Class Formation and Class Mobility: A New Approach with Counts from Life History Data

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Abstract

In this paper we focus on the role of inter-class mobility in the process of class formation. We argue for the conceptual centrality of mobility as a major influence on the emergence of the demographic identities of classes as stable social entities. Two main issues are addressed: First, what is the appropriate unit of analysis in the study of class formation? The conventional first class to last class data array where the entire mobility history is summarized by a single transition per person, or the complete count of all class to class transitions experienced by a population over the life course?

Second, what is the most appropriate technique for separating the historical (structural) influences on mobility from the tendencies (mobility propensities) for classes to exchange members to greater or lesser degrees, net of structural influences?

Using data for a single cohort of men in the Norwegian Life History Study, and a class schema developed by Goldthorpe and colleagues, we examine the comparability of a conventional mobility analysis and the analysis of complete event counts in regard to (a) the patterns of observed or absolute mobility, and (b) the patterns of structural and exchange mobility (the latter makes use of Sobel, Hout and Duncan's recently developed structural shift model).

The analysis suggests that the abstracted mobility summary used in conventional analyses (the first-last table) conveys a significantly different picture of observed and relative mobility patterns than is found using event counts from complete life history information. Our main conclusion is that the analysis of event counts is the preferred approach for the analysis of class formation through the mobility experiences of workers.

Analysts of class structure and formation disagree over the conceptual status of social mobility. Is class mobility largely irrelevant to processes of class formation? Together with Goldthorpe (1980) and Giddens (1973) we argue for the conceptual centrality of mobility as one major influence on the emergence of the "demographic identities" of class categories as social entities. Given this conceptual viewpoint, our paper addresses two analytic questions regarding the study of class formation through the mobility experiences of workers. First, what is the appropriate unit of analysis and database for the study of class formation? Conventions in mobility research typically analyse counts of persons arrayed by class of origin and destination. We argue that a more appropriate unit is the class event, counting all instances of class entry and characterizing the class event by its duration and the demographic characteristics of the individuals making this transition. For mobility research class events are arrayed by origin and destination, with each person contributing as many origin by destination counts or events as are contained within the worker's class history. Taken in the aggregate, the cumulation of class events encompasses a total and dynamically unfolding picture of the class structure and formative processes. Each frame of this motion picture is taken each time a class event occurs. We argue that class events not only describe the process of class mobility but they also lend themselves to dynamic analysis of duration in state or class. The latter features of the class system provide potentially new insights into processes of class closure and class formation.

Second, what is the most appropriate technique for dissaggregating the historical or structural influences on mobility and class formation from the inherent tendencies of classes to form distinctive demographic identities through delimited exchanges with other classes? Recent technical advances for the analysis of mobility tables (Sobel, Hout and Duncan 1985) provide conceptually preferable approaches for the study of class formation than previous methods (e.g., Hauser 1978; Featherman and Hauser 1978; Erikson, Goldthorpe and Portocarero 1979, 1982, 1983).

The chief advantage lies in making a simulataneous decomposition of the historical effects of changing economic and demographic conditions (structure) and the evolving patterns of class formation via mobility propensities (process); it provides a dynamic view of the reciprocity between structure and process that previous techniques of analysis have blurred.

Our arguments and illustrations are based on Norwegian data for a 1921 birth cohort of males who began their working lives during the pre-war economic depression and German occupation of that country. Using complete histories of this cohort's life course to age 50, we capture a dynamic historical period of post-war reconstruction and rapid industrial transition from agriculture and fishing to industrial and post-industrial economic bases. This setting provides an unusually rich context in data and history for the illustration of our arguments. It also offers an ample illustration of the interplay between social structure and the life course, as viewed from the historical process of class formation.

Demographic Identities, Mobility Propensities and Class Formation

It is generally acknowledged that the class structure of modern industrial societies is a fundamental feature conditioning individual achievement over the life course. Yet as a set of "empty places" in the social structure, classes are merely economic categories--a priori, they do not represent significant social categories. Beyond the consequences of economic differentiation in itself, the influence of class position on individual experience depends on the degree to which classes are galvanized as social collectivities with distinct socio-cultural identities. When conditions permit classes to take on the character of identifiable social collectivities, the process is termed class structuration (Giddens 1973), or, more commonly, class formation (Goldthorpe 1984).

Broadly defined, class formation encompasses all the factors which differentiate classes and promote common class life-styles, patterns of association, class solidarity and class consciousness. However, prior to class formation at these levels is a more basic process:the formation of a demographic identity. A demographic identity depends on the emergence and continuation of a relatively stable and permanent corps of individuals occupying the same class position--that is, the demographic identity of a class is a consequence of "...the association that exists over time between individuals and families and particular class positions...." (Goldthorpe 1984, p. 19). And central to class formation defined in this manner are the rates and patterns of inter-class mobility.

Notwithstanding this view, mobility often has been treated as irrelevant to the process of class formation. Structural Marxists, for example, generally reject the proposition that the movement of individuals through the class structure bears on the salience of classes in and for the structure of a society (e.g., Poulantzas 1975; Wright 1979). However, we maintain that class mobility is important as an indicator of whether or not a class has developed, or is in the process of developing, the stable, homogeneous population upon which rests its demographic identity. Mobility into and out of a class reflects the transience of class membership: classes where membership is not transient are more likely to develop the common life-styles, attitudes and behaviors that represent a unique class identity than are classes where membership is transient. In other words, "...it is difficult to see how distinctive life-styles and patterns of association could be properties of "classes" that exist simply as aggregates with a rapidly changing composition; or how...collective action in pursuit of [class] interests could be either motivated or organized." (Goldthorpe 1984, p. 20).

Movement through the class structure is governed by a system of formal and informal rules of allocation and access to class positions, and the personal motivations for individuals to move from or to stay in a class (class-based socialization). Rules of allocation and access produce a set of objective mobility propensities--factors which influence the chances of individuals entering, staying in or leaving class positions.

Mobility propensities derive from the location of each class in the total class structure and depend upon (1) the relative desirability of different class positions in terms of the rewards available to incumbents, (2) the relative economic, social and cultural resources class positions offer as origin categories, and (3) the relative barriers to access, or resources required for entry, they represent as destination categories (Goldthorpe 1984, p. 22).

