P57	0.2782	0.2420	0.2381	0.1962	0.2747	0.2978	0.2359	0.2084	0.3597	0.3250	1.0000	0.5077	0.4260	0.2632
P75	0.3012	0.2893	0.2641	0.2224	0.2487	0.2814	0.1991	0.1809	0.3048	0.2924	0.5177	1.0000	0.3353	0.3430
T57	0.1571	0.1352	0.1455	0.1239	0.1514	0.1714	0.0942	0.0963	0.3352	0.4242	0.4337	0.3248	1.0000	0.3731
T75	0.1099	0.0892	0.1313	0.0987	0.0927	0.1179	0.0503	0.0423	0.2801	0.3446	0.2713	0.3460	0.3715	1.0000
F57	0.2512	0.2393	0.2083	0.1710	0.2517	0.2818	0.2337	0.2167	0.2676	0.2723	0.4076	0.3265	0.3291	0.2283
F75	0.2490	0.2468	0.2155	0.1854	0.2607	0.3007	0.2230	0.2062	0.2322	0.2115	0.2913	0.2989	0.2339	0.2037
E57	0.2684	0.2435	0.2311	0.1773	0.2657	0.2888	0.2392	0.2198	0.4099	0.4406	0.5266	0.4825	0.4329	0.3588
E75	0.2502	0.2308	0.2079	0.1605	0.2372	0.2613	0.2034	0.1773	0.3875	0.4481	0.4774	0.4935	0.4037	0.3738
J57	0.2576	0.2359	0.2123	0.1753	0.2779	0.2986	0.2274	0.2056	0.4294	0.4382	0.5048	0.4393	0.4089	0.3305
J75	0.2708	0.2657	0.2242	0.1884	0.2876	0.3328	0.2451	0.2202	0.4329	0.4174	0.4841	0.4359	0.3751	0.2931
ED64	0.2901	0.2683	0.2464	0.1912	0.2842	0.2942	0.2248	0.1975	0.4291	0.4812	0.4837	0.4581	0.3857	0.2984
ED75	0.2983	0.2785	0.2720	0.2008	0.2919	0.2911	0.2205	0.1960	0.4455	0.5005	0.4592	0.4631	0.3932	0.3087
OC64	0.2856	0.2601	0.2136	0.1577	0.3096	0.3087	0.2439	0.2172	0.3851	0.3966	0.4096	0.3964	0.3426	0.2521
OC1	0.2583	0.2517	0.2121	0.1467	0.2803	0.3067	0.2098	0.1862	0.3680	0.3994	0.3954	0.3821	0.3405	0.2358
OC70	0.2521	0.2362	0.1892	0.1526	0.2838	0.2967	0.2275	0.2044	0.3525	0.3430	0.3618	0.3419	0.2970	0.2388
OCCR	0.2416	0.2229	0.1829	0.1416	0.2913	0.3053	0.2267	0.2048	0.3578	0.3234	0.3472	0.3272	0.2891	0.2105

Continued

Appendix Table B, continued

	F57	F75	E57	E75	J57	J75	ED64	ED75	OC64	OC1	OC70	OCCR
X1	0.2752	0.2805	0.3040	0.2791	0.2938	0.2708	0.3327	0.3288	0.2823	0.3040	0.2779	0.2710
X2	0.2646	0.2776	0.2780	0.2548	0.2710	0.2657	0.3096	0.3092	0.2486	0.2890	0.2643	0.2525
X3	0.2488	0.2444	0.2728	0.2539	0.2589	0.2242	0.2841	0.2914	0.2183	0.2567	0.2102	0.2199
X4	0.2006	0.2167	0.2107	0.2030	0.2067	0.1884	0.2366	0.2331	0.1637	0.2074	0.1851	0.1834
X5	0.2847	0.2770	0.3051	0.2694	0.3100	0.2876	0.3174	0.3090	0.2879	0.3132	0.2938	0.2999
X6	0.2908	0.3060	0.3234	0.2905	0.3320	0.3328	0.3266	0.3128	0.2923	0.3302	0.3112	0.3125
X7	0.2461	0.2054	0.2642	0.2302	0.2563	0.2451	0.2657	0.2450	0.2342	0.2472	0.2358	0.2448
X8	0.2198	0.1827	0.2426	0.2007	0.2247	0.2202	0.2291	0.2152	0.2060	0.2199	0.2074	0.2160
Q	0.3210	0.2553	0.4328	0.4011	0.4543	0.4329	0.4735	0.4833	0.3919	0.4303	0.4059	0.4153
G	0.3269	0.2492	0.4688	0.4618	0.4670	0.4174	0.5203	0.5269	0.4004	0.4459	0.3943	0.3816
P57	0.4148	0.3105	0.5388	0.4766	0.5070	0.4841	0.4998	0.4744	0.3941	0.4237	0.3823	0.3740
P75	0.3470	0.3280	0.4862	0.4942	0.4475	0.4359	0.4743	0.4654	0.3891	0.3975	0.3646	0.3510
T57	0.3365	0.2483	0.4513	0.4206	0.4195	0.3751	0.4138	0.4188	0.3535	0.3637	0.3226	0.3162
T75	0.2362	0.2123	0.3679	0.3809	0.3316	0.2931	0.3156	0.3168	0.2488	0.2594	0.2519	0.2431
F57	1.0000	0.4853	0.4999	0.4771	0.4729	0.4172	0.4887	0.4872	0.3707	0.4216	0.3817	0.3563
F75	0.4776	1.0000	0.4134	0.4181	0.3765	0.3439	0.4151	0.4147	0.3286	0.3516	0.3254	0.3157
E57	0.4761	0.3853	1.0000	0.7252	0.7637	0.5638	0.6402	0.6510	0.4960	0.5243	0.4559	0.4352
E75	0.4426	0.3830	0.7185	1.0000	0.6275	0.6032	0.6005	0.6018	0.4703	0.4818	0.4187	0.3992
J57	0.4482	0.3537	0.7457	0.6103	1.0000	0.6807	0.5977	0.5823	0.5242	0.5397	0.4919	0.4871
J75	0.4172	0.3439	0.5638	0.6032	0.6807	1.0000	0.5402	0.5259	0.5542	0.5468	0.5245	0.5265
ED64	0.4342	0.3980	0.6120	0.5725	0.5634	0.5402	1.0000	0.8551	0.6383	0.6936	0.5939	0.5537
ED75	0.4452	0.4003	0.6455	0.6020	0.5574	0.5259	0.8450	1.0000	0.6466	0.7694	0.6170	0.5732
OC64	0.3740	0.3390	0.4822	0.4719	0.5176	0.5542	0.6345	0.6450	1.0000	0.6841	0.6745	0.6402
OC1	0.3722	0.3259	0.4710	0.4496	0.5058	0.5468	0.6517	0.7329	0.6851	1.0000	0.6620	0.6292
OC70	0.3528	0.2970	0.4139	0.3849	0.4674	0.5245	0.5424	0.5626	0.6800	0.6275	1.0000	0.8198
OCCR	0.3144	0.2902	0.3893	0.3556	0.4587	0.5265	0.5002	0.5209	0.6454	0.6081	0.8168	1.0000

Note: Entries below the main diagonal are listwise-present correlations, and entries above the main diagonal are pairwise-present correlations. See Table 1 for identification of variables.