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ABSTRACT

The problem of the role of ability and education in career achievement is investigated in this cross-cultural study using a model developed in the United States by Duncan and modified by Blau and Jencks. The replication links variables of a respondent's income, schooling, achievement, ability, and occupation to similar variables for the respondent's father and a variable for family size. The study is is based on data gathered in Sweden from 1938 to the present from 1,544 third graders. Eleven hypotheses tested by applying the model to the data confirm the United States model with the following variations: father's occupation is in indirect rather than direct relation to the son's occupational status; background effects are mediated by schooling and ability, especially with respect to occupational status, and are more powerful determinants of education; and educational effects are more powerful determinants of ability at maturity. Some incongruences between the Swedish data and current analytical techniques and theoretical questions related to use of background variables, caution against basing educational policy on the models. Tables and figures illustrate the data and models; a bibliography concludes the report. (JH)

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Education and the Socioeconomic Career

U.S. – Swedish Comparisons

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ABSTRACT

This study constitutes a cross-cultural replication of the Duncan model of ability, education, and achievement as modified by Jencks. The 1938 Malmö data set from Sweden was used to test eleven hypotheses derived from environmentalist theory related to the socioeconomic career achievement process. Though the findings are supportative of main theory formulations, there are notable cross-cultural differences in the effect parameters of several specified relationships. It was shown that in Sweden father's occupation was not merely a proxy for family income in accounting for sons' educational attainments. Background effects in Sweden were more likely than in the U.S. to be mediated by the mechanisms of schooling and ability - especially in terms of impact on occupational status. Background effects were also more powerful than in the U.S. as determinants of education; and educational effects more powerful determinants of ability at maturity. In the final reduced form of the Malmö model of ability and achievement it was shown that the effects of system relationships accounting for income were almost identical to those found by Jencks in his analysis of U.S. data. Though scepticism was expressed as to the capability of the functional form of the additive linear model to capture income variation, the analysis of the Swedish data provided additional cross-cultural support for the underlying logic of the set of relationships constituting Duncan's model of the socioeconomic career.

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1. INTRODUCTION: THE PROBLEM

There are few parallels in the history of U.S. sociology to the sustained effort - from the early 1960's to the present - by O.D. Duncan in the area of social mobility, or the study of socioeconomic career achievement. The works of Duncan, his colleagues, and former students, are so well known, and the logic of their conceptual model of the social stratification process so well established (Duncan, Featherman and Duncan, 1972), that it is almost with surprise to note: (1) that it is only within recent years that the conceptual framework has been clearly articulated (Duncan and Hodge, 1963); (2) that the associated methodology known as the technique of path analysis was unknown to most sociologists prior to the early testing of the socioeconomic career achievement models (Duncan, 1966); and (3) that adequate tests on nationally representative samples are even more recent (Blau and Duncan, 1967; Duncan, Featherman and Duncan, 1968).

Extensions to the Blau-Duncan Paradigm. The basic theoretical model of occupational achievement is presented diagrammatically in Figure 1a. In the model the socioeconomic life cycle linkages - family, schooling, and job - are represented by two structural equations: (1) schooling as dependent variable, and two exogenous family background variables - father's education, and father's occupation - as independent; and (2) the respondent's occupational status as dependent with all three others - father's education, father's occupation, and educational attainment - as independent. In recent years the model has been extended in four directions. First, extensions have been made to the number of background variables such as family size and stability[1]; family environment[2]; ethnicity, race, and religion[3]; and urbanization and region[4]. Secondly, in addition to education, a number of variables intervening between background factors and socioeconomic achievements have been incorporated into the model, including motivation and ambition[5]; aspiration[6]; ability[7]; the interpersonal influences of wives, mothers, peers, and "others" in the school context[8]; and migration[9]. Thirdly, there have

been attempts made to examine the effects of proximate career contingencies such as age, first job and age at first job[10]; military service[10a]; and such job characteristics as work experience, size of firm, number of subordinates, and job complexity[11]. Fourthly, the basic model has been extended to include additional outcome variables such as the psychological functioning of job holders[12]; and occupation and income at successive stages in the life cycle[13].

The extensions are not exhaustive. Consider, for example, the effects of such intervening variables as the individual's health, the size of the family of procreation, and the spacing of children. Consider, too, the fact that the measures of some variables - education for example - are usually crude indicators which fail to measure the effects of the different dimensions of the underlying processes. A further research possibility, which is beginning to be exploited, is the application of the Blau-Duncan paradigm in cross-cultural settings[14]. There are several countries where high quality longitudinal data sets containing the basic variables already exist. One such country is Sweden, where the Malmö data set (Husén et al., 1969) has been used for research purposes for over thirty five years.

Purpose. The study has four major purposes. First, the research constitutes a replication of the Duncan ability and career achievement model as modified by Jencks et al. (1972). In this regard special attention is devoted to the long-standing question of the relative effects of ability and education on socioeconomic career achievement (Anderson, Brown, and Bowman, 1952; Boalt, 1954). Secondly, the ability and achievement model will be extended by the incorporation of the family income variable. In this way, problems related to the linkages between family resources and educational attainments will be examined. Thirdly, it is desired to examine in some detail the relative effects, both direct and indirect, of the major determinants of income in Sweden. Fourthly, crosscutting all three purposes will be the cross-cultural comparisons of both Swedish and U.S. findings.

Related Research. Though the conceptual model has been developed to its present level primarily by Duncan (1968a) with modifications by Jencks (1972: Figure B-1:339) the problem of the role of ability and education in career achievement is far from being recent. The major questions and issues were well known, and clearly identified by the 1920's (NSSE, 1928). Methodological difficulties and especially the lack of longitudinal data were the chief obstacles, prompting Anastasi in the 50's to formulate a research design capable of testing the auxiliary theory.

> ... investigations should begin with the testing of young people prior to their educational and vocational differentiation, i.e., after all have completed a uniform period of required schooling(1). Preferably the test should consist of a differential aptitude battery yielding a profile of scores rather than a single global measure(2). The subjects should be followed up until all or nearly all of their families are completed(3). Age of both parents at the birth of their first and last child should be recorded(4) Data should also be kept on deaths(5), unmarried persons(6), and childless marriages(7). Information should likewise be gathered regarding occupation(8), income level(9), and amount of subsequent education(10) for each member of the group. It would also be of interest to obtain indices of social mobility, such as changes in occupational(11), educational(12), or income level(13) within the subject's own life, as well as differences between his status and that of his parents(14). (Anastasi, 1956:206)

The far-sighted proposal was not acted upon at the time, nor subsequently, with the consequence that both Duncan (1968a) and Jencks (1972, Appendix B) have been severely limited by the fact that their data has had to be synthesized from disparate sources. Even if Anastasi's proposal had been initiated at the time - say, with 10 year old fifth grade respondents at the first wave - the most recent follow-up would not find the respondents at mid-career stream. It is precisely for this reason that the Malmö data has a credibility

lacking in the earlier analyses. Anastasi's proposal contained fourteen specific data requests all of which are met by the Malmö data set.

Since both main theory and auxiliary theory formulations have been well developed by Duncan (1968a), Duncan et al. (1972), Jencks et al. (1972, Appendix B); and more recently components of these models have been examined conceptually with great care by Eckland (1971), and Williams (1973a, 1973b, 1973c), only Duncan's conceptual model is presented here (Figure 1B), with Jencks' modification (Figure 1C).

Figure 1 about here

2. MODEL SPECIFICATION

The theoretical rationale for the Duncan and Jencks causal models is well developed, carefully formulated, and acceptable as the framework guiding the Malmö data analysis. The Jencks modification of Duncan's ability and achievement model, consisting of a demonstration of the dependence of early IQ on home socializing structures, is in keeping with the environmental effects literature (cf. Hauser, 1973, Williams 1973b, 1973c); and, hence, the change in the causal ordering, so that early IQ (IQ38) becomes an endogenous rather than an exogenous variable, is justified on sound theoretical grounds. There are reasons to believe, however, that the Jencks (1972; 339 (Fig. B-1)) formulation is misspecified in that family background effects on both occupational status and earnings are underestimated.

First, as the Duncan model demonstrates, the number of children in the respondent's household is a factor which is likely to have moderate negative effects on educational attainment and occupational status; hence, some indirect impact on earnings. Further to this point, it is anticipated that in the Jencks model where early ability is regarded as dependent on family socializing environment, the number of siblings will have negative effects on IQ. The rationale for this is based upon the assumptions: (1) that verbal ability will constitute a powerful subcomponent of measured IQ, and (2) that such ability is developed partly as a function of the opportunity that children have of interacting with persons with more mature vocabulary levels than their own. Since children in large families are likely to interact verbally with adults less frequently than the children in small families, this may account for slightly retarded verbal levels usually found for these children (Anastasi, 1956; Jensen, 1968).

Earlier ability models may be misspecified also as a consequence of the omission of a measure of the family income level as a background variable. In ability models the relation-

ship between background factors and education is itself considered problematic. The Blau-Duncan model demonstrated the importance of education as the intervening mechanism mediating the impact of social background on occupational achievement. Both Duncan and Jencks have examined the importance of ability or early IQ as one mechanism mediating social background and education. In addition, Duncan (Duncan et al., 1968:11) has proposed but not directly examined the possibility that the economic resources of the family act to determine the impact and length of schooling.