Classes which are alike in the market situation and work relations typifying component positions are likely to show a strong propensity to exchange members, while classes which are quite different will tend to show a weak propensity for exchange. Contrary to some views (e.g., Breiger 1981), mobility propensities do not define class boundaries, rather they reflect the degree of affinity between classes. That is to say, in our view of class formation, mobility propensities describe the distances between classes in a multi-dimensional social space. These distances index the potential for objectively defined class boundaries to become significant axes of differentiation in life chances, lifestyles and social action--to become active social categories that shape the life course of individuals. As differentiation increases, the potential for class formation increases--the differences between one class and another begin to outweigh the differences, among persons and their life histories, internal to the class.

Class Formation: Analysis of Dynamics

Analytically, one of the more important aspects of class formation is that the process is not a fixed or static feature of the class structure, but rather is an evolving historical process that is responsive to wider social and economic changes. Therefore, the study of class formation should be based on a representative cross-section of a population, with mobility histories of sufficient detail, and covering a long enough historical period to allow for the identification of the dynamics of class formation and the evolution of the class structure.

Due largely to limitations of data and analytic techniques, research to date has not appropriately characterized the dynamics of the process that interweaves life histories, life chances and changing statification systems. Research has been restricted to synoptic representations of class formation--descriptions of the mobility process
associated with class formation have been based almost entirely on the analysis of observed mobility flows in standard mobility tables where the process is characterized by 2 or 3 fixed points in time, such as in the standard

career mobility cross-classification of first by current class. But as Goldthorpe (1980) notes, standard mobility tables necessarily depict the process of class formation only in very broad terms; the details of individual lifetime class trajectories are uncertain.

The implications of this limitation are important: the demographic identity of a class depends upon the duration of tenure and the homogeneity of its members, and how these change over time. Similarly, mobility propensities underlie the actual volume of movement across class boundaries and how this changes over time. But these cannot be accurately assessed with data which provide only a broad summary of mobility. Instead, a more detailed picture of the mobility regime is required. The Cumulative Mobility Table as a Preferred Database for Studying Mobility.

The standard two-occassion mobility table cross-classifies each individual's class position at two more or less widely separated points in time (e.g., parental class by son's first class; first class by last class). As a result, none of the cell counts can be assumed to represent an actual instance of movement between two classes or, in the case of the main diagonal cells, an instance of immobility. Instead, the table abstracts from the mobility career of each person, recording only their first and last class positions--the number of moves and the mobility routes which connect these two are unknown. This raises two problems for the analysis of class formation. First, the counts in the cells of the main diagonal of the first-last table, those indicating immobility, comprise both individuals who are truly immobile, in that they never move out of their first class, and individuals who move out of their first class but who have returned to that class by the time the data are collected. When the concern is with the stabiltiy of class members over time, this attribute of the main diagonal limits its usefulness--the cases on the main-diagonal do not correspond to the stable corps of each class. Nor is there an acceptable way in which to decompose these counts into their two components.

Second, the off-diagonal cells in the first-last table, the cells representing mobility out of one class and into another, do not necessarily indicate that such movement actually took place at some point in time. The two classes involved represent only the end points of a mobility trajectory that results in a person who started in one class, ending up in another. The routes individuals follow in moving between a given pair of classes need not involve crossing the boundary between the two. Thus these counts do not reflect the actual volume of direct movement from one class to another. When the concern is the pattern of mobility propensities, these counts do not provide an accurate assessment of the volume of movement between class positions.

As an alternative to the standard table, we construct a mobility table which gives a full account of all events of immobility and mobility over the period spanned by the first to last class table. The counts in this table, the cumulative mobility table, represent the sum of all the class events, from first to last class, for each person's life history. The count in each diagonal cell represents the number of events of immobility in each origin class. An individual who does not leave his first class (by the time of the survey) is immobile and will be represented by a single class event appearing as part of the count on the main diagonal. The count in each off-diagonal cell represents all the events of mobility between two classes.

Thus, by construction the cumulative table reports the actual volume and pattern of immobility and mobility events in a population and the counts correspond to the central concepts of class formation--the counts on the main diagonal represent the stable core of each class, while the off-diagonal counts represent both the homogeneity of each class and the mobility propensities that exist in the class structure. Compared to the first-last table, the cumulative table provides a more complete and accurate picture of these aspects of the process of class formation.

Absolute and Relative mobility

Typically, the analysis of observed or absolute mobility patterns is the main focus of studies of class formation (e.g., Goldthorpe 1980; Bland, et al. 1978). Whether represented as inflow or outflow proportions, absolute mobility reflects the observable outcome of mobility opportunities for the stability and composition of classes and thus bears directly on the formation of demographic identities. In contrast, relative mobility patterns, or mobility tendencies net of structural change, generally have not been seen as important indicators of class formation precisely because they ignore the structural context. However, as Goldthorpe (1984) argues, relative mobility is a direct operationalization of the notion of mobility propensities, and as such does bear on the question of class formation. Moreover, an analysis of relative mobility need not ignore the structural context because an appropriate technology for modeling both structural effects and mobility propensities is available in Sobel, Hout and Duncan's (1985) structural shift model. Unlike earlier approaches to the study of relative mobility (e.g., Featherman and Hauser 1978; Goldthorpe 1980), the structural shift model does not ignore the structural context in which mobility propensities arise by factoring out marginal shifts in the mobility table. Instead, the model makes it possible to identify structural shifts and mobility propensities as coexiting elements of the table. At the center of this approach is the distinction between structural and exchange (relative) mobility.

Structural mobility is defined as the component of observed mobility that is a direct consequence of changes in the division of labor which occur as a society develops through time. Relative or exchange mobility is the component of observed mobility which reflects the pattern of exchange between classes, net of the changing structural context. Observed mobility is the combination of structural and exchange (relative) mobility.

