LIFE CHANCES AND THE CONTINUITY OF RANK: AN ALTERNATIVE INTERPRETATION OF MOBILITY MAGNITUDES OVER THE LIFE CYCLE*

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This paper presents an alternative to status attainment modeling of life cycles, originally proposed by Blau and Duncan (1967). Statistically, the paper describes a new way of representing causal chains, which is less complex, and more easily comprehended and communicated. Conceptually, it proposes a focus on life chances, defined as the probability distribution over hierarchical outcomes. Life chances order a population or cohort from most advantaged to least. For each life cycle stage there is a distinct rank. The transitions between stages reshuffle ranks. The correlation of successive rankings measures mobility/immobility, which was not directly assessed in the classical treatment. The "life chances perspective" recasts the original data as a sequence of correlations describing the degree of change in social rank. This leads to a substantive reinterpretation, that mobility is much less prevalent than it previously appeared.

The most extensively developed research agenda in sociology is probably status attainment. It was initiated by Blau and Duncan's (1967) research exemplar. That rich volume has many facets, but this paper centers on a seminal feature: the path analytic representation of the socioeconomic life cycle.

I will propose three related novelties that constitute an alternative approach. The first is a statistical technique for extracting indices of status continuity from a correlation matrix. The new tool condenses the information into a minimalist pattern, such that the rules of path analysis generate a causal chain where each stage depends solely on its immediate predecessor. This structure should aid comprehension and communication.

Second, I will propose a reconceptualization of the central problem in terms of "the life chance perspective." The life cycle stages of status attainment are taken as sites for the measurement of life chances. Life chances are thus conceptualized as a probability distribution over possible outcomes. These have a prospective component, namely expected outcomes, and a probabilistic component capturing the uncertainty that separates expectation and final fate.

Life chances order a population or cohort from most advantaged to least. At each life cycle stage there is a distinct ranking. Passage between life cycle stages reshuffles ranks. Change in life chances is social mobility. The amount of change is assessed by correlating life chances before and after the reshuffling process. (Strictly, the correlation measures immobility.) The numerical core of the "life chance perspective" is a sequence of correlations describing the continuity of rank. Each succession is associated with a definite quantity of reshuffling of rank, or social mobility.

Third, application of the life chance perspective to Blau and Duncan's data, and other data from that seminal period, will reveal striking immobility across the key transitions of educational completion and labor market entry. This reinterpretation is partly subjective, insofar as there is no widely shared standard for how large a correlation must be to merit an adjective like "striking."

It is therefore helpful to ground the interpretive issue in an apparent contradiction in findings. On the one side is "status attainment," for which Blau and Duncan's work is the paradigmatic exemplar. On the other is Paul Willis's (1977) insightful ethnography, *Learning to Labor*.

Willis's work does not directly confront the findings or interpretations found under the status attainment rubric. But it appears to be inconsistent with those results. His ethnogra-

* I would like to acknowledge helpful comments from Peter Blau, Christopher Jencks, Peter Marsden, Trond Petersen, and Aage Sørensen on earlier drafts of this paper. The errors or misinterpretations that remain are mine alone.

phy appears to suffer from a characteristic vice, namely, the acceptance (and uncritical transmission) of a small sample of members' accounts as if they faithfully reflected large-scale structural forces.

Willis's subjects, "the lads," were British working class youth disenchanted with academic striving. They believed that effort at school was useless, because their early adult life chances were largely fixed. They believed that people like themselves were confined to a narrow range of outcomes and that what they did (or did not do) in school would make little difference.

These beliefs seem to deny or contradict status attainment results. First, completed education is substantially decoupled from social background, so that working-class origins would be only a modest barrier. Second, labor market entry is further decoupled. Eventual occupational attainment was even more so. Therefore, mobility was far from impossible. Even if one grants the accuracy of Willis's report of "the lads" views, their folk beliefs appear to be unduly cynical. And if "the lads" are mistaken in viewing their early adult life chances, and those of their classmates, as already fixed by midadolescence, then Willis's larger interpretation based on the validity of those beliefs must be called into question.

And thus I will pose the issue. Should "the lads" (or at least Professor Willis) be required to read Blau and Duncan (or *Inequality* [1972] or Hope's [1984] British, Scottish, American comparison *As Others See Us*) to restore their faith in the enormous mobility chances of industrial society? Who was closer to the mark, Blau and Duncan or "the lads"?[1]

I will outline a new approach to such issues in five sections. First, I will characterize and critique the image of mobility chances that was implicit in Blau and Duncan. Second, I will motivate the "life chance perspective" as an alternative way to interrogate the same data. The third section will present empirical examples to make the contrasts of the two approaches concrete. The fourth section will suggest speculative applications, or thought experiments that are facilitated by the simplicity of the new approach. The fifth section will explore differences in interpretation between the two approaches.

THE MANIFOLD MOBILITY OF MULTIPLE CAUSES

The heart of the opposition between Willis and Blau and Duncan is the issue of mobility versus constraint or fluidity versus determinism. Blau and Duncan did not directly address the issue but it is closely intertwined with two of their major objectives. One goal was to assess the relative impact of achievement versus ascription. They further sought to untangle the magnitude of constraint operative at different life cycle stages. As they put it,

> The questions we are continually raising in one form or another are: how and to what degree do the circumstances of birth condition subsequent status? and, how does the status attained (whether by ascription or achievement) at one stage of the life cycle affect the prospects for a subsequent stage? (1967, p. 164)

A concealed choice anchors this agenda. Blau and Duncan's summary suggests that a key question is the amount of change in status as life cycle stages succeed one another. The amount of status change for a population or cohort is the amount of social mobility. Therefore, it might seem that a measure of the amount of mobility that accompanies each new stage would be central. But they undertook a different line of attack.

Without explicitly marking the shift, Blau and Duncan replaced the singular concept of "status" with a plural concept of the succession of "statuses." Successive ranks are along distinct, different dimensions. But transitions like education to first job combine quantitative change in rank with a confounding qualitative chance to a different criterion of rank. Consequently, "mobility" becomes a compound of vertical movement and alignment along a different metric of differentiation. In effect, the starting concern with mobility was abandoned, and in its place the causal relations among qualitatively distinct rankings were analyzed. This choice has a

[1] Folk observers generally have access only to small samples of people similar to themselves. An implicit issue motivating this paper is whether such samples should show reliable traces of the intersection of structure and biography, or whether lay interpretations are almost certain to depart from large sample findings. Ultimately this bears on a central motivating assumption of mobility research, that patterns and perceptions of opportunity shape sentiments toward inequality.

critical consequence. The Blau and Duncan approach does not provide a direct quantitative measure of mobility (or immobility) for each succession between life cycle stages.

Closely bound up with this shift is Blau and Duncan's key innovation: the introduction of path analysis, and the characterization of stratification as a succession of causal patterns among distinct dimensions of rank.[2] This innovation contributed to a new picture of the phenomenon.

In a central demonstration of the novelty of their results, Blau and Duncan demolished the previously prevalent imagery of cumulative disadvantage leading to "vicious circles" (1967, pp. 199–205). First, the modest value of the intergenerational correlation of occupation (.405) was cited as evidence against Lipset and Bendix's claim that "many factors . . . make it difficult for individuals to modify their status" (quoted on pp. 199–200). Second, they called attention to the tiny (.061) contribution of prior causes (i.e., family background) in the decomposition of the correlation of education with occupation.

> This is the *entire* part of the effect of education that has to do with "perpetuating" the "family's position." . . . Far from serving in the main as a factor perpetuating initial status, education operates *primarily* to induce variation in occupational status that is independent of initial status. (p. 201; italics and quotes in the original)

This statement is balanced by the qualification that "This is not to gainsay the equally cogent point that the degree of 'perpetuation' (as measured by r_{AY}) that does occur is mediated in large part by education" (p. 201). Since the preceding page belittles r_{AY} as an indication of major barriers to mobility, the balance of this argument is against the view that inheritance is as important as thought by previous analysts. By an indirect path, it suggests that parental status makes a very modest difference. The text nowhere suggests that it doesn't matter. But the impression is left that it doesn't matter very much.

Although this work is arguably the classic exposition of a causal analysis, the translation of numbers into words involves multiply faceted nuance that approaches ambiguity. There are different numbers of different kinds associated with each pair of variables and with larger blocks of variables. No single quantity captures "how much a factor matters." The amount of difference due to a factor is presented, indeed must be presented, as a set of magnitudes describing different facets of a factor's impact. And many of the qualified quantities are portions and partials, so that the more sophisticated angles of view reveal modest quantities.