In all industrial societies where accurate figures are available, the high rates of college and university attendance among the children of high income, high status families is partial evidence that the income resource may be convertible into educational resources. Such resource transformation is possible because high income families can afford to provide additional intensive instruction in two ways: (1) through special tutoring or intensive summer schooling; or (2) through enabling the child to take longer in school or college (Coleman, 1970). In other words, economic resources are used to convert time (that is, time spent on the material to be learned) into a variable, rather than holding it as a constant or fixed factor as it is for most children in the traditional school governed by notions regarding the distribution of educational resources as a zero-sum game. In recent years the time factor in learning has been given more systematic attention by educators (Carroll, 1963; Bloom, 1973a; Wiley, 1973), and has resulted in the advocacy of different approaches to learning known as "mastery learning" (Bloom, 1964, 1971, 1972, 1973b, 1973c; Block, 1971). Such procedures are designed to make available to all children including the disadvantaged the opportunities long enjoyed almost exclusively by the children from more affluent homes.

For these reasons, then, it is anticipated that the variable family income acts as a surrogate for resource conversion mechanisms such as length of schooling which it is hypothesized will account for effects on educational attainment

over and above those of other background factors. The possibility that family income will have direct effects on earnings will also be examined. The addition, then, of number of siblings (FAMSZ) and family income (FAMINC) to Figure 1C represents the full extent of the revisions to the extant conceptual model. These extensions to Figure 1C are illustrated in Figure 2A.

Other than the methodogogical issue of the "proper" functional form of the model, the major specification problem in recursive path models is one of ordering the variables in terms of causal priority in order to facilitate the formulation of the structural equations (Bohrnstedt and Carter, 1971). Since the logic underlying the Duncan and Jencks ability models has been developed elsewhere, and since the proposed modifications have been dealt with above, only the structural equations capturing the causal flow of the system of relationships in the Malmö model and its built-in system of hypotheses will be presented here.

Family Background Hypotheses[16]

1. Early cognitive abilities vary positively with levels of father's education, family income, and father's occupational status; and negatively with the number of siblings in the family.
2. Educational attainment varies positively with levels of father's education, family income, father's occupation, and early ability; and negatively with the number of siblings.
3. The occupational status of the respondent will be correlated with the occupational status of the respondent's father.
4. Earnings will be directly affected by the level of family income, and the father's occupational status.
5. Father's education, family income, and number of siblings will affect occupational status indirectly via the mediating mechanisms of cognitive ability and educational attainment.

6. The effects of father's education and number of siblings on earnings will be indirect - particularly via ability and educational attainment.

Ability Hypotheses

7. Early ability will directly affect educational attainments, and largely determine cognitive ability at maturity.

8. The effect of early ability on occupational status and earnings will be indirect via ability at maturity.

Educational Attainment Hypotheses

9. Educational attainment will positively affect cognitive abilities at maturity.

10. The effects of educational attainment on future occupational statuses and incomes will be both direct and positive.

Occupational Status Hypotheses

11. Earnings will vary as a direct positive function of the individual's occupational status.

Structural Equations

The following five structural equations capture the recursive path relationships hypothesized above for the extended Malmö model as presented diagrammatically in Figure 2A.

$$X_5 = p_{51}X_1 + p_{53}X_3 + p_{54}X_4 + p_{5s}X_s \quad (12)$$

$$X_6 = p_{61}X_1 + p_{62}X_2 + p_{63}X_3 + p_{64}X_4 + p_{65}X_5 + p_{6t}X_t \quad (13)$$

$$X_7 = p_{75}X_5 + p_{76}X_6 + p_{7u}X_u \quad (14)$$

$$X_8 = p_{83}X_3 + p_{86}X_6 + p_{87}X_7 + p_{8v}X_v \quad (15)$$

$$X_9 = p_{92}X_2 + p_{93}X_3 + p_{96}X_6 + p_{97}X_7 + p_{98}X_8 + p_{9w}X_w \quad (16)$$

3. DATA

(i) The Malmö Data Set

The Malmö data set is unusual in several respects. It is composed of longitudinal data originally gathered from all 1,544 third graders (most were ten years of age) in the private and public schools of the city of Malmö in southern Sweden in 1938. Thus, the cohort is representative of the complete spectrum of income groups and ability levels in the population. The phases in the data gathering are summarized in Table 1. In addition to the fact that the study covers an unusually long time span, is the fact that case loss has been low and the accuracy of the data gathered unusually high.

There are unique historical reasons accounting for the Swedish law making most demographic data open to public perusal. Then, there is the long tradition of accuracy and efficiency in public record keeping. Both considerations make it possible, for example, to locate any individual's annual income, at low cost, in the income assessment directory which is updated annually on the basis of filed income tax returns. Since the late 1950's extensive use of "birth numbers" for identification purposes has facilitated the computerization of public record keeping. Thus, knowledge of the birth number identification of a Malmö respondent in 1938 (easily calculated from the original data) makes it possible in two computer runs of the income assessment file maintained by the Swedish Central Statistical Bureau, to obtain income data, on both earnings and income from unearned sources, on the respondent, the respondent's spouse and other family members.

Different data gathering techniques are necessary to obtain mailed questionnaire data. Here the problem is one of tracing the respondents' home addresses. Even this time consuming task is relatively simple because the population registers for Malmö and other Swedish countries, the Church records, and military records use the "birth number" identification system. Thus, in the most recent follow-up two of the authors were able to trace the residences of all but twenty of the

living original respondents (forty had died). Of these twenty, fourteen resided abroad (Emanuelsson et al., 1973:8, Table 1).

Table 1 about here

More detailed information about the search strategies and data gathering procedures may be found in the Husén et al. (1969) monograph. Perhaps the most remarkable feature of the data is that the anticipated case loss at the time of the first follow-up in 1948, has actually decreased over time, as individuals now in mid-career stream and, hence, less mobile, become easier to trace through the facilities of the public record system.

Collection of the 1938 Data. The data were originally gathered by Hallgren (1939) in order to study the relationships between environment and mental ability. The ability test, carefully described in Hallgren's thesis, was composed of four first order factors or subtests labelled: (1) antonyms, (2) sentence completion, (3) identical figures, and (4) disarranged sentences. Test results were gathered for 835 boys and 709 girls. Most of the children were born in 1928. In keeping with the purposes of the study the data on social background was especially carefully gathered and consisted largely of behavioral indicators obtained from the public records. Income data, for example, came from the tax assessment registers and included the earnings, and income from investments, of both parents (FAMINC). The source of information on unemployment, illness in the home, and the public assistance received by the family came from the schools' social welfare registers. Parental occupational status data was obtained from the population registers maintained by the Church in cooperation with the Swedish tax authority (taxeringsnämnd). These registers were revised annually on the basis of the occupational data provided on the mantalskrivningsblankett - a government form determining among other things the electoral register. Almost complete data for 792 boys and 679 girls were gathered from these sources.

Collection of 1948 Data. Ten years later, the male respondents were inducted into the Swedish military in order to complete their national service, providing an opportunity to gather further data on 690 of the original male members of the population. Additional information included formal educational attainments, occupation at age 20, and mental ability at maturity. The loss of cases was attributable to the fact that the testing was restricted to the males in the 1938 population who were enrolled for military service in 1947 or 1948 (Husén, 1950:32). The split half reliability of the mental ability at maturity test was .97 and the test-retest reliability was .95 (Husén, 1950:184). There were four first order factors on the test which paralleled the equivalent U.S. military induction test (AFQT): (1) synonyms, (2) concept discrimination, (3) number series, and (4) matrices.

Collection of 1963 Data. An extensive follow-up effort was conducted in 1963. Through a search of the Swedish population registers 1,375 (89 per cent) of the 1,544 Malmö respondents were identified. Registers were used to gather data on incomes, education, social welfare, and criminality. A questionnaire was also used to gather supplementary data on adult education, career information, and spouse's social background. Husén et al. (1969:46ff) have provided a detailed description of the procedures and type of data gathered.

Collection of 1972 Data. The latest follow-up began in 1972 and is still underway. Income data every fifth year from 1949-1969, and for 1971 have been gathered. In this last phase only six respondents could not be identified. If deceased respondents are excluded ninety-eight percent of the original sample members were traced. This facilitated the gathering of supplementary career and educational data by mailed questionnaire. For further information see the Emanuelsson et al. (1973) report.

(ii) Variables

FATHED (X_1) Data for the variable, father's education, was not directly gathered in 1938. It had to be constructed on an ex-post-facto basis by judges familiar with the Swedish context and data set. This was the method used by Husén et al. (1969:56) in constructing a "socioeconomic status classification".

The socioeconomic variable contained, however, an educational component which when broken down provided the basis of the educational dimension; not in years of schooling, but rather on the basis of the level of formal schooling and post school training required to hold a specific occupational status.[17] Thus, though there will be some overlapping between adjacent categories, in the authors' judgment the scale has face validity.

FAMINC (X_2) The measure of parental income in 1937 was obtained from the tax-register. Both father's and mother's earnings plus any income from capital investments and other unearned sources were included in the measure. The parental income measure was broken down into a ten point ordinal scale.[18]

FATHOC 38 (X_3) In order to classify families into socioeconomic groupings, Hallgren grouped the grade three school population into four classes. For this purpose he used four items of information - the parent's occupation, the family income, the number of children at home, and occurrencies in the social welfare register. Occupational information was particularly heavily weighted (Husén et al. 1969:43). These four categories were used as the best index of father's occupation or family SES.[19]

FAMSZ (X_4) The family size is composed solely of the number of siblings. It includes foster children as well as the children of the biological parents, who were under the age of 16 and living at home in 1938 according to the population registers.

IQ 38 (X_5) The assessment of cognitive ability was based on the scores on the Hallgren (1939) group intelligence test. It was of the standardized mental ability test variety (IQ= 100(MA/CA)), and specially designed for the Malmö study.