In seeking to describe mobility, researchers have attempted to decompose observed instances of mobility into actual counts due to structural factors and actual counts due to exchange factors (e.g., Matras 1967; Erikson 1976; Bibby 1975; Krause and Slomczynski 1986a, 1986b). Such attempts are inappropriate because the two types of mobility are not empirically distinct, rather they are variable aspects of the mobility regime taken as a whole (Sobel, et al. 1985). Structural and exchange mobility are ways of conceptualizing the factors that generate mobility opportunities, not the moves which result from these--they are attributes of the the class structure itself.
Thus the distinction is not between types of mobility, but between sources of mobility, and in this sense the nature of exchange mobility does bear on the question of class formation because it is in the patterns of relative mobility that we see mobility propensities as aspects of the relations between classes. Structural change enters the equation in the way it changes the rules of allocation and access, enhancing or inhibiting the mobility propensities linked to each class.

A Class Schema for Industrial Nations

Goldthorpe and colleagues (Goldthorpe 1980, pp. 40-42; Erikson, Goldthorpe and Portocarero 1979; Goldthorpe and Hope 1974) have proposed a class schema for western industrial nations that incorporates the twin dimensions of market forces and work relations that define categories of social structure within capitalist economies. This schema has proven useful in comparing across nations to detect similarities and differences in social (class) mobility. We have adapted it for the analysis of Norway that follows.

Table 1 about here.

The service class enjoys high incomes, stability of employment and long career lines within internal or closed labor markets dominated by firms at the core (less competative, more oligopolistic) segments of the economy. In class 1, the span of control or lines of authority are long and entail high discretion and autonomy without supervision from above. In class 2, the jobs are at middle-management or below, and they involve less autonomy and discretion; many are supervised by others, although perhaps loosely. Class 1 also contains self-employed professionals whose training and control of their own labor supply (via licensure) gives them high command of their niche in the economy.

Routine nonmanual employees are staff within bureaucracies and other internal labor markets. Within the bureaucratic structure of the firm, these positions have formal wage and salary levels below jobs falling into the service class. Sometimes closely supervised themselves, they rarely supervise others, or, if they do, then usually under highly standardized and routinized procedures. This is white-collar labor, but lacking the marketability, authority, and discretion of the service classes.

The petite bourgeoisie is comprised of small, owner-operated shops and firms without employees (class 5) and those somewhat larger ones with employees (class 4). The larger ones probably reflect a slightly more secure hold in the very competative segment of the economy. Otherwise, the petite bourgeoisie is subject to booms and busts in the business cycle, to volatile shifts in consumer expenditures and tastes, and to changing market shares among competing firms.

Farmers and other agriculturalists (class 6) working on their "own account" are like the petite boureoisie except that their products (commodities) are vended in a different market. They, too, enjoy considerable autonomy and self-regulation on the job, subject of course to the vagaries of the weather. Their marketplaces, however, are also regulated by the state to a greater degree than other petite boureoisie.

Technicians and foremen (class 7) are sometimes called a "blue-collar elite", or the "aristocracy of labor" (Goldthorpe 1980 p. 41). In fact, these occupations may involve somewhat greater authority and autonomy than jobs in class 3, with close monitoring from above. But unlike their marginal white-collar counterparts, these marginal blue-collar jobs have fewer long-range career prospects for moving up the managerial ladder or rising through progressive pay grades. This is because their market position is less well intergrated within the administrative bureacracy at a level that permits inter-firm transfer of skills as well as advancement from a blue-collar to an upper white-collar career line within the firm.

Skilled wage labor (class 8) gains its relative place in the market by competing on the basis of relative vocational training and on-the-job training at skilled manual work. Unionization of some trades increases job security within a firm, and seniority within the union provides for easier, shorter job search when moving between employers (in a slack market), as well as for progressive wage levels. This work is heavily supervised.

Unskilled and semi-skilled labor (class 9), like its skilled counterpart, competes in a highly competative market of supply and demand. This class lacks the skill-level and therefore the bargaining position of the skilled manual class; it also tends to be less extensively unionized, except on a very local level.

Agricultural and kindred workers (class 10) tend to hold skills that are highly specific to a small class of industries that are subject to regional, annual, and highly unpredictable swings in demand.

Norway: The Context and the Data

Norway experienced a rapid transformation from a largely agricultural and primary-extractive economy to a modern industrial economy btween 1930 and 1960. Prior to WW II, the annual growth of GNP per capita averaged less than 2.0%, while in the post-war period the growth rate doubled to about an annual average of 4.0% (Visher 1982). To a large extent the change was due to the rise of the secondary and tertiary sectors of the economy. From about 1930 onward, primary industries, mainly agriculture and forestry, did not expand their contribution to GNP. Instead, the increase was due to substantial expansion in the productive and service industries (Lorentzen 1969). By 1969, the secondary and tertiary industries dominated the economy.

The contraction of the primary sector and the expansion of the industrial and service sectors substantially changed the occupational structure of the economy. In 1930, the primary sector, though shrinking, still accounted for more than a third (35.8%) of the labor force while the industrial and service sectors accounted for 26.5% and 37.4% respectively. By 1960, the primary sector had shrunk to just 19.5%, while the industrial and service sectors had grown to 36.5% and 43.6% of the labor force (Visher 1982).

This substantial shift in the composition of the occupational structure has significant implications for our study of class formation. The class careers we examine are restricted to the cohort of men, born in 1921, whose occupational histories span precisely the period of greatest economic and social change -- or, in terms of the analysis of mobility, the period of greatest structural change (1). Shifts of this magnitude can be expected to affect patterns of class formation for this cohort--as some classes expand rapidly, the level of class formation will be reduced, while classes that are contracting can be expected to exhibit higher levels of class formation.

The Norwegian Life History data represent the occupational histories of 3 cohorts of men born in 1921, 1931 and 1941. The job histories for each cohort cover the time from age 14 until 1971 when the data were collected. Each job event was assigned a class category code according to the Goldthorpe schema. For each respondent, sucessive job events with the same class code were collapsed to form a single class event. Sucessive job events with different class codes were treated as different class events. Each class event, therefore, contains one or more job events.

Initally we analysed a composite of all three cohorts in an effort to approximate Norwegian society across a wide historical spectrum. However, collapsing of the cohort histories proved unfeasible, inasmuch as strong age by cohort effects were found. Namely, the cohort by age analysis showed that the differences between equivalent first-last and cumulative tables varied across cohorts. Since these differences could confound comparisons of the tables, we restrict the present analysis to the oldest cohort, the men born in 1921. For these men we obtain an extensive work history spanning the full range of historical time since the close of World War II. Nonetheless, we do not have ideal data that would represent the life histories of multiple cohorts.