Applied repeatedly, this tends to a generalization about every factor discussed. In a phrase, many factors matter, but each matters modestly. Conversely, nothing stands out sufficiently to justify *any* ringing generalization about constraint.[3] This is illustrated by the conclusion of the quoted passage. Relative to what they saw as an important received view, they sound a contrarian note, that the key factor of education is mainly a motor of mobility, not a locus of status continuity.

That many factors matter, but only modestly is what I call the manifold mobility of multiple causes. It describes the global pattern that emerges when multiple, qualitatively distinct, variables are statistically integrated into an expanding model representing causal links. The paths are many, and the weights are small. Complexity grows, effects diminish, and residuals proliferate as the pattern is refined by the addition of more variables. The resulting picture sustains themes of the weakness of barriers and the fluidity of rank.

The message accumulates from several empirical circumstances that are ubiquitous across this research genre. First, the zero-order correlations are not very large, even while they are far from negligible. Second, the more sophisticated and refined "direct effects" are still smaller,[4] as are the enlarging

[2] Later analyses adopted the approach of structural equations where "cause" is quantified in the metric of the several dimensions. This is parallel with directing attention to relations among qualitatively different dimensions, and it highlights the qualitative differences that mark the succession of stages.

[3] Of course, race was prominently featured as an ascriptive defect in The American Occupational Structure. But the standard of comparison was the more favorable pattern for whites, so that even this exception tended to sustain the opposite implication for the bulk of the population.

[4] Of course, this pattern depends on measured magnitudes and is not logically inevitable. At the same time it is commonly observed and therefore somewhat independent of the empirical problem at hand.

tangle of "indirect effects." Quite often these are absolutely quite small. Third, few things matter in themselves. Most are entangled with other variables. Fourth, intervening variables are both non-negligible as causes, and as transmitters, but are substantially decoupled from (statistically "unexplained" by) prior factors.

The conceptual status of the different variables contributes to the impression of fluidity. The multiple dimensions can be categorized into ascriptive factors and individual achievements. The direct effects that unambiguously reflect ascription are among the coefficients that fade toward nonsignificance as impact is divided among more variables. The compensating indirect paths are not merely fractional, but multiple. Status continuation is fragmented into a plethora of channels. It is still there, in some sense, but subdivision into numerical trivia lowers visibility.

Each of the various dimensions of individual achievement is accompanied by a large residual. This suggests that generic Achievement is substantially orthogonal to measured social background. The many modest paths describing status transmission appear to be overlaid with a substantial residuum of accomplishment independent of background.

Two conclusions follow. Many modest effects along with large residuals imply that no factor delimits a major constraint. And modest effects for ascriptive factors combine with large residuals for individual achievements to suggest that "Rank" is achieved, in large part, independent of background. As Blau and Duncan summarize it, the United States approaches a type of society that "perpetuates a structure of differentiated positions but not their inheritance" (1967, p. 441).

The cumulative impression of massive mobility is only loosely grounded in the quantitative results. Since there is no direct numerical assessment of quantities of mobility, the relative magnitudes of mobility and constraint are not directly available. But the coefficients that describe constraint are modest. They are accompanied by substantial residuals, or "unexplained variation" in all critical factors. This means that constraint, in any satisfying sense of determination of individual fate by structural circumstance, is weak. It is not absent, nor negligible, but it is a highly qualified and complex consideration of many factors, overshadowed by substantial doses of indeterminacy.

Critics of the fluid, voluntaristic image are thereby disarmed. The patent injustice of fate imposed by external circumstance is nowhere clearly visible. Any complaint directed to any specific barrier is therefore much ado about next to nothing. The large residuals, which proliferate as more intervening stages are incorporated, buttress the impression that movement is prevalent. Strictly, the residuals are an index of ignorance. But the absence of constraint entails a veiled arena where winners are somehow sorted from losers without contamination by structural injustice.

Presumably, this applies to Willis's respondents. They are, on the standard interpretation, mistaken if they believe that their fathers' bottom-tier jobs will strongly determine their educational outcomes. Their labor market entry points are still further decoupled, and their ultimate outcomes are yet further removed. On the standard interpretation it follows that they cannot accurately anticipate immobility that would empirically justify their fatalism. But this judgment is premature. It must be tempered by attaching quantities to the amounts of mobility implied by the sample survey results of which "the lads" were presumably ignorant.

THE LIFE CHANCE PERSPECTIVE

Mobility can be measured by assessing changes in life chances. This possibility inheres in the "life chance perspective" which is a different agenda applicable to the

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In the Blau-Duncan matrix, the correlations lie between .322 and .596, with a mean of .456. Thus the observed correlations are clustered in a small range of the logical possibilities, $[-1 \ldots +1]$. An idealization of this (common) situation is a set of variables that are equally correlated. Under this condition, incrementing the set of independent variables decrements the direct effects in the preceding equations at a diminishing rate with zero as a limit. More exactly, $p_i = r/[1+(i-1)r]$ where r is the common correlation, and p_i is the (common) value of the path coefficient(s) when i independent variables are in the equation.

This idealization is the formal basis for the claim that adding more variables tends to decrease all coefficients. At the same time, zero-order correlations will be resolved into ever-enlarging tangles of ever-smaller indirect paths.

empirical materials of the status attainment perspective.

The life chance perspective, like status attainment, draws on the notion of a socioeconomic life cycle. The life cycle is operationalized as a sequence, arranged from birth to adult fate, of heterogeneous measurements of rank and/or restratifying processes. But one can abstract from this cacophony of distinct measures to populations, or to cohorts, differentiated along an abstract dimension of rank. As time passes, the contingents percolate up, sideways, and down in the social hierarchy. Percolation forward in time results in flows fanning out from initial locations. Or in retrospect, a given outcome is peopled by some pattern of flows fanning in from initial locations. The total collection of trajectories of individuals can be identified with my central conception of the unfolding of life chances.

The successive measurements over the life cycle are a record of the development of life chances. Life chances is not a simple idea, but one core meaning is "opportunities for individual development provided by social structure" (Dahrendorf 1979, p. 61). Health, power, autonomy, leisure, cultural variety, secure family life, and money are components. One also must somehow distinguish early life chances, or the range of possibilities that could have been reached, and later life chances which are the possibilities within immediate reach. A crude but serviceable index of the latter is provided by occupational rank as conventionally measured. By and large, higher occupational rank means greater access to the goodies, both vulgar and sublime.[5]

Chances also has a probabilistic, prospective connotation which corresponds to unfolding over the life cycle, as individuals fan out from initial ranks. Early in life, many possibilities or different fates are open. However, individuals' chances are different. Different prospects mean differences in probability distributions over outcomes, and do not refer to certainties. The wellborn are more likely to attain the desirable positions. The less wellborn are, in most industrial societies, not formally excluded but have lesser probabilities or reduced chances. As contingents advance through the life cycle, these early prospects gradually harden into adult certainties.

Movements up, down, and sideways correspond to changes in prospects marking the convergence toward certainty. In principle, one could identify various choices by individuals or decisions by gate-keeping power holders with such movements. Attaching grades to ninth-grade schoolwork ratifies or continues some persons' ranks and produces (tiny) shifts for others. Such minor events may be accumulating into larger summaries, like high school GPA, that will influence such major reshufflings of rank as the decisions of college admissions committees. Further up the scale of abstraction, coarse operational measures, like years of completed education, summarize many tinier fragments of information about choices and decisions.

Every incomplete biography is like a growing dossier of information that bears on social rank. The prospects or average chances associated with each dossier is the average or predicted outcome for that record. To capture predictability, one can imagine an array of persons in rank order of ultimate outcomes. Empirically, this ranking can be taken as eventual occupational attainment, although in principle one could employ any measure of differential life satisfactions that are socially structured.[6] This measure of final results I call the individuals' fates.

Regression provides a tool for measuring prospects as they unfold toward fate. Fate, as a vector of scores or ranks, can be regressed on a set of measures, for example, the various ranks characterizing family of origin. Application of the regression weights or coefficients to the background variables yields a score for each youngster that is the best predictor of eventual fate. I call this score a measure of the youngster's life chances.