EDUC (X_6) The four point educational attainment scale is based on the type of schooling obtained by respondents in the horizontally differentiated system in operation at the time, and characteristic of the systems to be found in most northern European countries in the 1920's and 30's.[20]

IQ 48 (X_7) Mental ability at maturity was based on the military intelligence test given at the time of induction. The test was only administered to the male respondents. The mean for the Malmö respondents was a little below national norms, being 97.6, with a standard deviation of 16.5.

OCC 71 (X_8) Questionnaire data gathered in 1972/73 was the basis for the occupational ratings of male respondents. These were classified into ordinal categories on a sixpoint scale.[21]

INC 71 (X_9) The income data was obtained from the central tax register. It was based on incomes from both earned and unearned sources (e.g. capital gains, dividends and the like). The information was recorded to the nearest SKR 1.000:-. The variable LOGINC (X_{10}) is the natural log of INC 71.

4. FINDINGS

Preliminary Comparisons. The first noteworthy findings are the direct comparisons made between selected U.S. models of the socioeconomic career achievement process and the equivalent findings based on the Malmö data set. These were presented in Figure 1. In Figure 1A the relationships between the variables in the basic Blau-Duncan model are examined. Only two of the five possible relationships as measured by the path coefficients differed by $\geqslant .05$; namely, p_{32} (father's occupation on educational attainment) with a difference of .052, and p_{42} (father's occupation on occupational status of respondent) with a difference of .070. In both instances the differences in effects of father's occupational status for Malmö respondents were not great. It is reasonable to conclude that the relationships are similar though SES effects are marginally stronger in the Swedish case.

The differences between the fifteen relationships in the comparisons presented in Figure 1B - the Duncan ability and achievement model - were greater than in the Blau-Duncan case. Thus, six differed by path coefficients greater than 0.1. Two of these were associated with the impact of early IQ on educational attainment and IQ at maturity respectively, which exerted a less powerful determining influence in the Malmö case. Three of the remaining large discrepancies were associated with the impact of educational attainment on IQ at maturity, occupational status and income. The direct effects of education on ability at maturity and income were greater in the Malmö case, whereas educational impact on occupational status was less. The remaining large discrepancy was between IQ at maturity and occupational status, where the Malmö effects were greater than those reported by Duncan. In summary, the larger discrepancies concerned the effects of the ability variables and the educational attainment variable, otherwise the differences were not pronounced. It is to be noted that except for the effect of education, the relationships accounting for variance in income

were almost identical between the two studies.

The discrepancies between Malmö data set findings and Jencks' findings (Figure 1C) were the greatest of all the Figure 1 comparisons. Whereas six out of fifteen (40 per cent) of the relationships between the Duncan and Malmö analyses were similar (i.e. had path coefficients $\leq$ 0.05) only two out of fourteen were similar between the Jencks and Malmö analyses. There were five relationships in which the differences were substantial (i.e. with path coefficients $>$ 0.10). Even so, with the exception of the effects of education there were no great discrepancies between the two analyses in terms of accounting for variance in income.

The remainder of the findings will focus on three matters. First, the findings related to the extended Malmö model will be presented. Secondly, comparisons will be made between these findings and those for parallel U.S. studies. Thirdly, on the basis of these comparisons, what is referred to as the final reduced form of the Malmö model is presented.

The Extended Malmö Model. The matrix of correlations presented in Table 2 constitutes the raw data for all subsequent analyses, including those presented in Figure 1. The relationships among the variables of the extended model are shown in

Table 2 about here

Figure 2A. There is support for including FAMSZ as a background factor but not for the FAMINC extension. The addition of the two background variables decreased the IQ 38 and EDUC residuals as shown by comparing Figure 1C the basic model with Figure 2A which includes the extensions. In the case of FAMSZ the negative effects on IQ 38 and EDUC were both highly significant in substantive as well as statistical terms. The effects of FAMINC, which it was thought might be the variable for which father's occupation in the Duncan and Jencks models stood as proxy, was not significant as a determinant

of educational attainment. Though it was a powerful predictor of income as shown in Figure 2A, this was largely an artifact of the extreme skewness of the income variable. In the final reduced form of the model (Figure 2B) the family income effect was shown to be unstable and not statistically significant. The implications of this finding in terms of the model specification presentation above are discussed in the concluding section of the paper. A reasonable conclusion at this stage might be that by simply adding global background variables to the model one is unlikely to generate much additional explanatory power.

Figures 2A and 2B about here

Further Comparisons. One procedure for examining the extent to which independent cross-cultural research produces replications of important findings is to compare estimates of standardized regression coefficients from different research sources. Detailed comparisons between three such data sources are made in Table 3: Duncan (1968a), Jencks et al. (1972), and the Malmö findings presented here for the first time. It is important to note that the Table 3 comparisons are for the effects of the basic variables on income only.

Though the Duncan and Jencks estimates are based on roughly the same synthesized sources there is one important difference; namely, that the Duncan analysis is limited to a single age cohort (25-34 age group) whereas Jencks' is not. The two major differences between the U.S. and Swedish data are that the measures of most variables are quite different; and the Swedish data comes from a single set of individuals.

Given that the Jencks and Duncan data sources are similar it is useful to note that there are pronounced inconsistencies between them - especially in the first three panels. Further, it would appear that these differences are as great, or greater, than the differences between either one and the Malmö data set as far as the INC 71 criterion is concerned.

Table 3 about here

Because of the difficulty of assessing the fortytwo first order comparisons in Table 3 the ratios of the relative effects of the basic variables in the Malmö data set to the relative effects of identical variables in the Duncan and Jencks data sets are presented in Table 4. The ratios are those of the standardized betas presented in Table 3, which may be interpreted to mean that the greater the departure from unity (1.0), the more either the Swedish effects or the effects of the contrasted U.S. data set are important. It can be readily seen from row one of Table 4 that there are two inconsistencies between the Duncan and Jencks data sets: namely, for the effects of father's occupation (FATHOC 38) and educational attainment (EDUC). In row two there are similar, but not equally pronounced, inconsistencies between Malmö and Duncan data sets for the same two effects. Row three shows that, with the exception of the radical difference regarding the effects of education on income, the Malmö and Jencks comparisons do not differ appreciably.

Table 4 about here

The Final Reduced Form of the Malmö Model. The large discrepancy between the effects of education on income between Malmö and Jencks' findings (row 3, Table 4) is disconcerting in view of the degree of similarity in the remaining effect ratios In substantive terms the finding might be interpreted to mean that education was distributed sufficiently unequally during the 1930's and 40's when the Malmö respondents were in school that it is, therefore, a more powerful predictor of income variability than more equally distributed educational attainments in the U.S. If, further, the income variability in Sweden is greater than that in the U.S., then the effect of education in Sweden would be even more powerful. An additional consideration is the direct effect of the occupation variable. Both Duncan's and Jencks' occupational

variable was coded using a detailed occupational classification system; that is, one in which the score assigned to an occupation correlated with the mean income of the men in the occupational category concerned. Such coding will likely account for a larger direct effect of occupation on income than the six-point occupational scale available to the Malmö analysts. And since the larger the estimated effects of occupation on income, the smaller the estimated direct effects of the other variables in the system, there is a distinct possibility that educational effects in the Malmö data set are overestimated due to the underestimation of the direct effects of occupation.

For these three reasons, then, it is possible that educational effects on income for the Malmö data set are exaggerated. A partial solution is to examine the possibility that the income distribution is highly positively skewed towards higher incomes as a result of the presence of a few extremely high and unrepresentative incomes. In such cases the extremes of the distribution - that is, those with very high incomes and those with negligible incomes - can be excluded from the analysis; or, the arithmetic value can be transformed into a natural logarithmic function; or both procedures can be followed as in the de Wolff and van Slijpe (1973) paper. The second alternative is preferred for two reasons. First, the natural logarithm of income is superior to the arithmetic value as a dependent variable (Lydall, 1968:36-42; Roy, 1950; Carnoy, 1967). Secondly, in the second alternative the path coefficient can be interpreted to read approximately as the percentage increment in earnings associated with a unit increase in the educational attainment effect parameter (Welch, 1973). That is, as a function of the transformation, the values of raw and standardized betas will converge as shown in the last two columns of Table 5.

The relevant findings for the Malmö model in which the dependent variable is the natural logarithm of income have been added to the tables and figures presented above. The LOGINC correlations with system model variables were added as vari-

able X_{10} to the Table 2 matrix. The path weights for the regression of LOGINC on all predictors in the Malmö model are shown in Figure 2B. Between data set comparisons (Table 3) and the accompanying effect ratios for the full panel of predictors (Table 4) also include the appropriate statistics for the final reduced form model. The detailed presentation of the structural coefficients for both the extended and final reduced form models will be found in Table 5.

Table 5 about here

The findings related to the reduced form model as a consequence of the data transformation bring the effect parameters of the predictors more closely in line with those of parallel U.S. models especially with regard to the effects of educational attainment. In doing so the explanatory power of the final reduced form equation is cut in half (from a residual of .797 to .911), and confidence intervals widened.[22] The most dramatic effects of this is that whereas the direct effects of predictor variables on income in the extended Malmö model were all statistically significant at the .99 confidence level, in the final reduced form only the effects of ability and occupational status are significant. The effects of family income, father's occupational status, and education are not significantly different than zero. The implications of these findings are discussed below.

5. DISCUSSION AND CONCLUSION

Some issues and paradoxes raised in the foregoing analysis will be considered under four headings. First, the problems attributable to the incongruencies between current analytical techniques and 1938 data will be touched upon. Secondly, the theoretical questions related to the claim that the Jencks formulation (1972; 339 (Figure B-1)) is misspecified due to the omission of important background variables are taken up. Thirdly, some substantive implications of the impact of ability on socioeconomic career attainments are examined; and finally, the implications of the findings for the effect of schooling on earnings are discussed.