For the 1921 cohort we constructed a standard career mobility table, the first class to last class table. First class is defined as the first class position occupied upon entering the labor force full-time for a period of at least ten months, and last class is class position at the time the survey was conducted (1971) when the men in this cohort were 50 years of age (2). We also constructed a cumulative mobility table of class of origination by class of destination in which all the transitions between first class and last class are counted (including instances of immobility). Our basic analytical question is: Are these two tables, the first-last and cumulative, the same? Do the truncated counts of class events in the first-last table contain the same information as the full matrix of class events in the cumulative table?

There are marked apparent differences between the tables. The first-last table (Table 2), for example, shows that 6.9% of those who started their work lives in class 9 had moved to class 1 by the age of 50. This seems a not inconsequential amount of movement from class 9 to class 1. However, the cumulative table (Table 3) shows that of all the class events making up class 9 only 0.4% ended in a direct move into class 1--which suggests that this type of mobility has a very low probability. The level of immobility for class 9 is shown in the diagonal cell (9,9). In the first-last table, 22.8% of those who started in class 9 appear to be immobile, while in the cumulative table only 1.1% of the class events in class 9 truly reflect immobility.

Tables 2 and 3 about here.

Inflow and Outflow Mobility Models

As noted in the introduction, several aspects of class formation are reflected in the patterns of observed mobility inflow and outflow proportions. In comparing the first-last and cumulative tables, then, the first step in our analysis involves a comparison of the extent to which the two types of tables represent these proportions in the same way. We do this by estimating log linear models that constrain the inflow or outflow proportions to be equal for corresponding destination or origin classes in the two tables. For example, given two mobility arrays with equal row by column dimensions, it is possible to test for equal outflow proportions by treating the two tables as a single 3 dimensional array indexed by row, column, and table variables, where the table variable has two values representing the first-last and cumulative tables. The test for equality in row (outflow) proportions across tables, requires a model that fits the row (origin) distribution exactly (i.e., that allows the row margins to differ across tables) but constrains the column (destination) margins, and the row by column interactions, to be equal across tables (Bishop, et al. 1975, Chapter 7).

The additive model of equal outflow proportions is:

$$Fij = Oi + Dj + Tk + ODij + OTik \qquad (1)$$

where Fij is the log of the expected counts, fij. The terms Oi, Dj and Tk are the marginal effects for origin class, destination class and table type respectively, ODij represents the association between origins and destinations, and OTik represents an origin margin by table interaction which fits the row margin exactly. Formally the model tests the hypothesis that the association patterns and the destination distributions for the two tables are equal: the two effects, DTjk and ODTijk, are hypothesized to equal zero. Under these constraints the model will fit the data only when the outflow proportions are the same for matching origin classes. That is, if the model fits the data, then the outflow proportions for matching first-last and cumulative table origin classes are equal and the pattern of observed mobility is the same across tables.

In testing for equal inflow proportions the same procedure is followed except that in this case the column (destination) margins are fit exactly while the row (origin) margins are constrained to be equal. In model (1) above, the term OTik is replaced by the term DTjk. If the model fits the data, then the inflow proportions for matching destination classes are equal across tables.

In both the inflow and outflow analyses, a baseline model of constant association is also fit to the data. This model relaxes the constraint that the destination (or origin) distributions be equal but retains the requirement that the association be equal in the two tables. That is, the baseline model fits exactly both the origin and destination distributions in each table and thus relaxes the equality constraint on either the inflow or outflow proportions while retaining the requirement of constant across-table association. If this model fits the data, the two tables are equivalent in their association patterns but differ in either their inflow or outflow proportions. If neither model fits the data than the tables differ in respect to both observed inflows or outflows and association patterns.

The models are fit to two versions of the data. In the first, the full row by column array for each table is used and in the second the cells on the main diagonal of each table are excluded from the fit. In the first case, the tests address the basic question of whether or not the two tables convey the same information about inflow and outflow proportions when we consider both the counts of mobility and immobility. In the second case, the tests address the question of whether or not the probability of entering or leaving a class is equal across tables when we consider only the counts of mobility. The latter eliminates the very different levels of immobility observed in each table (see Table 4 for a comparison of the counts on the main diagonals in the tables).

Table 4 about here.

In fitting the models the counts of the cumulative table have been re-scaled in order to produce fitted counts estimated under the models that are equal across tables. For inflow models this is done by weighting the counts in a given column of the cumulative table by the ratio of the column marginal totals in the two tables for that column. For outflow models, the counts in a given row are weighted by the ratio of the row marginal totals in each table for that row. The effect of the re-scaling of the cumulative table, however, changes the accuracy of the model fitting tests--in general, the reduced counts make it easier to fit the more restricted models. Thus a model fit to the combined first-last and adjusted cumulative tables will result in a smaller Chi-square value than would be the case if the same model was fit to the unadjusted data. For this reason, models which fit with boarderline significance should be viewed with caution; using the unadjusted data would result in even poorer fits.

As shown in Table 5, both the equal inflow and equal outflow models (1A and 3A) are very poor descriptions of the data when the cells of the main diagonals are included in the fit. Thus when the counts of mobility and immobility are considered in combination in the full data array, the observed patterns of entry to and exit from classes are substantially different across tables. This is also reflected in the fact that the null hypothesis that the relevant marginal distributions are equal across tables is strongly rejected in both cases (the test of OT=0 for the inflow model, line 1C, and DT=0 for the outflow model, line 3C, in Table 5).

Table 5 about here.

The difference between the first-last and cumulative tables is also evident in the fact that the less restrictive constant association models (1B and 3B) also provide a very poor fit to the data. Thus not only are observed inflow and outflow proportions different across tables, but the association of origin and destination classes differs when the counts of mobility and immobility are considered jointly.

When only the off-diagonal cells are considered the difference between the tables is reduced in regard to equivalence in inflow and outflow proportions. Nonetheless, the differences are still significant in that neither the inflow nor the outflow models (2A and 4A in Table 5) fit the data. Even when the comparison is restricted to instances of mobility, the patterns of observed mobility into and out of classes differ across tables. And again, the null hypotheses that the relevant marginal distributions are equal across tables are both strongly rejected (lines 2c and 4c in Table 5).