[5] This distributional concept of life chances is less ambitious than Dahrendorf's broader conception that included collective goods, such as civil liberties or an orderly social environment, in addition to private goods. For present purposes, I restrict the concept to relative position or ranks, which endows differential life chances with overtones of zero-sum competition among individuals. The anti-utopian bias that results is a common and probably unavoidable consequence of a focus on individual mobility.

[6] The strict requirement is that one could use any one dimensional summary. Occupational SEI is adopted here for the sake of comparison with the vast body of work based on this measure.

This ranking score is the predicted value of the individual's fate. Arithmetically, it is a weighted linear combination of the individual's status attributes. The weights are the regression coefficients when fate is regressed on the set of predictors. Conceptually, it measures differential expectations.

Differential expectations are both present advantages and "mere" chances subject to revision. Those with high expectations will, on average, get better outcomes. But expectations are merely the predictable part of personal choices and decisions by power holders. Some with lesser expectations will pull ahead of some who had greater, as deviant decisions and unpredicted outcomes accumulate into changes in rank. Life chances are subject to modification as probabilities give way to certainties.

Most strictly, the aggregate of persons sharing a given rank have shared chances. Life chances refers to their total distribution of probabilities over outcomes. This is not directly measurable (at reasonable cost) but can be summarized by the mean and variance of the outcomes they will experience. The mean is the average or expected outcome, which corresponds to the "predicted" value of the regression summary. The variance corresponds to the error or residual variance of the regression. Life chances are a mixture of expectation and variance. People with identical life chances do not enjoy identical outcomes.

The dispersion of subpopulations from common expectations to divergent fates is the unfolding of life chances. As cohorts advance through restratifying processes, like education, some move up and some move down. But each new ranking is predictable in definite degree from its predecessor. Insofar as the new rank is predictable, no mobility has occurred. And each new ranking can be calculated in parallel by regressing fate on current facts. So the new ranking after, say, reshuffling due to education is based on a new regression with education added to family of origins measures.

Unfolding can also be viewed by looking back from adult rank. In the immediate past, last year's occupational rank must be a nearly perfect predictor of this year's. Stepping back in time, the prediction weakens steadily. Far enough back, at labor market entry, occupational rank winks out of existence, but a foreshadow of adult rank based on education and other factors can be calculated. Ultimately, one could unfold the process all the way back to rank based solely on family of origin. Each ranking could be resolved into little categories like percentiles. And then the movement of a cohort through the life cycle could be viewed as myriad trajectories or flows where occupants of each percentile disperse upward, sideways, and downward into the succeeding set of boxes.[7] And, of course, associated with such transitions are the various choices by individuals and by gatekeepers that move some ahead and others behind.

A measure of the immobility associated with the change in the ranking of persons is the correlation between successive rankings. No mobility has occurred if prospects or life chances are predictable from previous prospects. This is equivalent to saying that one's rank was unaltered by the new information or score on the most recent dimension. Conversely, mobility or changes in life chances is measured by the residual that is the complement to the correlation.

Thus the perspective leads, first, to a comparative ranking across the sample for each life cycle stage. Infants, teens, young adults, and so forth can each be stratified on the basis of the applicable variables. In principle, one can regard successive studies as refinements converging toward an upper bound of predictability based on all information about persons of a given maturity. In practice, attention is confined to the variables available within a study.[8] Second, the transition between stages is identified with a definite degree of stability and reshuffling or immobility and mobility.[9] Some transitions,

[7] In continuous form, this can be identified with a Gaussian random walk. The present paper is an approximate operationalization of this concept, which was my original starting point.

[8] There is no restriction against categorical predictors. And there is no requirement that every sample member have values on all variables. The possibility mentioned in the text of employing full information is not entirely theoretical.

[9] In general, scores used for ranks are "continuous" linear combinations of "continuous" measures. Ordinary product moment correlations are employed. (One could examine the metric variant, but the resulting coefficients are identically equal to 1.0 and carry no information.) So the scores are ranks only insofar as they refer to placement along an abstract dimension of expectations.

like college admission against a backdrop of high school performance, presumably would show high predictability. Predictability means that the new positions are ratifications or continuations of previous rank. More significant watersheds, like the reshuffling imposed by gatekeepers at labor market entry, should lead to lower correlations. In the latter case, the empirical analysis will soon provide a definite magnitude for inspection.

Associating a definite ranking with each stage of the life cycle makes it possible to assess the degree of change of rank, or social mobility, associated with each life cycle transition. "How much mobility" is not directly apparent from status attainment statistics. Instead, these address a variety of questions of dependence/independence among qualitatively varied factors. In effect, the dependence of any factor, like education, reflects immobility with respect to that axis of differentiation. However, the importance of the particular axis in the larger picture is empirically contingent. The result is something akin to "how much mobility" that on close analysis must be doubly qualified, once because the mobility is with respect to a particular dimension, and again to incorporate how much that dimension matters for other things.

The life chance perspective addresses a different question: how much any factor like education reshuffles the rank order of predictable access to the goodies. Such ranks summarize the chances associated with the cumulative statuses and outcomes of one's life to date. As the empirical material will show, the predictability of global rank generally exceeds, often by a wide margin, the predictability of the contributing components.

Thus the life chance perspective is an alternative to examination of the causal relations among variables. Attention is directed to the degree to which accumulating information (about stratifying outcomes and decisions) alters the ranking of individuals as expectations converge toward fate. With these tools, one can directly examine the amounts of mobility associated with the transitions captured by any sequence of empirical measures along the life cycle.

EMPIRICAL RESULTS

The relation of rankings at different stages in the life cycle is summarized by the correlations of the successive scorings predictive of fate. I call this summary a prediction table since it records the predictability of rank among the several stages of the empirical life cycle under examination. Panel D of Table 1 presents such a table for the correlations reported in Blau and Duncan (1967). Panels 1A to 1C record the correlations and other statistical summaries and decompositions.[10]

The calculations needed for panels A to C are widely understood. Panel D, the prediction table, is the novelty. The entries are correlations, but the variables are the rankings of life chances for each life cycle stage. The new variables are "life chances after *factor*" denoted as LCA (*factor*). These are calculated by regressing fate on the variables realized by that stage. For example, LCA (education) is the linear combination $-.0068$ (PA_ed) + .1808(Pa_occ) + .5120(Ed). (The weights are the path coefficients for occupation on the three variables.) Thus the rows and columns in Panel 1D refer to collections of variables associated with life cycle stages linearly combined into rankings with respect to expected fate. The left stub of Panel D lists the variables recoded into each LCA measure

Note, however, that the comparison is specific for sample members and one could single out, say, the 97th percentile based on family of origin. The normal (Gaussian) distribution could be used to interpolate details of the probabilities implicit in a sequence of percentiles. Conversely, given sufficient biographical detail to replicate the coding procedures, one could examine any life, like one's own, as a sequence of percentiles and jumps of definite length. Then one could see if one's personal intersection of history with biography contained statistically significant departures from the model.

Such applications rest on the approximation that the pattern from a given empirical cross section can be applied to other times. Fortunately, there is considerable evidence (cf. Featherman and Hauser 1978) that change over the present century is within rather narrow bounds. The weighted sums of components called for by the present approach further involve a damping that will help insure reasonable accuracy for such extrapolation.

[10] Numbers calculated by author are set off from numbers taken directly from published sources by reporting four digits in the text and six in the tables. The extra digits are to aid efforts to verify comprehension by calculation but are not intended to convey any empirical significance.

Table 1. Correlations, Path Analyses, and Life Chance Summaries for the United States, from Blau and Duncan (1967)

A. Correlations and path analyses

	pa_ed	pa_occ	educ	1st job	'62 occ
pa_ed	1	0.516	0.309361	0.025399	−.013940
pa_occ	0.516	0.733744	0.278369	0.214425	0.120526
educ	0.453	0.438	0.737933	0.432575	0.398303
1st job	0.332	0.417	0.538	0.669426	0.281082
'62 occ	0.322	0.405	0.596	0.541	0.566222

Note: Path coefficients for the column variable as dependent are in the upper right, residual variances are on the diagonal, and correlations are in the lower left.

B. R^2, multiple R, and the residual e

	pa_ed	pa_occ	educ	1st job	'62 occ
R^2	na	0.266256	0.262066	0.330573	0.433777
R	na	0.516	0.511924	0.574955	0.658618
e	na	0.856588	0.859030	0.818184	0.752477

Note: Entries are for the column variable regressed on variables to the left.