Raw Data Problems. The 1938 Hallgren study was cross-sectional in design. The data gathered included a set of variables that were analyzable using zero-order correlations, and one-way partial relationships in crosstabula displays. Though in some respects the variable construction was simple in comparison to current practices, the variables gathered included most of the ones required for testing current status attainment theory. In this last respect Hallgren possessed remarkable "foresight". Nevertheless, today's analyst has to make some "best judgments" regarding variable interpretation in order to test contemporaneous social theory.

Thus, there is ambiguity associated with the two background variables - FATHED and FATHOC38 - to consider. In our resolution of these ambiguities two criteria were involved in making judgments. The first, and most important, was our knowledge of the Swedish social structure. Thus, decisions were made regarding variable interpretation which in the first place would safeguard as much as possible a common language meaning for a concept in main theory terms, and in the second place minimize the gap between main theory and auxiliary theory linkages. Secondly, there was the knowledge that the typical measures for socioeconomic background variables - father's occupation, parental education in years of schooling or type of schooling, and family income - are themselves gross indicators and, hence, weak surrogates for the important underlying dimensions or

effect parameters of home environments. As Williams (1974) points out, such indicators tell us little about the manner and magnitude of the effects of these environments. Thus, while we do not wish to underestimate the policy relevance of background variables, we do wish to draw attention to some of their theoretical limits. The foresight of today's Hallgren minimally demands the identification of the important theoretical dimensions of the family environment and their operationalization in order to be able to estimate their relative magnitude in accurately specified models of environmental influence.

In the case of the father's educational variable it will be noted that it bears close correspondence to father's occupational status. It was our considered judgment that the major component of this variable was the father's educational level and that this aspect of the measure could legitimately take priority over the job status component. The underlying notion was the assumption that father's education would approximate a measure of the level of knowledge and skills of the parents and, hence, the degree of emphasis that the family would place on both cognitive achievement and schooling.

A similar dilemma was faced in labelling the FATHOC38 variable. This construct was carefully operationalized by Hallgren and labelled "socioeconomic groups" (Husén et al., 1969: 43). The criterion of greatest importance in its construction was the occupational status of the father, though income and family size were also considered. Again, in our "best judgment" the most accurate label for this variable was father's occupation. Our rationale for its use over-and-above the FATHED variable was that it would carry a conative force representing a set of expectations and SES values over and above the more cognitively oriented force of FATHED.

These expectations, however, were not completely borne out. Both variables had moderate-to-strong impact on IQ38 and EDUC as can be noted from Table 5 and Figure 2A, but FATHOC38 had a more powerful effect on early ability than FATHED, and

FATHED had a more pronounced impact on schooling than FATHOC38. Both proxies carry part of the underlying effects of family environments, but we are still at square one in trying to infer the type of effect. A fair conclusion might be that FATHOC38 carried greater cognitive force than FATHED which in turn seemed to carry greater conative and possibly affective force. - The reverse of what we expected.

Another data problem involves the measuring scales of some key variables. This has already been referred to above, in the case of the six-point OCC71 scale, though the correlation of .58 between EDUC and OCC71 approximates the slightly higher coefficients of .64 found in the Jencks et al. (1972: 337) and Duncan (1968:2) data sets. Nevertheless, the 1, 2, 3, 4 scaling of the EDUC variable is considerably different from the way in which the variable was scaled in U.S. data sets. The difference reflects the fact that in U.S. models EDUC refers to years of schooling - an interval measure - whereas in the Swedish model EDUC refers to the stage (and, to some extent the quality) of schooling completed. It reflects the difference between the vertically (U.S.) integrated school systems and horizontal (European) systems operative in the 1940's. We are unable to estimate the extent of the differences in the findings between the U.S. and Swedish analyses attributable to the different scales and the differenc mode of variable operationalization for such variables as EDUC and OCC71.

Family Background Factors. In keeping with what Eckland (1971: 66) calls the "standard deprivation model of social class and intelligence", the family background variables did account for substantial variability in early mental ability. It is likely, however, that this segment of the final reduced form model is misspecified as Williams (1973a) points out, due to the omission of variables representing father's and mother's abilities. Nevertheless, the findings (Table 5) that father's education, family status, and family size, have significant effects on early ability is congruent with the environmentalist position; hence, supportative of cultural

disadvantage theory. In other words, the finding provides little support for pervasive social Darwinist doctrines.

The conclusion that father's occupation was probably not a proxy for family income and the finding that family income effects were unstable, require some explanation in view of our thesis that family income resources are convertible into educational resources. And though the number of siblings variable (FAMSZ) operated as predicted we have some reservations about its validity as a predictor. These matters will be taken up in turn.

The finding concerning family income effects is difficult to explain. Normally, one cannot deduce from a failure to find support for a hypothesis embodied in a structural equation whether the main theory or the auxiliary theory is at fault as Blalock (1968:26) has pointed out. The position favored here is one supportative of the main theory formulation of income resource convertibility. Income resource convertibility - that is, the notion that high income families can afford to provide extra tuition, can keep their children in full-time schooling longer, can afford to enrol their children in high quality, high cost schools - is probably not so much a matter of the gross amount of family income, but rather a function of the family income per capita. Thus, for middle income families in particular, whether income is convertible into educational attainments depends on the number of children. Taking siblings into consideration will have effects on the rank ordering of family incomes and, therefore, will account for differential effects on the early ability and educational attainment outcomes.

Furthermore, the ten-point scaling of the FAMINC variable into unequal intervals, which was performed by Hallgren in 1938, may have seriously undermined both the interpretive quality and impact of the variable. This can be overcome in future research by obtaining access to the raw arithmetic FAMINC data. Thus, we are recommending that in future analyses the family income effects be examined by constructing

a variable representing the relationship of family income to family size - for example, family income per capita.

Such a decision would not be incongruent with our interpretation of the finding regarding the effects of number of siblings for two reasons. First, we believe that the FAMSZ variable may be too gross a measure. Like other family background variables it is probably a proxy for unknown dimensions of home environment. Further more, in a causal analysis of the type presented in the extended Malmö model it is not plausible to interpret the number of siblings variable as a cause in the reducation in IQ or mental ability. What may be more correct is that the birth order (and possibly spacing) of children may account for the suppression of certain types of ability. In terms of its effects on schooling (EDUC), it may not be so much the number of siblings that matters as, again, the relationship of family income to family size (cf. Beveridge, 1942:7). We suggest, in other words, that number of siblings is a proxy for birth order, and that the reason for the effects of number of siblings being as predicted is that the variable is "picking up" family environment dimensions more effectively than the other background surrogates. Thus, in future analyses the variables family income per capita and birth order might be used in heir of our FAMINC and FAMSZ, which we believe may have accounted for model misspecification.

One of the most interesting differences between Swedish and U.S. findings concerns the direct effects of background variables on occupational status (OCC71). Both Jencks and Duncan found that the father's occupational status accounted for variability in son's occupational status, whereas FATHOC38 had no such direct effect in any of the Swedish models presented in Figures 1B, 1C, or 2A. Thus, in Sweden background variables only affected son's occupational status indirectly via the mediating mechanisms of education and ability at maturity. There is no "obvious" explanation for this finding. It would be easy to conclude that ascribed statuses are easier to transmit across generations in the U.S. than in Sweden. On the

other hand one might also consider that the operation of screening mechanisms between the horizontal levels of the traditional European school system favored higher SES pupils sufficiently that the direct transmission of ascribed statuses was redundant. That there is some plausibility to this latter explanation is shown by the fact that in the more open and accessible U.S. system the role of ability effects in determining schooling seems greater. Compare the path coefficients of .44 for Jencks in Figure 1C with that of .26 for Malmö. Given that occupational status in the short term is zero sum, in that there are only so many high status jobs to go around at any one time, and given that ability considerations are more salient in open systems, the direct intergenerational transmission of status may be more necessary to ensure intergenerational status congruence in open access systems as in the U.S. than was the case in the less open Swedish system at the time of the 1938 survey.

The findings are congruent with regard to the direct effects of background factors on incomes. In all three data sets the direct effects were negligible and indirect effects were via the intervening mechanisms of education and ability at maturity. The finding, however, fails to consider the possibility of interactions between such variables as family income and ability, which suggests that background effects may be underestimated because the functional form of the path analytic model fails to capture such effects.

Ability Considerations. It is reassuring to note that the effects of both early ability (IQ38) and ability at maturity (IQ48) were as predicted on the basis of theory (e.g. Duncan et al., 1972). Likewise, the similarity in the effects of early ability on ability at maturity, and ability at maturity on income, for both Jencks and Malmö data sets should be noted. Despite these similarities, the differences between the effects of early ability on educational attainments, and the effects of later ability on job status are perplexing. The first of these differences has been referred to in the prior discussion of background effects. The explanation sug-

gested was that the type of education received in Sweden in the 1930's depended more on social background than on ability; whereas in the U.S. how far one went in school was determined more on the basis of ability. This ex post facto explanation has the added plausibility of being in keeping with notions about talent loss in horizontally structured systems compared to the more vertically integrated comprehensive systems operative in the U.S.

If educational attainment or type of schooling in Sweden in the 1930's was as much, or more, a function of family background factors as ability, it seems plausible to infer that in the attainment of job status, ability considerations would be likely to play a more prominant role than in systems where schooling attainments were more a reflection of ability. The simple explanation for this lies in the fact that schooling reflects curriculum complexity, which is correlated with occupational complexity. If schooling outcomes reflect only limited curriculum complexity as may be the case in horizontally structured systems due to their greater dependence on family background as selectivity factors than on ability considerations, there will likely be greater scope for ability at maturity to independently effect occupational complexity. The hypothesis remains untested however.