However, the exclusion of the counts of immobility does produce an equivalence in the tables in the pattern of association--the models of constant association (2B and 4B) fit the data quite well.

Taken together these comparisons of the first-last and cumulative tables suggest that differences in the information carried by the tables are due to (1) significant differences in the levels of immobility each reports, and (2) significant differences in the origin and destination distributions across tables. That is, when the main diagonals are removed from the comparison, and when the marginal distributions are allowed to differ across tables, the pattern of association is the same in both tables. We examine this apparent correspondence in greater detail below. First, however, a more detailed examination of the non-correspondence of the tables in terms of observed mobility porportions is informative of the locations of mis-match. This involves an examination of the residuals from the fit of these models. For illustrative purposes, we examine only the standardized residuals from the model of equal outflow proportions for tables with the main diagonals removed (model 4A in Table 5).

Only the residuals from the fit of model 4A to the first-last table observed counts are show in Table 6. Because the model constrains the outflow proportions to be equal and the cumulative table is adjusted by row margin ratios, the residuals from the counts in the cumulative table mirror those from the first-last table. Thus where the residual for a cell in the first-last table is positive, the residual for the same cell in the cumulative table must be negative and will be of exactly the same magnitude. A positive residual shows that the observed count in the first-last table is larger than the expected count, while a negative residual shows that the observed count is smaller than the expected count.

Table 6 about here.

There are four distinct areas of non-correspondence shown by the residuals. In the first, the six cells in the upper left hand corner of the table, the first-last table shows a higher level of mobility than does the cumulative table (the residuals tend to be positive and large). The second area is represented by the six cells in the lower righthand corner of the table. Here the first-last table shows a distinctly lower level of mobility (the residuals are negative and large). In the third area, the nine cells in the lower left corner, the first-last table shows a notably higher level of mobility, and in the last area, the nine cells in the upper right, the first-last table shows a lower level of mobility. Grouping the classes in these areas such that classes 1 through 3 represent the white-collar service classes and classes 8, 9 and 10 represent the blue-collar working classes, the pattern of the residuals is instructive. The first-last table tends to show a higher degree of stability in the white-collar service classes (upper left) and a lower degree of stability in the blue-collar classes (lower right) than appears in the cumulative table. In broad terms this implies a higher level of class formation in the first instance and a lower level in the second instance than would be found in the cumulative table.

The non-correspndence in the lower left and upper right corners of Table 6 also bears on the issue of class formation; the first-last table shows a higher level of mobility from the blue-collar into the white-collar classes while at the same time showing a lower level of mobility in the reverse direction. Thus the first-last table shows less stability in the blue-collar classes overall and more stability in the white-collar classes than is evident in the cumulative table.

Since these residuals come from a model which hypothesizes equality in the outflow proportions across tables, these patterns of non-correspondence suggest that the first-last table may not be entirely appropriate as a database from which to address issues such as class formation or the pattern of observable barriers to mobility because it tends to over- or under-represent the frequency of various types of moves. This conclusion does not appear to be merely a peculiarity of the data for the outflow model -- the residuals of the inflow model (model 2A in Table 5) also show a distinct pattern of over- and under-estimation of inflows across destination classes in the first-last table.

Class Formation and Mobility Propensities

While they call into question the propriety of using the first-last table in the analysis of observed mobility patterns, the tests in Table 5 do show an important similarity between the two tables; with the comparison limited to the off-diagonal cells, the models of equal association between origins and destinations fit the data quite well. Once differences in the marginal distributions are accounted for, the pattern of association in the two tables is the same. In this regard the two tables reproduce the same information about the relation between origin class and destination class, implying that either table would be an appropriate basis upon which to estimate models which parameterize the association in the table in various ways (e.g., Hauser 1978, 1979; Goodman 1972; Hout 1983). That is, either table is an adequate database with which to investigate questions concerning mobility propensities in the class structure. However, as noted above, the re-scaling of the cumulative table when fitting inflow and outflow models tends to reduce the differences between the tables. As a consequence, the apparent correspondence in the patterns of association may not be as strong when the weighting procedure is not used. More importantly, the origin-destination association model is in fact the saturated model in the single table case and thus is not very informative of the structure of the data. A more instructuve model would place additional constraints on the structure of the association in the data, thus entailing a more restrictive assessment of correspondence. Although several such models exist (e.g., Hout 1983; Hauser 1978, 1979; Hope 1981), the most appropriate for data where the categories of the cross-classification are not assumed to be hierachically ordered is the model of quasi-symmetry. In a single table, quasi-symmetry constrains the interaction parameter associated with mobility from one class to another to be equal to the parameter for mobility in the reverse direction for all pairs of classes; that is, the association parameter for cell (i,j) is equal to the association parameter for cell (j,i) (Bishop, et al. 1975, Chapter 8).

In comparing the first-last and cumulative tables, the baseline model hypothesizes quasi-symmetry in each table but allows the pattern of association to differ between the tables. That is, the model holds that the mobility propensities are symmetric across the main diagonal within each table but are heterogeneous across tables. The model of interest adds to this baseline the constraint that the pattern of symmetric association be identical across tables. If this model fits, the mobility propensities are both symmetric within tables and homogeneous (equal) across tables.

Table 7 about here.

Mobility propensities are symmetric within each table; the model of quasi-symmetry with heterogeneous interactions across tables fits the data fairly well (model 1 in Table 7). However, even with the additional 36 degrees of freedom entailed by the cross-table equality constraint, the model of quasi-symmetry with homogeneous interactions (model 2 in Table 7) fits the data poorly. These results show that while quasi-symmetry is an accurate description of the mobility propensities in each table, the magnitude of the propensities differ across tables. Again the first-last and cumulative tables convey different representations of a central aspect of class formation.

Class Formation and Structural Shift Models

Tests to this point show that major differences between the two tables arise because both their marginal distributions and patterns of association are significantly different. Yet the testing procedures separate the comparison of marginal differences from the comparison of association differences. By first examining inflow and outflow models, and then association models, the comparisons separate the examination of observed mobility, where structural and exchange mobility processes unite, from the examination of mobility propensities, where exchange processes are emphasized and structural effects are ignored. Since both structural and exchange mobility bear on aspects of class formation, a more informative approach would accomplish these analyses simultaneously. By taking advantage of the fact that quasi-symmetry holds in each table and applying the model of structural shifts proposed by Sobel, Hout and Duncan (1985) we can achieve this synthesis.