C. Multiple R for '62 occupation on sets of independent variables

pa_ed	pa_occ&	educ&	1st job&
0.332	0.425950	0.617161	0.658618

Note: educ& designates the set { pa_ed, pa_occ, educ}.

D. Prediction table

	pa_ed	pa_occ&	educ&	1st job&	'62 occ
pa_ed	1.0	0.779434	0.537947	0.504085	0.332
pa_ed, pa_occ		1.0	0.690176	0.646732	0.425950
pa_ed, pa_occ, educ			1.0	0.937052	0.617161
pa_ed, pa_occ, educ, 1st job				1.0	0.658618
'62 occ					1.0

Note: Correlations of life chances after the variable in the top label, which are based on the set given in the left label.

while the top labels abbreviate LCA (*factor*) as *factor&*.

It is straightforward, but tedious, to calculate the correlations among the LCA variables using the actual weights that describe the successive measures of life chances. Appendix A justifies a shortcut. The life chance correlations are shown to equal the ratios of the multiple correlations for fate on the variables included in each stage. Thus .6902, the correlation between LCA(background) and LCA(education), is the ratio of .4260 and .6172 which are the multiple R for fate on father's occupation and education, and the multiple R for fate on education, and father's occupation and education, respectively. Accordingly, life chances results can often be generated from published reports without recourse to microdata.[11]

Correlations among nonadjacent columns are multiplicatively related, for example, .6467 = .6902*.9370 where the three numbers are the correlations of LCA(background) with LCA(first job), LCA(background) with LCA(education), and LCA(education) with LCA(first job), respectively. Appendix A contains the proof that this property generalizes. If A,B,C,D denote successive stages of the life cycle character-

[11] If the multiple R after including an intervening variable were zero, then the formula for the life chances correlation is a ratio of two zeros. It is undefined, because it refers to the correlation of two zero vectors. This means that an implicit assumption for this perspective is that fate is somewhat predictable from at least the first intermediate variable. Thus differentiation of life chances would be undefined in societies like Marx's utopia where the division of labor has been abolished. In more practical terms, the perspective implicitly assumes that previous research has identified measures that show some continuity or correlation over the life cycle. I would like to thank Christopher Jencks for calling attention to this limiting case.

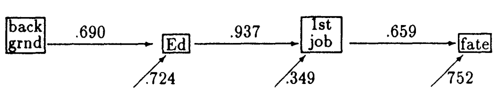
ized by the addition of one or more measured variables, then the life chances correlation of A with D, denoted $R(\mathrm{A,D})$, is equal to the product $R(\mathrm{A,B})*R(\mathrm{B,C})*R(\mathrm{C,D})$.

This property entails a simple structure for path analysis of a life chances correlation matrix. Figure 1 shows the result for the Blau and Duncan data. The path model forms a perfect causal chain, with A→B,B→C, and C→D. Bypassing direct effects, such as A→C, are identically equal to zero. Therefore, a consequence of the life chances reconceptualization is an image of minimum complexity. An incidental consequence of the absence of bypassing effects is that the paths in the life chances model are identically equal to the life chances correlations. Accordingly, the model can be understood and communicated in terms of correlations and without recourse to part correlations, or other higher-order quantities.

This means that the life chances approach can be viewed as a strategy for recoding variables into a pattern that gives a perfect causal chain. It therefore provides a useful summary or baseline for statistically oriented workers. The reduction to simple correlations may prove useful for teaching and other communication. Even sophisticated workers may find this useful for grasping the individual level implications of a multivariate picture.

The results in Table 1E summarize the data in a new way. For example, LCA(education) correlates .6902 with LCA(background). This is larger than the .596 correlation of education with adult occupation that is the largest correlation in the Blau and Duncan matrix. Thus one could say that background is more closely related to life chances before labor market entry than education is to occupation. This is a simple, alternative description of the same evidence that depicted education as a prime motor of mobility.

Perhaps the most apt contrast is of the .6902 life chance correlation with the multiple correlation of education with background of .5119.[12] The latter says that, on average, white male offspring from two standard deviations above the mean retain an educational advantage of only one standard deviation. In terms of life chances, about 1.4 standard deviations of advantage will be retained at the end of schooling. This still entails substantial regression to the mean, but the 35 percent increase in apparent status retention is hardly trivial.[13] And while advantaged white males might be dismayed to realize that their white male offspring will, on average, retain only 69 percent of parental advantage after completing education, those



The estimates apply to life chances after the variable appearing in the box. They are based on the correlations in Panel D of Table 1.

Fig. 1. Path Diagram describing life chances based on Blau and Duncan (1967)

[12] There is some ambiguity in selecting comparisons. The life chances approach describes the continuity of rank before and after education by a correlation of .6902. This directly measures immobility, and the complementary residual describes movement. But mobility and immobility are not complements within the standard perspective.

In the conventional analyses, mobility is an untidy combination of unexplained variance and variance explained by intervening processes. Immobility, if visible at all, is not a single number but a hodgepodge of inheritance measures across various contributing factors. One source of this ambiguity is the concern for direct and indirect effects. In the influential language of Lazarsfeld, an intervening variable which reduces a causal measure (e.g., a direct path) to zero, "explains" the original relationship. In the first instance, inheritance or immobility is thereby "explained." But the explanatory factors, like education, are frequently measures of individual achievement. Since these must "explain" final outcome, in the sense of incrementing R-square, to perform as intervening variables, these factors also "explain" mobility. The ambiguity arises because effective intervening variables "explain" both mobility and immobility, but in different senses of the verb "explain." As a result, the two complementary concepts become confounded.

[13] One could also compare the logically complementary residuals of the correlations, although this requires suitable negations of propositions. The residual variance in education (.738) is 41 percent greater than the residual variance in life chances after education (.524). The percent describes the ratio of the areas of the ellipses that circumscribe "most" of the observations in the corresponding scatter plots. But, in general, it can be misleading to mix comparisons of linear metrics such as correlation with square metrics like variance, just as it can be awkward to compare lengths and areas. In the text, I will restrict attention to correlations.

without advantage might be less than overwhelmed by this fluidity.

Of course, life chances after education is not the end of the story. At each succeeding stage, there are conditionally independent lotteries that will further reshuffle the rank order. In one sense, those who have retained disadvantage might envy the advantaged less because the race toward fate is slightly less than half over. Within the life chance perspective, the partition of the metaphoric race is numerically definite. LCA(education) correlates .6172 with fate, which means that slightly more reshuffling will occur from educational completion to fate than occurred from background to LCA (education).

But conditionally independent displacements from current rank offer limited solace to individuals. There is no built-in tendency to cancel extremes of advantage or disadvantage. Future positive and negative displacements around current position will exactly balance at every position.[14] So the provisional or preliminary advantage retained after education is not yet fate; but relative to age peers it is advantage calculated over the only factors that yet exist. In the larger picture, it is a foreshadow subject to modification. In the short term, it is the sum total of the life story to the present.

Labor market entry is a minor lottery, and presents the sharpest contrast between the two ways of representing the pattern of status continuity. The life chances correlation is .9370. This close coupling with background plus education is quite different from the decoupling suggested by the multiple correlation for first job of only .5749. Although first job is not very predictable, life chances at first job are. On the other side of the coin, the modest reshuffling entailed by first job contrasts with the substantial direct effect of first job on final attainment of .2811.[15]

The contrast between the high life chances correlation from educational completion to first job with the much weaker dependence of first job on the prior variables of background and education corresponds to a central novelty of the life chances approach. Appendix B shows that in the limiting case where direct effects of the prior variables on fate are zero, the life chances correlation for any stage with its predecessor will equal the dependence of the variable added at that stage on preceding variables. (Similarly LCA [*factor*] will be a vector of scores perfectly correlated with *factor*.) The excess of the life chances correlation over its path analytic counterpart increases as "bypassing" direct effects from prior variables are greater.