The suggestion here, then, is that the closer educational attainments reflect ability, the closer the articulation between education and its impact on job status. Or, alternatively, the less educational attainments reflect ability, the greater the independent effects of ability at maturity on job status attainments, irrespective of the extent to which ability at maturity is a function of education. It must be noted, however, that these explanations for the variable relationships are of the ex post facto variety and are perhaps best regarded as working hypotheses.

The Impact of Schooling. As Spady (1972) has pointed out, there is no more controversial question in the sociology of education than the one concerning the relative impact of schooling on a range of outcomes. At the eye of the storm is the seminal work of Jencks and his associates (1972) at the Huron Institute. Thus it is desirable to point out at the outset that the relationships in the final reduced form of the Malmö model (Figure 2B and Table 5) between predictors and the income criterion were remarkably similar to those found by Jencks in his U.S. data analysis. In particular, the direct effect of education on income is negligible and not statistically significant.

This finding was unexpected. We expected the schooling effects to be both direct and of substantial significance, in contrast to the U.S. findings, for at least three reasons. First, the Malmö population was a more homogenous one in two respects. There are no regional differences to confound the findings; and, additionally, the Malmö respondents constituted a single age cohort compared to the extended age range of the U.S. sample. Secondly, Mincer has shown that schooling effects are a function of the age of the respondents. For men in mid-career, age 40-44, the correlation of earnings with schooling is higher than for men entering the labor market, or for men in older age groups - age 45 and over. In 1971 Malmö respondents were on average 43 years old - a time when schooling effects on earnings might be expected to peak. Thirdly, we began with a naive faith in the conventional wisdom regarding school impact. This, when allied to greater confidence in the accuracy of the Malmö data set based on a single set of individuals rather than on synthesized sources, accounted for our scepticism of the negligible p_{74} beta in Figure 1C in the Swedish case.

Offsetting this "optimism", however, was our awareness that the log normal distribution of income would likely supress the schooling effect as was the case in the Hauser analysis (1973b); and, secondly, the awareness that by including unearned income from investment, interest, capital gains, and

other sources as an income component, the income distribution would be confounded. Even so, we were unprepared for the consequences that the log transformation had on the interpretation of schooling effects. There are two further possibilities to consider within the framework of the additive linear model. First, by eliminating the non-earners and the wealthy from the data set, in the de Wolff and van Slijpe (1973) manner, the confounding of the income distribution attributable to the presence of non-representative respondents would be reduced. Secondly, the analysis could be conducted on, say, 1973 earnings where only the earnings component of the respondents' incomes was included in the variable. The refinement of the income criterion in this way would be in keeping with current earning theory and constitute an "acid test" of the relative strengths of the system relationships as predictors of earnings. Even so, we remain sceptical of the magnitude of the difference that such changes would bring about.

We believe that despite the number of unresolved issues raised by this comparative analysis of education and the socioeconomic career data, the research has been more than a mere prolegomenon to further research. We share with Anderson (1974) a belief that identification of national differences in the institutionalization of factors in the status attainment process is a necessary step in the formulation of a general theory of status attainment. A solid introduction to such a theory has been recently prepared by Spaeth (1974).

At the present time we share with Jencks the finding that schooling exhibits powerful determining influences over job prestige and that job prestige in turn has a powerful impact on earnings. Thus, we have shown that the total indirect effect (TIE) of education on income via occupational status and ability at maturity is significant ($r_{94}-p_{94}=.31-.06=.25$).[24] Though we are sympathetic to the conclusions reached by Jencks on the basis of his analysis we wish to defer firm conclusions regarding the practical implications of the findings for Swedish society because we are not yet convinced that the additive linear model realistically captures the "true" rela-

tionships in the conceptual model.[25] There are the background variables to modify as redommended above and refinements desirable in the scaling of the earnings criterion. Unfortunately, Jencks is unable to test for the presence of non-additive effects with his synthetic data set; a constraint which does not apply to the Malmö data.

Several analysts have suggested that earnings and income variation is dependent upon the contribution to variance of interaction vectors. Two analysts have presented some preliminary evidence that the effects of schooling levels across ability accounts for disproportionate effects on income (Hause, 1972; Emanuelsson, 1974:chapter 6). The presence of statistical interaction between social class and schooling on income can be detected from the crosstabulations presented by Husén et al. (1969:157, Tables V,14 and V,15). Interaction between ability and social class were detected by de Wolff and van Slijpe (1973:250-254). In a more theoretical vein, Bowman and Anderson (1974:17), Welch (1973) and Fägerlind et al. (1974) redommend that more attention be given to the examination of interaction effects in studying the impact of schooling and ability on post school job status and earnings.

Thus, though it is gratifying to have cross-cultural confirmation for U.S. formulations of ability and achievement models - since with the exception of the reservations mentioned this is what the foregoing analysis largely does - it may be prudent for the time being to continue to interpret the income residual with healthy scepticism. For this reason we believe it to be premature to reach conclusions about the implications of such research for educational policy making.

FOOTNOTES

1. B. Duncan, 1965, 1967; Duncan, 1968a; Duncan et al., 1972.
2. Hauser, 1973.
3. Duncan and Duncan, 1968; Duncan, 1968b; Gockel, 1969; Goldstein, 1969; Warren, 1970; Featherman, 1971a; Duncan et al., 1972; Duncan and Featherman, 1972.
4. Featherman, 1971b; Mueller, 1973.
5. Crockett, 1966; Duncan, 1969a; Duncan et al., 1972; Duncan and Featherman, 1972; Featherman, 1972.
6. Sewell, Haller, and Ohlendorf, 1970.
7. Duncan, 1968a; Duncan, 1969b; Jencks et al., 1972; Griliches and Mason, 1972.
8. Alexander and Campbell, 1964; Campbell and Alexander, 1965; Wilson, 1969; Hauser, 1969; Duncan, Haller and Portes, 1971; Duncan et al., 1972; Nelson, 1972.
9. Blau and Duncan, 1967; Duncan et al., 1972.
10. Duncan, 1965; Blau and Duncan, 1967.

10a. Mason, 1968; Mason, 1970; Griliches and Mason, 1972.

11. Kohn, 1969; Kohn and Schooler, 1973; Spaeth, 1973.
12. See footnote 11.
13. Blau and Duncan, 1967; Duncan et al., 1972; Featherman, 1971c; Kelley, 1973.
14. Jones, 1971; Kelley and Perlman, 1971; Treiman & Terrell, 1972.
15. It is noteworthy that in 1961 and again in 1967 data on nationally representative random samples of 6th graders in Swedish schools was collected. The samples are referred to as the Individual Statistics Project. Each year until the respondent left school supplementary data was gathered and at least two follow-up studies of sub-sets of the 1961 sample have been conducted subsequent to the respondents leaving school. The 1961 respondents are now 25-26 years old and not yet in mid-career stream in most cases. Nevertheless, if data were systematically gathered the impact of the recent educational reforms in Sweden could be assessed by comparing the effects of education as a mobility mechanism for respondents in the Malmö sample born in 1928 with its effects for those in the Individual Statistics Project data sets born a generation or more later in 1948 and 1954 respectively. Findings on the effects of such structural reforms as the abolishment of grouping practices and the introduction of a comprehensive secondary school system would be of interest to educators outside Sweden, since, although there is considerable interest in reforming contemporaneous educational practices, little is known about which educational structures can be most profitably manipulated for the least societal effort. The Individual Statistics Project was initiated by Härnqvist (see Härnqvist and Svensson, 1964, 1973) at the University of Göteborg. See Svensson (1971) for an introduction to the data set and for an example of the edu-

cational research being conducted by the Göteborg research group. The Svensson monograph, unlike most of the 40 or so reports published to date, is in English.

The credibility of the Malmö data set stems only partly from the fact that it is a rich data source containing particularly accurate measures on key mobility, education and ability indicators. The chief value of the data stems from the fact that, since it comes from a single set of individuals, the constraints placed on the analyst by the assumption of additivity, necessitated by the synthisized data sets of both Duncan's (1968a) and Jencks' (1972:Appendix B) analyses, need not be followed. This possibility, however, is not the focus of the present paper.

16. The rather arbitrary procedure used to decide whether the relative effect of a variable has a direct impact or not will be to delete all paths with path coefficients less than 0.05. Note also that the following set of hypotheses may not be exhaustive. It is merely hoped that they are an accurate reflection of the causal laws governing the relationships as described in main theory explications.

17. The six categories are as follows: (1) six or seven years of schooling followed by no additional formal job training; (2) six or seven years of schooling followed by some limited on-the-job training; (3) Folkskola graduate (7 years of schooling) followed by an extended period of apprenticeship training or its equivalent; (4) Folkskola graduate with formalized post-school vocational training (for example, Folkhögskola); (5) Academic high school graduate (Realskola) or some gymnasium but without matriculation standing; (6) University matriculation standing (student-examen) plus higher academic education at a post-secondary college or university.

18. The intervals were as follows: (1) less than or equal to SKR 1000; (2) SKR 1,001-2,000; (3) SKR 2,001-3,000; (4) SKR 3,001-4,000; (5) SKR 4,001-5,000; (6) SKR 5,001-7,500; (7) SKR 7,501-12,000; (8) SKR 12,001-20,000; (9) SKR 20,001-50,000; (10) greater than SKR 50,000.

19. A brief verbal description of these categories is: (1) unskilled and semi-skilled workers; (2) skilled blue collar workers; (3) independent small business owners and proprietors, white collar clerical and service workers, and lower civil servants; (4) employers and managers in large business organizations, higher civil servants in local and central government, members of the established professions.