The structural shift model parameterizes the mobility table in a way that distinguishes between structural and exchange mobility through a simultaneous decomposition of observed mobility into symmetric and asymmetric mobility effects. The models starts with very specific definitions of structural and exchange mobility. Structural mobility is equated with the marginal heterogeneity which exists when origin and destination distributions are not equal. Structural mobility is an asymmetric effect which accounts for all such heterogeneity in the table. In addition, structural mobility to a particular destination is defined as an effect which operates uniformly across all origin classes--that is, it is an effect which changes the odds of occupying a given destination by the same proportional factor for all origin classes (Sobel, et al. 1985 pp. 360-361).

Concommitantly, structural constancy (Luijkx 1985) is a symmetric marginal effect which accounts for the level of homogeneity in the margins--it is the average origin and destination distribution. Combined, the asymmetric structural mobility and the symmetric structural constancy effects completely account for the origin and destination distributions.

Exchange mobility is equated, not with the association between origins and destinations as in often the case (e.g., Goldthorpe 1980), but only with equal flows between pairs of cells (i,j) and (j,i) in the mobility table. Thus exchange mobility is linked to symmetry in the flows between classes (by definition, symmetry in exchange mobility subsumes the structural constancy effect because the model of symmetry presupposes marginal homogeneity).

If structural and exchange mobility (and structural constancy) - are sufficient to account for all observed mobility in a table, then the model of quasi-symmetry must hold. When quasi-symmetry does not hold, then a third component of observed mobility must exist -- an asymmetric association effect which Sobel et al., (1985, p. 360) call unreciprocated mobility. In other words, net of marginal effects, the association between origins and destinations is decomposed into two types of mobility effects--a symmetric component representing exchange mobility, and an asymmetric component representing unreciprocated mobility. When quasi-symmetry holds, all the association can be accounted for by the symmetric exchange mobility effects and no unreciprocated mobility exists.

The model estimates cell frequencies as a function of these symmetric and asymmetric terms. In an I by J table (where I=J), the expected counts in the saturated multiplicative model are given by:

$$F_{ij} = T_{ij} L_{ij} \qquad (2)$$

Where the T_{ij} represent the symmetric effects (structural constance and exchange mobility) and the L_{ij} represent the asymmetric effects (structural and unreciprocated mobility). The T_{ij} are decomposed into the symmetric marginal effects, betas, and symmetric association parameters, deltas, and the

Lij are decomposed into asymmetric marginal effects, alphas, and asymmetric association effects, gammas, as follows:

$$Fij = Aj\ Bi\ Bj\ Gij\ Dij \qquad (3)$$

where TTj Aj=1, Bi = Bj if i=j, Dij = Dji if i=j, Dij = 1 if i=j, Gij = 1 if i=j and Gij = Gji if i=j.

The Aj are the structural mobility parameters, subject to the normalization that the product of the Aj equals 1. Each Aj thus represents a proportional effect that increases or decreases the odds of being in destination j (relative to other destinations) for all origin classes. The Bi and Bj are structural constancy effects. Because these parameters are symmetric (Bi=Bj if i=j), they account for all the marginal homogeneity in the table. The Dij are the symmetric association parameters representing exchange mobility, such that Dij=Dji if i=j. Where i=j (the cells of the main-diagonal) these parameters have a value of 1 (the cells of the main-diagonal do not affect the fit of the model of quasi-symmetry, e.g., Bishop, et al. 1975, Chapter 8). The Gij are the asymmetric association parameters, representing unreciprocated mobility, such that Gij=Gji if i j, and Gij=1 if i=j.

In the saturated model there are I(I+1)/2 symmetric parameters and I*I asymmetric parameters. But only I*I parameters in total are identified. However, if the model of quasi-symmetry fits a particular mobility table, then all of the asymmetric association parameters, Gij, must equal 1--there can be no asymmetry in the interactions, and the remaining parameters are identified. Under quasi-symmetry, the asymmetry in the table must be due to heterogeneity between the origin and destination distributions, and this is captured by the remaining asymmetric parameters, the Aj. Thus, estimating the symmetric and asymmetric paramters in a single model jointly describes structural mobility and mobility propensities. A number of models, constructed in a stepwise fashion in Table 8, test the parameter sets of the structural shift model (e.g., Luijkx 1985). In these models a fourth set of parameters, Ti, where T=1 for the first-last table and T=2 for the cumulative table, are added to the Sobel, Hout and Duncan model. Interacting the various parameter sets of the structural shift model with the variable T tests for equality across tables in the parameters of the model.

Table 8 about here.

Model 1 in Table 9 is the baseline model. It says that there is independence of origins and destinations once the symmetric marginal effects (Bi and Bj) are accounted for. Since earlier tests show that origins and destinations are not independent, it is not suprising that Model 1 does not fit the data.

Model 2 adds the asymmetric marginal Aj effects to model 1. If observed mobility were identical in the two tables and due solely to marginal effects, then this model would fit the data. This is not the case, since the model fits poorly. The next step is to determine whether or not observed mobility is accounted for by marginal effects that may differ across tables. Models 3 and 4 in succession allow the symmetric marginal effects (Bi and Bj) and the asymmetric marginal effects (Aj) to vary across tables by interacting each parameter with the table variable. These models also fit poorly, so there must be significant interaction effects in the tables.

Model 5 adds the symmetric interaction effects, Dij, to the model. If the differences between the tables are due solely to heterogeneity across tables in the marginal effects (the Bi, Bj and Aj) then Model 5 should fit the data--it allows the marginal effects to differ across tables but holds the interaction effects constant. Thus model 5 says that the differences between the tables are due only to different levels of structural constancy (betas) and structural mobility (alphas), with exchange mobility (deltas) held constant across tables. The lack of fit for this model is not large (L = 176.6 with 116 degrees of freedom) but it still fails at the conventional levels of significance. Thus the differences between the tables cannot be attributed solely to marginal differences.