What this means, in the current context, is that relative standing or rank at first job depends on more than first job alone. It also depends on education and background. Those with identically ranked first jobs are unequal with respect to final outcome, in the degree that there are differences on prior factors. This means that such differences on prior variables need to be taken into account in assessing mobility. Conversely, the residual variance for first job overstates the fluctuation in rank that accompanies succession into first job.[16]

If there were no other direct effects to be accumulated into total rank, one could assess

[14] This claim assumes that the conditional means estimated by the regressions are unbiased, which is similar to assuming that the model is correctly specified. Under this assumption, most individuals lack any objective basis for expecting their future to be more advantaged or disadvantaged than their current rank, even though collectively there will be many modifications. Strictly, this refers only to the information incorporated into the model. If one believed oneself to have a preponderance of unmeasured positive (or negative) qualities, then one could rationally expect favorable (or unfavorable) modifications.

My suspicion is that subjective interpretations of this will turn where one stands in the process. Young persons, whose total rank can be based only on early factors, may be less inclined to discount the extant retention of advantage, because there is no reason to believe that they personally have any prospect of benefiting from later modifications. Older persons, especially those looking down from positions of success, may be considerably more inclined to regard the earlier ranking as permeable to those who, like themselves, possess the requisite unmeasured qualities.

[15] Algebraically, the squared direct effect appears in the denominator of the life chance correlation. Numerically $.9370^2 = (.3809)/(.3809 + (1-.5799^2)(.2811^2))$. All things equal, larger direct effects mean smaller life chance correlations. The example illustrations, however, that a relatively large direct effect can accompany a life chance correlation that is by no means small.

[16] Compare Goldthorpe (1980) for the substantial rebound from low-ranking first jobs by persons with other advantages.

dependence/independence from prior factors by attending to first job alone. The life chances result would converge to the standard result for this special case. More generally, the life chances correlation reflects the weight of direct effects, and shows that the summary ranking after first job is quite similar to the ranking that described expectations for persons completing education.

Tables 2 and 3, derived from Hope's (1984) comparative study of meritelection (his coinage for meritocracy) show interesting similarities and differences with the preceding analysis. Table 2 presents Scottish data. Table 3 is American data, derived by Hope from Jencks et al. (1972) who assembled it from various sources. For identification purposes, I will refer to it as Jencks's data. Proceeding directly to the prediction tables (panels D), we see that education reshuffles the rank somewhat more. The correlation of background life chances with post education life chances is .6117 for Scotland versus .6485 for the American data (.6902 was the most comparable Blau-Duncan result).

The reason for this is worth exploring since it affords some insight into the present perspective. Comparison of panel C of Tables 1, 2, and 3 shows that the correlation of background with fate is quite similar for the three sets of data (.4259 [Blau and Duncan], .44 [Jencks], and .423 [Hope]). The correlation of post education with fate, respectively .6171 (Blau and Duncan), .6784 (Jencks), and .6915 (Hope), differs more. Since the life chances correlation is the ratio of the first to the second for each country, the stronger relation of education plus background to outcome in Scotland is the difference that leads to the lower status retention in the Scottish case. Over the longer haul, status retention is at similar levels in the three data sets. But in Scotland, more of the shuffling takes place by educational completion, while the American data suggests that labor markets (or in any event, post education processes) do more of the decoupling.

The preceding comparison is somewhat unscrupulous. Blau and Duncan's data included father's education, but not IQ, while the reverse holds for the Jencks and the Hope data sets. In the latter analyses, IQ is incorporated in postschooling rank. Yet this makes surprisingly little difference. If one simply uses the common variables of father's occupation, education, and own occupation, the life chance correlations would be .6563 (=.405/.6171, Blau-Duncan), .6629 (=.44/.6637, Jencks), and .6206 (=.423/.6816, Hope). This sort of stability with respect to measurement differences is common among the life chance calculations (most not reported here) I have carried out. The source of this robustness is an interesting topic for future investigation.[17]

The most interesting comparison concerns IQ in the American versus Scottish data (panel D, Tables 2 and 3). Information about measured IQ leads to a new ranking for the Scots that correlates only .6825 with father's occupation. Rank is more impervious to IQ results in the Jencks data, since r is .7660. This result parallels Hope's (1984) finding that IQ results are more rigorously heeded in the Scottish system. (However, comparison with the Scottish [.3] and American [.357] correlations of IQ with background shows that the reshuffling in both systems is far less than would be needed to bring life chances into alignment with measured ability.) Most dramatically, in the Scottish data, background together with test results produce a ranking that correlates .8962 with the rank after school completion. The comparable figure, from the Jencks data, is a smaller but still quite large .8467. In both systems, early adult life chances differ but slightly from the ranking based on the information available in early adolescence.

INTERPOLATIONS AND GUESSTIMATES

Magnitudes aside, the conceptual and numerical simplicity of life chances offers additional advantages. The succession of stages is placed in a common framework, and each succession is described by a single, simple correlation. The resulting simple pattern is both rich in implications and easily extended to incorporate new features.

The life chances summary results in a perfect causal chain when subjected to path analysis. As a result, the several paths

[17] But it is not completely mysterious. First, many kinds of measurement error cancel (or nearly cancel) when life chance correlations are calculated. Second, adding new indicators to the measures incorporated to a stage increases both the numerator and the denominator of the life chance correlation, leaving the result fairly stable.

Table 2. Correlations, Path Analyses, and Life Chance Summaries for Scotland, Derived from Hope (1984)

A. Correlations and path analyses

	pa_occ	IQ	educ	occ
pa_occ	1	0.3	0.230879	0.172369
IQ	0.3	0.91	0.653736	0.168523
educ	0.427	0.723	0.428763	0.468555
occ	0.423	0.559	0.664	0.521762

Note: Path coefficients for the column variable as dependent are in the upper right, residual variances are on the diagonal, and correlations are in the lower left.

B. R^2, multiple R, and the residual, e

	pa_occ	IQ	educ	Occ
R^2	na	0.09	0.571236	0.478237
R	na	0.3	0.755802	0.691547
e	na	0.953940	0.654800	0.722330

Note: Entries are for the column variable regressed on variables to the left.

C. Multiple R, for '62 occupation on sets of independent variables

pa_occ	IQ&	educ&
0.423	0.619762	0.691547

Note: educ& designates the set {pa_occ, IQ, educ}.

D. Prediction table

	pa_occ	IQ&	educ&	occ
pa_occ	1.0	0.682520	0.611671	0.423
pa_occ, IQ		1.0	0.896196	0.619762
pa_occ, IQ, educ			1.0	0.691547
occ				1.0

Note: Correlations of life chances after the variable in the top label, which are based on the set given in the left label.

connecting background to fate are factors whose product is the multiple correlation from background to fate. Thus the paths are a partition.

Interpretively and conceptually, this offers major advantages. Sequences of stages can be combined by simple multiplication. Both the components and the products are correlations, and thus the familiar model of the bivariate normal (Gaussian) distribution can be used to interpolate details for any transition.

This is potentially useful in several regards. The correlations linking life cycle stages can be approximately identified with years of age for cohorts. This means that the model places limits, and often very narrow limits, on the expected amount of change over particular intervals. One can quite readily translate these into percentiles, and into other descriptions that can be interpreted as a contest among persons.

Narrow limits can produce sharp implications. If mobility is contextualized in this manner, productive thought experiments become possible. For example, consider the fictitious headline "Harlem youth graduates from Harvard." Can this be regarded as a change from the 10th percentile to the 99th? If the frame is taken as youth from age 16 to age 22, then the governing correlation is higher than .85. The corresponding probability is less than 1 in 20,000,000,000 ($z = 6.49$, $p = 4.29 \times e-11$). At those odds, it has probably not happened in the history of the republic.[18]

In a somewhat similar fashion, it should

[18] The correlation of .85 is below the estimates in Tables 2 and 3 for rank after testing to rank after educational completion. Alternatively, the estimate in Table 1 for family of origin to school completion is .69, and age 16 to 22 must be a small fraction of that. The 10th percentile amounts to a standard deviate of -1.28. The conditional distribution has a mean of -1.09 and a standard deviation of .5267 ($=$ sqrt$(1-.85^2)$). Thus an outcome in the 99th percentile, or unconditional standard deviate of 2.33, corresponds to a standard deviate of 6.49 ($=(2.33-1.09)/.5267$) in the conditional distribution.

Table 3. Correlations, Path Analyses, and Life Chance Summaries for the United States, Taken from Hope (1984), Derived from Jencks et al. (1972)

A. Correlations and path analyses

	pa_occ	IQ	educ	occ
pa_occ	1	0.357	0.318537	0.147232
IQ	0.357	0.872551	0.466282	0.173319
educ	0.485	0.58	0.575065	0.476067
occ	0.44	0.502	0.648	0.539720

Note: Path coefficients for the column variable as dependent are in the upper right, residual variances are on the diagonal, and correlations are in the lower left.