20. The essentially ordinal categories were as follows: (1) less than eight years of school; (2) eight to ten years of realskola or vocational school; (3) eleven to fourteen years of gymnasium-level academic education; (4) fifteen or more years of formal full-time schooling including university.

21. These were as follows: (1) unskilled laborer; (2) semi-skilled manual worker; (3) skilled blue-collar; (4) foreman or the equivalent; (5) senior clerk; (6) leading position, member of established professions.

22. For example, in the case of the structural effects of EDUC on INC 71 in the extended Malmö model, the confidence interval for the population weight (B_j) at the 0.95 level was between 3.579 and 10.297 (F=16.354; with 5 and 440 df.). After the transformation, however, the relative increase in the range of the interval was considerable so that the "true" weight (B_j) of EDUC on LOGINC lies between -0.065 and 0.379 at the .95 level (F=0.831, with 5 and 440 df.), where B_j equals the population weight.

23. More recently Kelley (1973) has shown that, in U.S. society, the effects of educational attainment on occupational statuses over time progressively decreases. Thus, the initial effect of education on the individual's first job status may be considerable but rapidly declines for subsequent jobs or subsequent statuses in the same job category.

24. The TIE estimate is only approximate in view of the exceptions to the formula as discussed by Finney (1972) and Charner and Cohen (1973). Thus, the coefficient of 0.20 is undoubtedly too liberal an estimate.

25. Husén (1974:chapter 5) makes essentially the same point in commenting on Jencks but brings to bear a different kind of evidence.

TABLES AND FIGURES

TABLE 1: PHASES IN THE COLLECTION OF THE MALMÖ DATA SET 1938-1973

Date of Collection	Type of Data	Size of Sample	Source of Data	Mode of Collection	Principal Researchers
1938	Group intelligence test	1544 (835 boys, 709 girls)	All third grade children in Malmö public and private schools	Pencil & paper test	Hallgren (1939)
	Demographic data	(100%)	Taxpayers register Population registers, School class registers, & social welfare register	Public records	
1942	Types of school to which students transferred, and scholastic ratings	440	All children transferred to junior secondary or higher school	Teacher ratings	Hallgren (1943)
1948	Social data, school marks, IQ test at maturity	613	All male respondents enrolled for military service	Military records, pencil & paper test	Husén (1947, 1948, 1950) Husén & Henricson (1951)

Cont'd over

. . . Table 1 cont'd

1958-65	Criminality data, social assistance data, & education data	104	Central criminal register Central welfare registers Malmö schools & central bureau of statistics	Public records Public	Husén, Emanuelsson, Fägerlind & Liljefors (1969)
	Income data	1236 (80.1%)	County tax departments	records	
	Social background data	1116 (81.2%)	Questionnaires	Mail	
1971-73	Adult education Data on occupations & working conditions Social welfare and criminality data. Income data	1077 (72%)	Questionnaire	Mail Public records	Emanuelsson, Fägerlind, & Hartman (1973)
1974	2nd generation data on: IQ at maturity Expectations data School marks Type of school program		Military records	Data collection underway	Fägerlind

TABLE 2

CORRELATIONS, MEANS, AND STANDARD DEVIATIONS OF VARIABLES IN THE EXTENDED MALMÖ MODEL OF ABILITY AND ACHIEVEMENT (N = 835 MALES)[a]

VARIABLE		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	Mean	SD
X_1	FATHED		.484	.593	-0.084	.238	.476	.300	.330	.316	.134	2.641	1.206
X_2	FAMINC	734		.830	-0.113	.212	.430	.292	.307	.374	.226	3.600	1.587
X_3	FATHOC 38	764	753		-0.230	.307	510	.383	.357	.380	.241	2.100	1.00
X_4	FAMSZ	760	753	785		-0.190	-0.241	-0.233	-0.118	-0.099	-0.086	2.559	1.556
X_5	IQ 38	788	752	788	783		.408	.751	.352	.370	.312	97.738	16.021
X_6	EDUC	580	553	578	575	599		.567	.584	515	.313	1.839	0.950
X_7	IQ 48	629	600	626	623	653	499		.526	.441	340	97.577	16.474
X_8	OCC 71	548	522	544	544	566	497	461		.507	.357	3.840	1 360
X_9	INC 71	741	705	739	735	773	594	629	564		720	40.831	29.435
X_{10}	LOGINC[b]	741	705	739	735	773	594	629	564	777		3.423	0.965

(a) Correlation coefficients are above the diagonal. The figures below the diagonal represent the case base for each correlation coefficient. All coefficients are significantly different from zero at the $p \leq .001$ level except for the three underlined coefficients which are significant at the $p < .01$, but $p > .001$. The key to the mnemomics used is as follows: FATHED = father's educational level; FAMINC = parents' income; FATHOC 38 = father's occupation in 1938 at the time the respondent was in the third grade of the Malmö school system; FAMSZ = number of siblings including foster children in respondent's family; IQ 38 = respondent's mental ability in 1938 at age 10; EDUC = years and type of schooling completed by respondent; IQ48 = respondent's mental ability measured at the time of induction into the Swedish armed forces in 1948; OCC71 = occupational status in 1971; INC71 = pretax income (all sources) 1971.

(b) The case base for LOGINC and INC71 is the same (N = 777).

TABLE 3

REGRESSION COEFFICIENTS IN STANDARD FORM SHOWING THE INFLUENCE ON INCOME OF VARIABLES IN THE BASIC MODEL OF ABILITY AND ACHIEVEMENT: COMPARISONS BETWEEN DUNCAN, JENCKS, AND MALMÖ DATA SETS[a]

	STANDARDIZED COEFFICIENTS					
DATA SET	FATHED (X_1)	FATHOC 38 (X_2)	IQ 48 (X_3)	EDUC (X_4)	OCC 71 (X_5)	R^2
1. Duncan	.128	.147				.057
2. Jencks	.051	.254				.084
3A. Malmö (INC71)	.139	.298				.157
3B. Malmö (LOGINC)	-.014	.250				.058
1. Duncan	.081	.095	.260			.117
2. Jencks	-.003	.181	.281			.149
3A. Malmö (INC71)	.101	.191	.337			.253
3B. Malmö (LOGINC)	-.048	.156	.294			.132
1. Duncan	.042	.050	.154	.221		.144
2. Jencks	-.016	.148	.190	.159		.161
3A. Malmö (INC 71)	.029	.119	.200	.327		.311
3B. Malmö (LOGINC)	-.083	.121	.227	.162		.146
1. Duncan	.031	.019	.127	.089	.258	.181
2. Jencks	-.016	.095	.158	-.008	.331	.222
3A. Malmö (INC 71)	.017	.114	.126	.224	.263	.353
3B. Malmö (LOGINC)	-.093	.116	.167	.079	.213	.173

(a) Kind permission to use the format of this table, and the recalculated coefficients for the Duncan and Jencks data sets, has been given by Joe L. Spaeth (compare Spaeth, 1973: Table 3).

TABLE 4

RATIOS OF RELATIVE EFFECTS OF VARIABLES IN THE MALMÖ DATA SET TO THE RELATIVE EFFECTS OF IDENTICAL VARIABLES IN THE U.S. DATA SETS[a]

	INDEPENDENT VARIABLES				
EFFECT RATIOS	FATHED	FATHOC 38	IQ48	EDUC	OCC 71
1. 1/2: Duncan/Jencks	1.94	0.20	0.80	11.13	0.78
2. 3A/1: Malmö (INC71)/Duncan	0.55	6.00	0.99	2.52	1.02
3. 3A/2: Malmö (INC71)/Jencks	1.06	1.20	0.80	28.00	0.79
4. 3B/1: Malmö (LONGINC)/Duncan	3.00	6.11	1.31	0.89	0.83
5. 3B/2: Malmö (LOGINC)/Jencks	5.81	1.22	1.06	9.88	0.64
6. 3A/3B: Malmö (INC71)/Malmö (LOGINC)	0.18	0.98	0.75	2.83	1.23

(a) The ratios are those of the standardized betas presented in the bottom panel in Table 3. They are for the effects of the basic independent variables on income only.

TABLE 5

THE STRUCTURAL COEFFICIENTS FOR THE EXTENDED AND FINAL REDUCED FORM OF THE MALMÖ MODEL OF ABILITY AND ACHIEVEMENT BY ORDINARY LEAST SQUARES: (I) PATH COEFFICIENTS, (II) RAW REGRESSION COEFFICIENTS[a] (STANDARD ERROR)

	DEPENDENT VARIABLES											
INDEPENDENT VARIABLES	IQ 38 (X_5) I	IQ 38 (X_5) II	EDUC (X_6) I	EDUC (X_6) II	IQ 48 (X_7) I	IQ 48 (X_7) II	OCC 71 (X_8) I	OCC 71 (X_8) II	INC 71 (X_9) I	INC 71 (X_9) II	LOGINC (X_{10}) I	LOGINC (X_{10}) II
X_1 FATHED	.098 (.740)	1.299	.257 (.037)	.202	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X_2 FAMINC	0.0	0.0	.092 (.041)	.055	0.0	0.0	0.0	0.0	.186 (1.269)	3.442	.089 (.047)	.054
X_3 FATHOC 38	.218 (.913)	3.498	.178 (.073)	.169	0.0	0.0	.043 (.059)	.059	-0.032 (2.127)	-0.947	-0.001 (.080)	-0.001
X_4 FAMSZ	-0.132 (.474)	-1.357	-0.122 (.024)	-0.074	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X_5 IQ 38			.250 (.002)	.015	.623 (.032)	.641	0.0	0.0	0.0	0.0	0.0	0.0
X_6 EDUC					.313 (.537)	5.432	.402 (.069)	.576	.224 (1.667)	6.942	.056 (.062)	.057
X_7 IQ 48							.281 (.004)	.023	.135 (.087)	.241	.174 (.003)	.010
X_8 OCC 71									.259 (1.062)	5.610	.206 (.040)	.146
RESIDUAL PATH $\sqrt{1-R^2}$	.941		.785		.595		.775		.797		.911	
REGRESSION CONSTANT		90.432		-0.503		24.947		0.391		-27.441		1.567
100 R^2	11.53		38.35		64.58		39.86		36.36		17.03	

(a) The LOGINC (X_{10}) column of Table 5 presents the path coefficients and raw regressions for the final reduced form of the Malmö model. In this final from the arithmetic value of the income measure has been transformed to the natural logarithm of income. Compare Figures 2A and 2B. The figures in [illegible] below the path coefficients are the standard errors.