Next the equality constraint on the symmetric association parameters is relaxed by interacting the Dij with the table variable (model 6). This model fits the data well--L is approximately the same magnitude as its degrees of freedom. In addition, the test of the null hypothesis that each parameter set, sucessively added to the baseline model, is zero can be rejected in each case (lines 9 through 13 in Table 8). Thus the addition of each parameter set, and the interaction of these across tables, significantly improves the fit of the model at each step.

Model 6 implies that the first-last and cumulative tables differ with respect to structural constancy, structural mobility, and exchange mobility effects. In short, none of the components of observed mobility appear to be equivalent across tables. However, the stepwise testing procedure does not test the equivalence of marginal effects net of the interaction effects. That is, it remains to be seen whether or not the marginal effects might in fact be equal across tables when the interaction effects are already in the model and are allowed to vary across tables.

Models 7 and 8 in Table 8 re-introduce in turn the cross-table equality constraint on the symmetric and asymmetric marginal parameters. Model 7 introduces the constraint for the symmetric beta parameters by eliminating the beta-by-table interaction term from model 6. Model 8 introduces the constraint for the asymmetric alpha parameters by eliminating the alpha-by-table interaction term from model 6. Neither model fits the data very well, and in both cases the re-introduction of the equality constraint results in a large and statistically significant deterioration of the fit as the comparisons of models 7 and 8 with model 6 show (lines 14 and 15).

Thus the conclusion reached earlier concerning model 6 stands; the two tables convey significantly different information about all three components of observed mobility. As these relate to aspects of class formation, the tables present different pictures of structural and exchange mobility.

Testing the Structural Shift Parameters

Given the parameterization of the structural shift model, a test of the significance of the structural shift parameters, the A_j, can be made by comparing the model to the model of true symmetry. Since the A_j are the only asymmetric parameters in the model of structural shifts, when they are removed the result is the model of true symmetry:

$$F_{ij} = B_i \, B_j \, D_{ij} \qquad (4)$$

with the constraints that $B_i=B_j$ if $i=j$, $D_{ij}=D_{ji}$ if $i=j$ and $D_{ij}=1$ if $i=j$. A comparison of the two models is the conditional test for marginal homogeneity and is a global test of the hypothesis that the set of Aj are actually zero (Sobel, et al. 1985, p. 365). The results of this test for the first-last table and the cumulative table are shown in Table 9.

Table 9 about here.

Panels A and B of Table 9 show that the Aj, the structural shift parameters, are needed in order to fit the data--the model of symmetry does not fit (models 1 and 4) but the structural shift model does fit the data well (models 2 and 5) and lines 3 and 6 show that the Aj in each case are not zero. For each of the tables there is a significant level of heterogeneity between origin and destination distributions--there is a significant amount of structural mobility.

The final question regarding the two tables is how, substantively, they differ in the story they tell about mobility. By examining the parameters of the strucural shift models 2 and 5 in Table 9 we can better understand where the similarities and differences lie. Tables 10 and 11 show the Aj, Bi (or Bj) and Dij parameters of the two models.

Panel A of Tables 10 and 11 show the structural shift parameters associated with each destination class. Since the product of the Aj is 1 (TT Aj=1), they measure the proportional adjustment to the destination distribution due to marginal heteogeneity, or structural mobility. The Bi (Bj) in panel B indicate the strength of structural constancy, or the average origin-destination marginal effect for each class (Luijkx 1985). The Dij in the upper triangle of panel C show the strength of the propensity to exchange members for pairs of classes.

Tables 10 and 11 about here.

In the lower triangle of panel C are the ratios of Aj to Ai. These indicate the nature of structural mobility between classes j and i: Ratios less than 1 indicate an excess of structural mobility from class j to class i (downward) as compared to mobility from class i to class j (upward). Conversely, ratios larger than 1 indicate an excess of structural mobility from class i to class j as compared to the reverse direction.

The structural shift parameters, the Aj, differ markedly in absolute magnitude but are similar in their relative magnitude when comparing the first-last and cumulative tables. Since the Aj measure the proportional adjustment to the origin category resulting from structural change, a parameter value greater than 1 indicates structural expansion of a class while a value less than 1 shows contraction of a class. In both tables, class 1, the upper service (or white-collar) class shows the largest structural expansion and class 10, the agricultural working class, shows the largest contraction. In addition, classes 2 and 4 show structural expansion, while classes 3 and 7 show relative structural stability. And on the whole, the upper levels of the class structure tend to show either expansion or stability while the lower levels show contraction. Given the substantial shift in the sectoral distribution of the labor force which accompanied Norway's rapid economic tranformation, this net upward shift in the composition of the class structure is not suprising.

The ratios of the Aj for pairs of classes, the lower triangle in panel

C of Tables 10 and 11, show both similarities and differences between the first-last and cumulative tables. In both tables almost all the ratios are greater than unity, indicating that structural mobility is most often upward mobility. However, the first-last table shows more and stronger downward effects: structural mobility from classes 2 and 3, the lower levels of the white-collar service classes, into class 4, the petite bourgiosie, greatly exceeds structural movement in the reverse direction. This is also true for movement from class 3 into class 5, class 6 into classes 7 and 9, and class 8 into class 9. By comparison, the cumulative table shows only four ratios less than unity, and even then the ratios are just less than 1 showing the downward effect to be weak. Where the ratios show an excess of upward structural movement, the first-last table shows far stronger effects throughout the class structure, and a somewhat different relative pattern to the effects. The strongest upward structural effects occur in class 8, the skilled working class, while in the cumulative table they occur in class 9, the semi- and unskilled working class. Moreover, class 6, the farmers in the first-last table, also show a stronger effect than class 9. Overall, the ratios in the first-last table indicate an much larger excess of either upward or downward movement than do comparable ratios in the cumulative table.

Taking the Aj and the Aj/Ai ratios together, the comparison of the two tables illustrates an important difference in their representation of structural mobility. The first-last table shows larger structural effects because it brackets the career mobility trajectory of each individual. The structural shifts it reflects represent a comparison of the class structure at two widely separated points in time. With structural movements tending to one direction (as the Aj/Ai ratios show), the strength of structural shift effects will increase as the time between the two points (first and last class) increases. By comparison, structural shifts in the cumulative table are measured at all points between first and last class, and thus are represented by small excesses of upward over downward shifts. An apt analogy is that of a staircase representing structural shifts: The cumulative table shows structural shifts as a series of small steps upward on the staircase (because upward moves predominate). The first-last table, in contrast, shows structural shifts as a single large step from the bottom to the top of the staircase -- in one sense the small excess of upward moves cumulate into a single large step in the first-last table.