B. R^2, multiple R, and the residual, e

	pa_occ	IQ	educ	Occ
R^2	na	0.127449	0.424934	0.640279
R	na	0.357	0.651869	0.678439
e	na	0.934104	0.758330	0.734656

Note: Entries are for the column variable regressed on variables to the left.

C. Multiple R for '62 occupation on sets of independent variables

pa_occ	IQ&	educ&
0.44	0.574410	0.678439

Note: educ& designates the set {pa_occ, IQ, educ}.

D. Prediction table

	pa_occ	IQ&	educ&	occ
pa_occ	1.0	0.766003	0.648547	0.44
pa_occ, IQ		1.0	0.846664	0.574410
pa_occ, IQ, educ			1.0	0.678439
occ				1.0

Note: Correlations of life chances after the variable in the top label, which are based on the set given in the left label.

prove possible to contextualize other local investigations of small and nonrandom samples, for example, ethnographies. With narrow limits, even small samples can defy the laws of chance and could suggest where the larger model needs modifications. Thus life chances provides the beginnings of tools for constructing a framework of expectations based on expensive large samples that can be applied to smaller local samples.

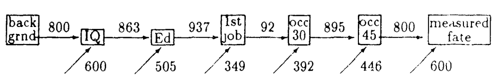
Another kind of interpolation involves variables and social processes. The multiplicative property becomes additive in logarithms. Therefore, letting 1 stand for background, I for fate, 2, 3 . . . $I-1$ for intermediate stages, and $R(4,5)$ for the life chances correlation among stages 4 and 5,

$$Ln(R(1,I)) = \Sigma\ Ln(R(1,2) + Ln(R(2,3) \ldots + Ln(R(I-1,I)).$$

An implication is that interpolation of additional stages is a zero sum analysis. That is, to stick a stage between two extant stages is one-to-one with dividing the corresponding log of the correlation into two pieces that sum to the old total.

An additional intuitive tool is provided by the fact that for correlations that are large $-Ln(r)$ approximately equals 1-r (where Ln refers to the natural logarithm). Thus the numbers to be subdivided are decrements of correlations from unity. So a .9 can be divided approximately into a .99 and a .91, or a .98 and a .92, or into any other combination of numbers whose difference from 1.0 sums to 1.0 $-$.9.

I have used this property to guesstimate the values in Figure 2, drawing mainly on the



The estimates apply to life chances after the variable appearing in the box. They are based on the interpolations discussed in Section IV.

Fig. 2. Path Diagram describing life chances based on Blau and Duncan (1967) with interpolations

data used above. One additional feature is that measurement error in occupational rank, estimated by Bielby, Hauser and Featherman (1977) to be .8, appears at the penultimate stage, as it were, between this year's job and last year's, since in fact it was derived from a test retest over an eight-month interval.

I would not defend the estimates in detail, but merely suggest that such interpolations within the zero sum context of the life chances approach are far from arbitrary. All such interpolations are governed, first, by making sure that products correspond to any actual estimated paths, and second, by imposing a zero sum split into portions as new stages are added. It is a considerable aid that the guesstimates are accessible as decrements of correlations from unity. It is hard to imagine that any interpolations are off by as much as .05, because most of them cannot logically vary across much more of a range.

Together these tools point toward rough and ready estimates of the typical kinds of changes associated with the full range of ranks across the full range of life cycle stages. Life chances thus provides a simple summary for synthesizing results. Within such a summary, thought experiments relating local observations to large sample results generate quite narrow bounds on outcomes. It offers a new way to attach new meaning to patterns of social mobility.

THE CONTINUITY OF RANK

So what should "the lads" make of it? Since "the lads" had been tested and placed in academic tracks by the time of Willis's observations, they were somewhere midway in the mobility from IQ results to school leaving. Hope's claim that the British system is intermediate between Scotland and the U.S. means that their movement is circumscribed by a correlation falling between the Scottish result of .8962 and the U.S. result of .8467. Since the least of these is "high" by almost any standard, fatalism on the part of "the lads" seems amply warranted. The typical result of academic striving versus alienation can amount to only a very few rungs on the social ladder. For example, a person starting from the 99th percentile under Scottish conditions would land between the 98.4th and 99.4th percentiles two-thirds of the time. The looser American system would give a range of 96.5th to 99.8th. There is rank to be won or lost at school, but it is hard to argue that the stakes are very great.

Should "the lads" discount this because earlier and later processes also decouple people from origins? The only earlier process recorded in the data is IQ measurement. Willis reports that "the lads" were not overly impressed by the validity of such testing. In any case, their appreciation of their personal chances incorporated the fact that they had already been tested and found wanting. On the other side, they might take comfort in the possibility of later good fortune. But such luck as there might be is independent of schooling outcomes, and thus irrelevant to orientations toward schooling. Furthermore, there are no grounds for anticipating more good luck than bad. So if the "the lads" were attending to their immediate future, or more precisely to the prospects associated with their future 10 years hence, they were essentially correct in their assessment that effort at school would avail them very little.

In some strict sense, such conclusions were implicit in earlier analyses. The prediction table is based on the same empirical base and summarizes the same facts. But the interpretive or subjective difference is substantial. And it is useful to outline the sources of the greater continuity of rank that emerges from the alternative analysis.

The greatest contrast is that the correlations in the prediction tables are large. This, in turn, is connected with the simplicity of the life chances path representation. At the limit, if the standard representation yielded a simple causal chain, then the diagrams from the two approaches would be identical. More generally, the standard representation disperses continuity across a complex tangle of bypassing direct paths. The greater life chances magnitudes correspond to condensing the tangle into simpler, and more striking, indices of status continuity.

Greater simplicity and larger magnitudes recording continuity are therefore empirically contingent. The contingency will usually hold, since perfect "explanation" by intervening variables is more the exception than the rule. The contrast between life chances and conventional causal analysis will be greater as bypassing direct effects are more numerous and are weightier. And since the greater continuity brought out by life chances is contingent on the data, the contrast between the approaches is not one of fact or validity.

The life chances pattern may appear novel, but in another sense it merely highlights what was already (or always) there.

The central difference is in the question(s) addressed. Adoption of the path analytic representation impels attention to the family of questions "how do each of the earlier measures of status contribute to standing on each of the later measures?" But the same material can be used to address the more pointed question "how much mobility?" The latter question leads to a simpler family of answers because it abstracts from the qualitative distinction among variables to a singular characterization of abstract rank that is comparable across the several life cycle stages.

The abstraction to rank brings into focus the slowly shifting relative positions of individuals. The more pointed question leads to a wholistic summary of total position across the several contributing factors. The result is directly analogous to a contest among persons; it describes standing vis-à-vis age peers as the metaphoric race for advantage unfolds. The close analogy between popular metaphor and technical summary suggests that the results lend themselves to direct comparisons with lay perceptions.

Standard causal analysis forces attention onto an intervening conceptual layer of qualitatively distinct variables. Interpretation requires contextualization, for controls on prior variables and by degrees of effect on later variables. This intermediate complexity does not refer to persons with scores on the several factors. Causal results are separated from the ordinary language of wholistic anecdotes and stories that are a primary means of communicating understanding of social life. The less abstract causal pattern is not false and should be examined when substantive concerns parallel the possibilities implicit in relative causal weights. But the relevance for subjective appreciations, by individuals concatenating their various ranks into a total position, is obscure.

First job illustrates the contrast. The Blau and Duncan result assigns a complex role as a mediator for both education and background. First job is also a moderately potent precursor for adult occupation. But it is also substantially orthogonal to prior factors. In one sense, this indeterminacy is a species of mobility. But it is misleading. The life chance result brings out the very substantial continuity of rank across labor market entry. This damping of apparent motion occurs because family background and education exert considerable weight on fate over and above first job. For persons, with scores on all dimensions simultaneously, advantage/disadvantage at labor market entry turns on more than first job status, and therefore the volatility of this status overstates the fluidity that would enter a realistic assessment of where one stands.