FIGURE 1

COMPARATIVE CONCEPTUAL MODELS OF ABILITY, EDUCATION AND THE SOCIOECONOMIC CAREER[a]

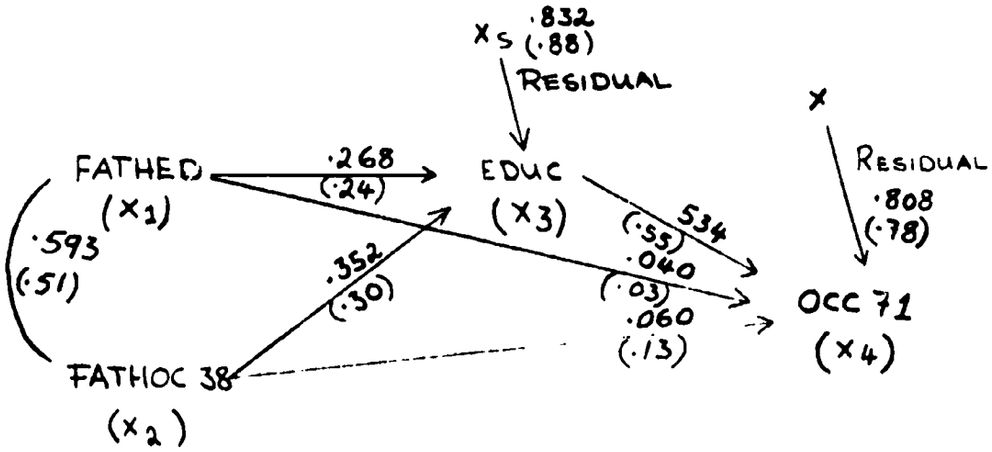

FIGURE 1A: THE BASIC MODEL OF OCCUPATIONAL ACHIEVEMENT (Blau and Duncan, 1967)[b]

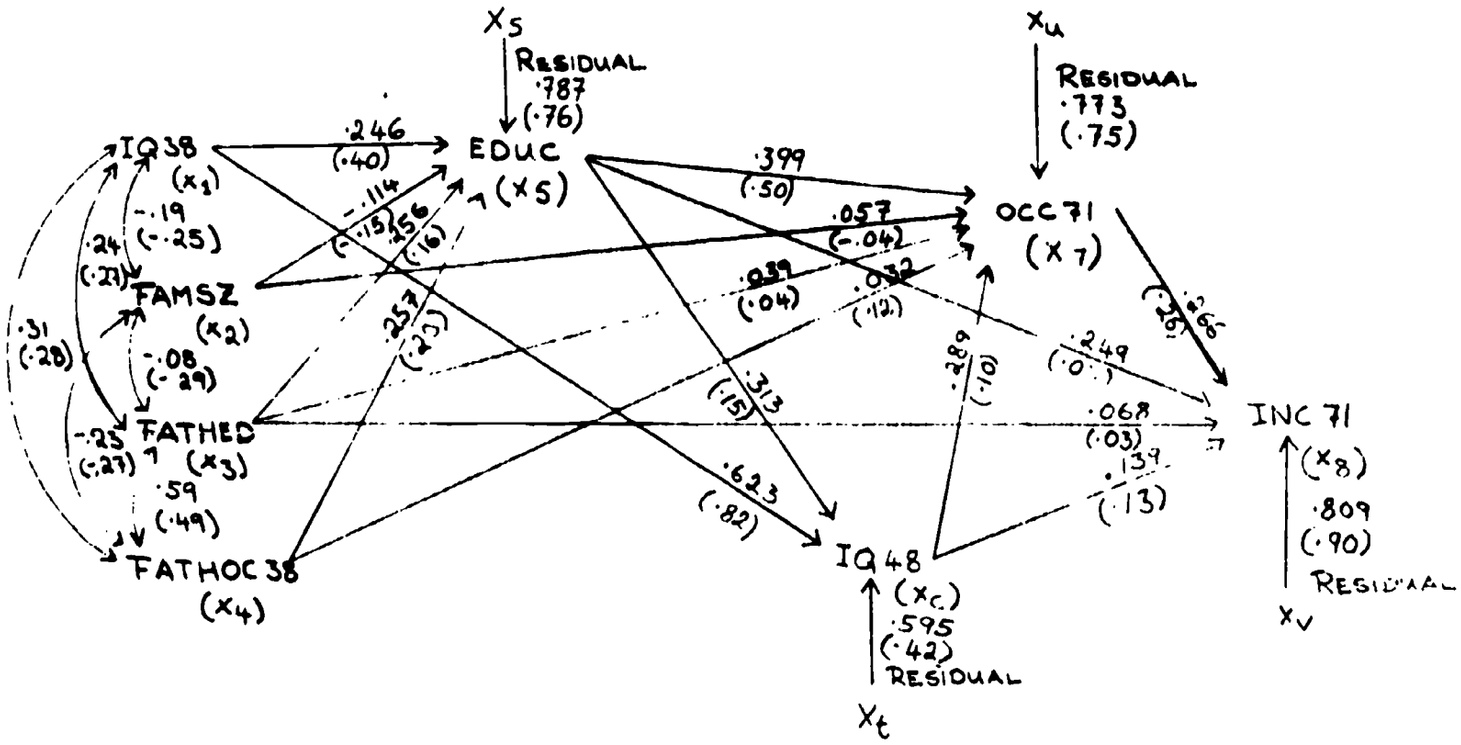

FIGURE 1B: CONCEPTUAL MODEL OF DEPENDENCE OF SOCIOECONOMIC ACHIEVEMENT ON BACKGROUND, ABILITY, AND EDUCATION[c] (Duncan, 1968a)

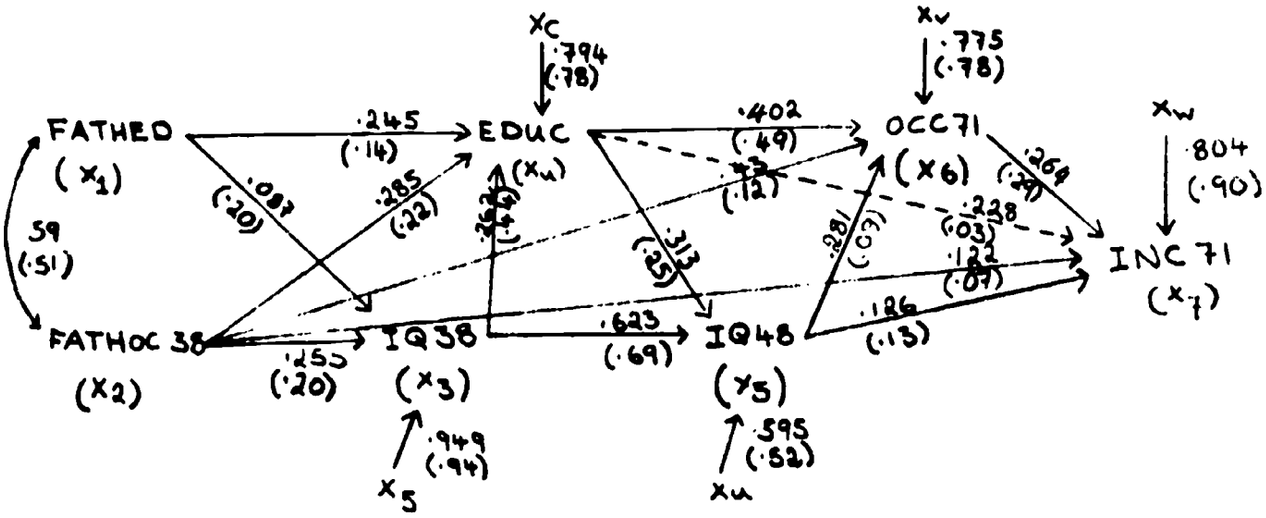

FIGURE 1C: MODIFIED CONCEPTUAL MODEL OF DEPENDENCE OF SOCIO-ECONOMIC ACHIEVEMENT ON BACKGROUND, ABILITY, AND EDUCATION
(Jencks et al., 1972:339)[d]

(a) The matrix base of the path coefficients shown above the paths is presented in Table 2. The mnemonics used in Figure 1 models will be used throughout the paper. They are appropriate to the Malmö data set, but parallel closely the ones used by both Duncan and Jencks. The key is as follows: FATHED = father's educational level; FATHOC 38 = father's occupation in 1938 at the time the respondent was in the third grade of the Malmö school system; FAMSZ = number of siblings, including foster children, in respondent's family; IQ 38 = respondent's mental ability in 1938 at age 10; EDUC = years and type of schooling completed by respondent; IQ 48 = respondent's mental ability as measured at the time of induction into the Swedish armed forces in 1948; OCC 71 = occupational status 1971; INC 71 = pretax income (all sources) 1971.