In sum, life chances does not represent an empirical "refutation" of path analytic results. Such refutation as there may be is conceptual. The difference is one of focus and of motivating question. The greater simplicity and greater continuity of rank is one-to-one with changing the focus to shifts in the relative positions of individuals and away from the interdependencies among variables. Thus a simpler pattern, expressed in the lower-order concept of correlations, emerges from a more central question, to yield results more directly relevant to individuals as wholes. This holds promise for more direct comparison with lay perceptions of changing relative standing. The striking continuity of rank that is revealed may even alter the subjective appreciation of some sophisticated observers.

In a strict sense, the greater continuity of rank revealed by life chances is not novel. It may appear novel because framing the issue differently leads to different answers. But the empirical facts are the same. In principle, one could apprehend the slowly changing ranks of individuals from the various small effects dispersed across paths in the more baroque causal representation. In another sense, the novelty is substantial. By condensing the continuity that was previously splintered among causal effects into singular indices of the continuity of rank, the life chance perspective reveals a picture of considerably reduced fluidity.

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APPENDIX

Formal results

The first section will state and prove the theorem that justifies the calculation of correlations among ranks. The multiplicative rule relating trios of stages follows a correlary. Together these justify the construction of the prediction tables. The second section will outline the relation of correlations among ranks with direct and indirect effects.

The correlation of life chances from different life cycle stages

The correlation of life chances for two different life cycle stages, i and j, can be denoted $R_{i,j}$. It is the correlation between the rankings of individual expected outcomes at the two stages. Each ranking is a vector of predicted values, or $\hat{Y}$ for a given set of independent variables. Call the first set X_1 and the second X_2, where X_1 and X_2 are matrices of 1 or more independent variables. $X_{1,2}$ stands for the matrix of the two sets taken together.

In this setup,

$$\begin{aligned}\hat{Y}_1 &= X_1(X_1'X_1)^{-1}X_1'Y\\ &= H_1Y\\ \hat{Y}_{1,2} &= X_{1,2}(X_{1,2}'X_{1,2})^{-1}X_{1,2}'Y\\ &= H_{1,2}Y,\end{aligned}$$

where $\hat{Y}_1$ and $\hat{Y}_{1,2}$ are the predicted values from the regression of Y on X_1 and $X_{1,2}$, respectively. H_1 and $H_{1,2}$ are notation for the corresponding symmetric, idempotent matrices $X_1(X_1'X_1)^{-1}X_1'$ and $X_{1,2}(X_{1,2}'X_{1,2})^{-1}X_{1,2}'$. They are called H matrices because they "put a hat" over Y.

The covariance of the predicted values is given by

$$\begin{aligned}\mathrm{COV} &= \hat{Y}_1'\hat{Y}_{1,2}\\ &= Y'H_1H_{1,2}Y.\end{aligned} \quad (1)$$

This can be simplified by noting that

$$H_{1,2} = H_{2.1} + H_1$$

(compare Searle 1982, p. 269), where $H_{2.1}$ is the idempotent form associated with the regression of Y on $X_{2.1}$, and $X_{2.1}$ stands for X_2 residualized on X_1.

$$\begin{aligned}\text{Since } X_{2.1} &= (I - H_1)X_2,\\ &= H_{2.1}(I - H_1)X_2\\ &\quad (X_2'(I - H_1)X_2)^{-1}\\ &\quad (I - H_1)X_2'.\end{aligned}$$

Substitution yields

$$\begin{aligned}\mathrm{COV} &= Y'H_1(H_{2.1} + H_1)Y\\ &= Y'H_1Y\end{aligned} \quad (2)$$

since $H_1 \times H_{2.1} = 0$ and H_1 is idempotent.

The correlation is the covariance divided by the standard deviations of the vectors $\hat{Y}_1$ and $\hat{Y}_{1,2}$ which are $\sqrt{Y'H_1Y}$ and $\sqrt{Y'H_{1,2}Y}$. Therefore, the correlation of the predicted values is given by

$$\begin{aligned}R_{\hat{Y}_1,\hat{Y}_{1,2}} &= \frac{Y'H_1Y}{\sqrt{Y'H_1Y}\sqrt{Y'H_{1,2}Y}}\\ &= \frac{\sqrt{Y'H_1Y}}{\sqrt{Y'H_{1,2}Y}}\quad .\end{aligned} \quad (3)$$

Since the R^2 for Y on X_1 and for Y on X_1 and X_2 jointly are

$$\frac{Y'H_1Y}{\mathrm{Var}(Y)} \text{ and } \frac{Y'H_{1,2}Y}{\mathrm{Var}(Y)}\quad ,$$

the correlation may also be given as

$$R_{1,2} = \sqrt{\frac{R^2_{Y \text{ on } X_1}}{R^2_{Y \text{ on } X_{1,2}}}}\quad . \quad (4)$$

Thus the correlation of life chances is the square root of the ratio of the R^2 for Y on X_1 to the R^2 for Y on X_1 and X^2. This describes the calculation of the entries in the prediction tables.

The multiplicative relation among more than two life cycle stages follows from the theorem. If R_1, R_2, and R_3 are the square roots of the proportion of variance explained (i.e., the multiple correlation coefficients) after stages 1, 2, and 3 respectively, then the correlation of expected outcomes of stage 1 with stage 2, or $R_{1,2}$, is equal to R_1/R_2. Then

$$\begin{aligned}R_{1,3} &= R_1/R_3\\ &= (R_1/R_2) \times (R_2/R_3)\\ &= R_{1,2} \times R_{2,3}\ .\end{aligned} \quad (5)$$

Of course, this extends to any number of stages.

The relation of direct and indirect effects to correlations of life chances

This section will connect the correlation of life chances with direct and indirect effects. Matrice notation is employed to achieve full multivariate generality. More accessible results are presented for the special case of one intervening variable and in the qualitative summary in the final section.

Let X_1 stand for an n by k_1 matrix of n observations of k_1 independent variables. Let X_2 stand for an n by k_2 matrix of k_2 intervening variables, and Y for the dependent variable. In concrete terms, Y might refer to culminating occupation, X_2 to measures of the educational process, including years completed, and X_1 to assorted ranking criteria applicable to the family of origin.

The model is two matrix equations,

$$Y = X_1\beta_1 + X_2\beta_2 + \epsilon_y \tag{6}$$

$$X_2 = X_1\beta_3 + \epsilon_{X_2}, \tag{7}$$

where β and ϵ refer to unobserved population values. I will use Roman letters ($\hat{B}$ and e) to refer to sample values. Since the following argument rests on the algebra of OLS estimators, assumptions about the errors would be superfluous.

Assume that all columns are mean centered so that intercepts can be ignored. Assume further that the independent variables are scored so that their zero-order correlation (and hence covariance) with Y is $\geqslant 0$. There is no restriction on the correlations among independent variables or the $\hat{B}$s or βs, so that these can be negative. This directional convention does not sacrifice generality.

The (squared) correlation of life chances at stage 1 and stage 2 is

$$R^2_{1,2} = \frac{Y'H_{X_1}Y}{Y'H_{X_{1,2}}Y} = \frac{\hat{Y}'_1\hat{Y}_1}{\hat{Y}'_{1,2}\hat{Y}_{1,2}} \ .$$

Since

$$\hat{Y}_1 = X_1\hat{B}_1 + X_1\hat{B}_3\hat{B}_2$$
$$\hat{Y}_{1,2} = X_1\hat{B}_1 + X_2\hat{B}_2$$

the (squared) correlation can be written in terms of the sample estimates as

$$R^2_{1,2} = \tag{8}$$

$$\frac{\hat{B}'_1X'_1X_1\hat{B}_1 + 2\hat{B}'_2\hat{B}'_3X'_1X_1\hat{B}_1 + \hat{B}'_2\hat{B}'_3X'_1X_1\hat{B}_3\hat{B}_2}{\hat{B}'_1X'_1X_1\hat{B}_1 + 2B'_2B'_3X'_1X_1\hat{B}_1 + \hat{B}'_2X'_2X_2\hat{B}_2} .$$

When $\hat{B}_1$ is zero, there is no "direct" effect, and the (squared) correlation of life chances reduces to

$$R^2_{1,2} = \frac{\hat{B}'_2\hat{B}'_3X'_1X_1\hat{B}_3\hat{B}_2}{\hat{B}'_2X'_2X_2\hat{B}_2} \ . \tag{9}$$

The substitution $\hat{B}'_3X'_1 = X'_2X_1(X'_1X_1)^{-1}X'_1 = X'_2H_{X_1}$ leads to

$$R^2_{1,2} = \frac{\hat{B}'_2X'_2\,H_{X_1}\,X_2\hat{B}_2}{\hat{B}'_2X'_2\,X_2\hat{B}_2} = R^2_{X_2\hat{B}_2 \text{ on } X_1} , \tag{10}$$

which reveals that this is a squared multiple correlation with $X_2\hat{B}_2$ taking on the role of the dependent variable and X_1 as independent variable. Since $X_2\hat{B}_2$ is the vector of values of Y predicted on X_2, this multiple correlation indexes the degree that X_1 contributes to Y through X_2, i.e., indirectly.

In the context of the model, this makes good sense. X_2 can refer to multiple variables. But the dependency that matters is of the particular linear combination of the columns of X_2 that carry Y. As it were, the construction brings out the optimal path of indirect dependence of Y on X_1 through the variables making up X_1. When $\hat{B}_1 = 0$ life chances at the latter stage depend on the former stage only insofar as the prior stage variables "explain" the part of the latter stage variables that cause (or index) final fate.

For the case when X_2 is a single variable, a particularly simple result holds. The interior portion of the numerator $X'_2H_{xI}\,X_2$ is the ESS for X_2 regressed on X_1. This ESS is equal to $X_2X_2R^2{}_{X2}$ on ${}_{X1}$. Then

$$R^2_{1,2} = \frac{\hat{B}'_2R^2_{X_2 \text{ on } X_1}X'_2X_2\hat{B}_2}{\hat{B}'_2X'_2X_2\hat{B}_2} = R^2_{X_2 \text{ on } X_1} \ . \tag{11}$$

Hence, no direct effects ($\hat{B}_1 = 0$) implies that the (squared) correlation of life chances is equal to the R^2 for the intervening variable X_2 on the preceding variables, X_1. In this happy circumstance, the dependence of the intervening variable on the prior variable is an index of the preservation of rank (or immobility) while the residual (or "unexplained") variance is an index of change of rank or social mobility. Thus, when direct effects are absent, the dependence of intervening statuses and the dependence of life chances are numerically indistinguishable.

In general there are direct effects. To assess their impact, derivatives can be calculated to see how increases in $\hat{B}_1$ affect the (squared) correlation of life chances.

To describe the derivative of the correlation of life chances with respect to changes in direct effects, it is helpful to substitute simple symbols for complex ones. Let

$$f(\hat{B}_1) = \hat{B}'_1X'_1X_1\hat{B}_1 + 2\hat{B}'_2\hat{B}'_3X'_1X_1\hat{B}_1$$
$$C = \hat{B}'_2X'_2X_2\hat{B}_2$$
$$R^2 = R^2_{X_2\hat{B}_2 \text{ on } X_1}$$

so that

$$R^2_{1,2} = \frac{R^2C + f(\hat{B})_1}{C + f(\hat{B})_1} \quad .$$

Since

$$\frac{\partial f(\hat{B}_1)}{\partial \hat{B}_{1i}} = 2(X'_1X_1)\hat{B}_1 + 2(X'_1X_1)\hat{B}_3\hat{B}_2 = 2X'_{1i}Y,$$

$$\frac{\partial R^2_{1,2}}{\partial \hat{B}_{1i}}$$

$$= \frac{(C + f(\hat{B}_1))2X'_{1i}Y - (R^2C + f(\hat{B}_1))2X'_{1i}Y}{(C + f(\hat{B}_1))^2}$$

$$= \frac{2C(1 - R^2)X'_{1i}Y}{(C + f(\hat{B}_1))^2} \qquad (12)$$

describes the implications for the (squared) correlation of a change in the i-th element of $\hat{B}_1$. The numerator of this derivative is always $\geqslant 0$ since $1 - R^2 \geq 0$, C is a positive semidefinite quadratic form and always ≥ 0 and $X'_{1I}Y$ is non-negative by the convention of the coding of variables so that $X'_1Y \geqslant 0$. The denominator is a square and always positive. Thus any increase in an element of $\hat{B}_1$, implies an increase in the life chances correlation.

One special qualification is in order. Any increase in a *negative* element of $\hat{B}_1$ toward zero is here regarded as an *increase* in direct effect. This is verbally straightforward, and substantively sensible. By convention, all zero-order relations with the dependent variable are coded to positive. Thus a negative element denotes a partial relation of opposite sign from the zero-order relation, or an instance of suppression. Of course, such configurations are rare empirically, and almost always are modest in magnitude.

Although it is conventional to regard negative partials as diminishing toward zero, such usage improperly collapses two different changes away from zero direct effects. Congruent changes, where direct effects increase, are accompanied by increases in the zero-order relation and in explained variance. Incongruent changes, where direct effects become more negative, have the unusual implication of diminishing zero-order relations. (Of course, parallel considerations govern negative zero-order relations and partials of the same or of opposite sign.) Thus conventional usage leads to the awkward possibility that a relationship strengthens and weakens at the same time. I prefer to regard any change in a direct effect that strengthens a zero-order relation as an increase, although that does include the possibility of an increase toward zero that is a decrease in absolute magnitude. Those who wish can add the appropriate qualification, which amounts to substituting "direct effects changing so as to increase the magnitude of the (non-negative) zero-order relations, that is diminishing toward zero or increasing above zero" for "direct effects increasing."

Thus any increase in any element of $\hat{B}_1$ will increase the correlation of life chances. With the qualification on sign given above, any increase in "direct effects" will increase the life chance correlation.

The qualitative relation of direct effects, indirect effects, and life chances correlations

"Direct effects" refers to the circumstance where an intervening variable fails to mediate all of the relation between a prior and a posterior variable. The preceding justifies two generalizations. At a limiting point where direct effects are zero, the life chances perspective and the path analytic results converge. The correlation of life chances is equal to the correlation of intermediate status rank with preceding rank. The residual ("unexplained") variance in the intervening variable corresponds to the change in rank, that is, to the mobility as measured in terms of life chances. The path models for the two variants would be numerically identical.

In contrast, where direct effects persist when intervening variables are introduced, the life chances correlation will be greater than the corresponding explained component of the intervening stages. As direct effects are greater, the excess of the life chances correlation will be greater.

A useful concept for understanding the contrast is "sufficiency." If an intervening factor reduces all residual direct effects to zero, then prior variables carry no additional predictive capacity. Such a factor is sufficient for later rank insofar as other factors give no additional predictive power. In general, intervening variables like IQ, education, and first job are not sufficient.

If a variable were "sufficient" the associated LCA variable would be perfectly correlated. Correspondingly, the weights for the prior variables would be zero. When "sufficiency" fails, these weights are greater. And accordingly, the correlation of the LCA variable with prior variables increases from the lower limit where the weights were zero.

Substantively, this reflects the circumstances that prior variables must be weighted in along with any variable that is insufficient. First job is an example. Education and background carry substantial weight, alongside first job, in the prediction of fate from the point of labor market entry. Accordingly, rank at first job is more predictable than first job alone, because the factors employed as predictors are also components of rank at labor market entry.

At the opposite extreme, if first job had no net impact on fate, then rank at first job would be a linear combination of education and background alone. Indeed, it would be the same linear combination as LCA (education) and the life chances correlation would be unity. Of course, empirical configurations will generally fall somewhere between, as illustrated by the Blau and Duncan data.

The analysis revealed an exception that is more apparent than real. If a factor has a negative direct effect, even though it is positively correlated with fate, and produces "status inversion," it reduces the predictability of life chances. This makes substantive sense since "the first become last and the last become first." As such a pattern is weaker, the life chance correlation is greater, and measured mobility is reduced. Although reduction in "status inversion" is absolute diminution of a direct effect, it is also an increase in the coupling of a factor with fate, and it makes substantive sense to assimilate it to the notion of "increase of direct effect."

In sum, zero direct effects, which means that some variable is a sufficient predictor for eventual outcome, is a limiting case where life chances and conventional path results coincide. But greater direct effects, and more numerous direct effects, increase the life chances correlation in comparison with the degree of determination of the relevant intervening variable. In this sense, the more parsimonious life chances representation is a condensation of the effects which causal analysis disperses across the paths bypassing the intervening factor. The complexity which comes with intervening variables that leave residual direct effects masks the continuity of individual rank. Simplicity and larger magnitudes indexing continuity go hand in hand.

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