(b) Path coefficients above the paths are for the Malmö data set. The source of the figures in brackets below the paths is the OCG (Occupational Changes in a Generation) data set used in the Blau-Duncan (1967) monograph. See also Duncan, Featherman and Duncan (1968:61, Fig. 4.2.1). The structural equations for Figure 1A are:

$$X_3 = p_{31}X_1 + p_{32}X_2 + p_{3s}X_s \quad (1)$$

$$X_4 = p_{41}X_1 + p_{42}X_2 + p_{43}X_3 + p_{4t}X_t \quad (2)$$

(c) The path coefficients for the Malmö data are above the paths. The figures in brackets below the paths are the parallel path coefficients from Duncan (1968a:6, Fig. 1). The structural equations for the Duncan ability and achievement model as presented in Figure 1B are:

$$X_5 = p_{51}X_1 + p_{52}X_2 + p_{53}X_3 + p_{54}X_4 + p_{5s}X_s \quad (3)$$

$$X_6 = p_{61}X_1 + p_{65}X_5 + p_{6t}X_t \quad (4)$$

$$X_7 = p_{72}X_2 + p_{73}X_3 + p_{74}X_4 + p_{75}X_5 + p_{76}X_6 + p_{7u}X_u \quad (5)$$

$$X_8 = p_{83}X_3 + p_{85}X_5 + p_{86}X_6 + p_{87}X_7 + p_{8v}X_v \quad (6)$$

(d) The path coefficients for the Malmö data are above the paths. The figure in brackets below the paths are the equivalent path coefficients from the Jencks et al. (1972:339, Figure B-1) monograph. The Jencks model coefficients are the observed correlations uncorrected for attenuation. Relationships in Figure 1C are captured by the following five structural equations:

$$X_3 = p_{31}X_1 + p_{32}X_2 + p_{3s}X_s \quad (7)$$

$$X_4 = p_{41}X_1 + p_{42}X_2 + p_{43}X_3 + p_{4t}X_t \quad (8)$$

$$X_5 = p_{53}X_3 + p_{54}X_4 + p_{5u}X_u \quad (9)$$

$$X_6 = p_{62}X_2 + p_{64}X_4 + p_{65}X_5 + p_{6v}X_v \quad (10)$$

$$X_7 = p_{72}X_2 + p_{75}X_5 + p_{76}X_6 + p_{7w}X_w \quad (11)$$

FIGURE 2A

PATH DIAGRAM OF THE EXTENDED MALMÖ MODEL OF ABILITY AND ACHIEVEMENT (N = 835)

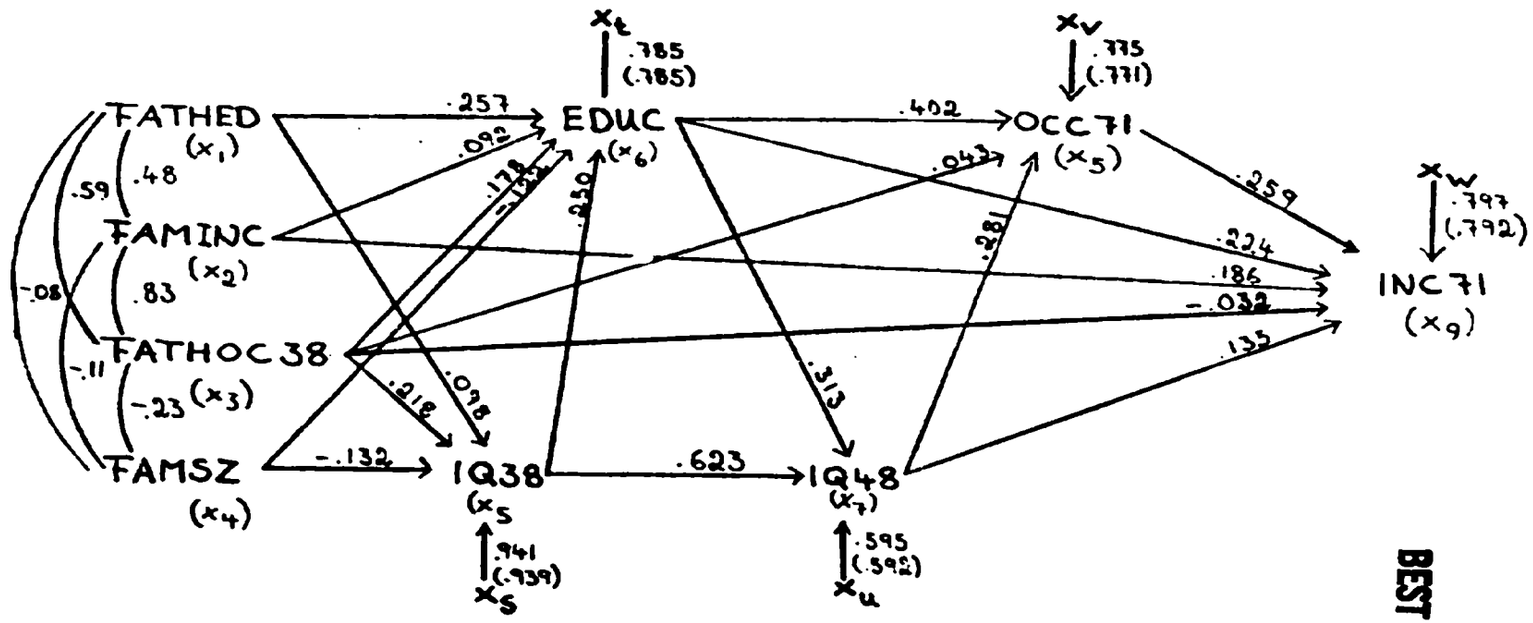

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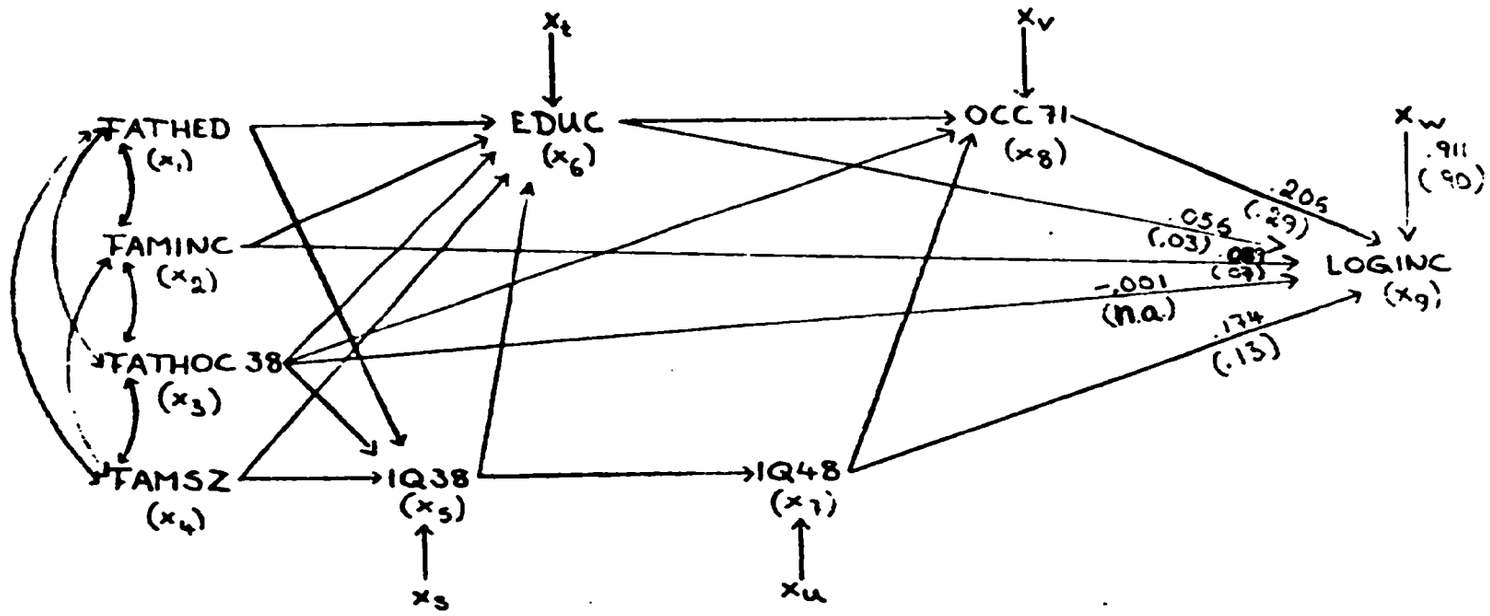
FIGURE 2B

PATH DIAGRAM OF THE FINAL REDUCED FORM OF THE MALMÖ MODEL OF ABILITY AND ACHIEVEMENT AFTER THE LOGARITHMIC TRANSFORMATION OF THE INCOME MEASURE[b]



Footnotes to Figures 2A and 2B

(a) In Figure 2A the residuals in brackets are the ones for a fully identified model indicating the mathematical accuracy of the reduced form model.

(b) In Figure 2B the residual for the fully identified model is .902. The residual in brackets (of 90) is the one reported by Jencks et al. (1972:339, Figure B-1) based on the observed rather than the "true" correlations. The Malmö data matrix (Table 2) is similarly based on observed correlations uncorrected for attenuation. The figures in the brackets reported below the path coefficients are the equivalent standardized betas reported by Jencks et al. (ibid.). It is assumed that the father's occupational status variable in the Jencks data set is a surrogate for parental income (FAMINC) used in Figure 2B. The Jencks coefficients should be interpreted cautiously, however, since his income variable consisted of the raw income metric, whereas the LOGINC variable in Figure 2B is the natural logarithm transformation of the 1971 incomes of Malmö respondents. The path coefficients for the remaining relationships in Figure 2B are unreported since they are the same as those in Figure 2A.

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