The pattern of symmetric association effects also shows important differences between the tables. The Dij are the geometric means of two odds: Fij/Fii, or the odds of moving from class i to class j, relative to staying in class i, and Fji/Fjj, the odds of moving from class j to class i, relative to staying in class j. The ratio of these odds is the association parameter:

$$Dij = (Fij\ Fji\ /\ Fii\ Fjj)$$

Thus the Dij will be greater than 1 when Fij*Fji is greater than Fii*Fjj, or when the odds on moving between classes i and j (in either direction) are greater than the odds on staying in either class i or j. When Dij is less than 1, the odds on staying in either class are larger than the odds of moving between them. And when Dij equals 1 the odds of moving equal the odds of staying.

The Dij in the first-last and cumulative tables are quite different. The paramters for movement among the three white-collar classes (1, 2 and 3) are less than 1 in the first-last table, indicating that the odds of moving between these classes is less than the odds of staying in any one of them. In comparison, the parameters in the cumulative table are all larger than 1, showing that the odds of moving are considerably larger than the odds of staying. In regard to a process like class formation, this difference leads to very different conclusions about these three classes: The first-last table suggests that these classes tend toward stability once structural shifts are eliminated--the propensity to exchange members is fairly low. In contrast, the cumulative table indicates that the three show fairly distinct propensities to exchange members among themselves. The nature of exchange mobility between these three and the other classes is also different in the two tables. The first-last table shows that the odds of immobility outweigh the odds of mobility in all cases. (The parameters for class 4 are suspect because this class has a sampling zero on the main diagonal. The level of stability or immobility is thus underestimated by some unknown amount.) The cumulative table does not show this consistant pattern--for class 1, the propensity to exchange members with classes 5 through 10 is, in each case, lower than the likelihood immobility in these classes, but the same is not true for classes 2 and 3 in relation to the other classes. Comparing the association parameters for mobility among classes 5 through 10 also shows distinct differences. Again the first-last table tends to under-estimate mobility propensities when compared to the cumulative table. If mobility propensities indicate the likelihood for the boundaries between classes to become significant axes of social differentiation, the first-last table shows greater potential for differentiation, and thus for class formation, among these classes than does the cumulative table. In fact, the cumulative table shows only a weak potential for differentiation.

The structural shift models show that the two tables differ substantially in the information they carry about association between origins and destinations. This is due to the difference between the tables in the nature of the diagonal counts--the cells representing immobility or stability. In the first-last table the diagonal counts representing immobility in a pair of classes tend to dominate the off-diagonal counts which represent exchange between the pair. As a result the odds of staying in either class tend to be larger than the odds of moving between them. In the cumulative table the reverse tends to be true--the diagonal counts tend to be smaller than the off-diagonal counts. Thus the mobility propensities estimated for the two tables lead to different conclusions concerning the connections between classes. The first-last table tends to show low propensities for mobility between virtually all the classes, while the cumulative table shows a more varied pattern in the propensity for classes to exchange members.

Conclusions

Our analysis shows that the first-last and cumulative career mobility tables do not convey the same information about observed and relative mobility. A key difference between the tables seems to arise from counting people versus counting class events. The difference is more apparent than real, for the first-last table can be construed as a one event per person table; it provides a summary of a stream of class events by portraying a set of averaged class events. We emphasize that this average, abstracted summary--this single class event--does not necessarily correspond to any actual class to class transition;

neither does it represent with fidelity the observed pattern of class immobility. In the case of the Norwegian cohort, the discrepancies between the abstracted, averaged class event and the cumulation of class events are qualitatively significant. Conclusions about class formation derived from the full set of class events are not fully equivalent to those derived from the summary table most often used by mobility and class analysts.

In one respect, the differences we find between the first-last and the cumulative tables can be attributed to the fact that the tables allow unevenness in the counts of class events to arise in different ways. Unevenness in the counts in a table--its lumpiness--is what gives rise to observed mobility and immobility patterns, and the association between origins and destinations. The first-last table, because it contains only a summary or averaged representation of each individual's class trajectory over the life course, smooths the career mobility pattern.

In comparison, the cumulative table does not smooth the career pattern. To the extent that moves over the life course are tied to typical mobility routes through intervening classes (the more heavily traveled routes between classes widely separated in social space), the cumulative table will show a different pattern of unevenness. Moreover, the factors that generate unevenness may change over the life course of individuals; mobility routes between classes may open and close over time (i.e., shifting mobility oportunities). These changes may not affect the counts in the first-last table but will show up in the counts in the cumulative table. In addition, the cumulative table allows for another specific kind of movement that generates unevenness--repeated moves back and forth between two classes by a single individual. These moves, which are not unusual in our data, can substantially increase the unevenness of the cumulative table.

The study of class formation via the consolidation of demographic identities calls for new dynamic approaches that match concepts and methods more closely than in conventional analyses. Using life-course histories for multiple cohorts and modeling the pattern of mobility (and immobility) propensities as revealed in the full array of class events is one innovation we recommend. Class events, not people, are the more enlightening material for class and mobility analysis when the goal is to elucidate aspects of social structure. We believe this material, derived from individual life histories but aggregated as the cumulative history of successive cohorts, provides new information about structural relationships and transformations in the stratification system.

By itself, these cumulations of class events that are embodied in cohort histories are but one lens by which we see class formation in process. Another method, that examines directly the durations of incumbency in classes and the social homogeneity of class comnposition, provides yet another view. That analysis, based on event history models of events within and between class categories, is the topic of research in progress.

Footnotes

1. The Norwegian data are composed of a sample of three cohorts of men, born in 1921, 1931 and 1941, who were ages 50, 40 and 30 at the time of the survey. While we would have wished to use all three cohorts in our analysis in order to better approximate a representative cross-section of the male population, a preliminary analysis convinced us that we could not combine the cohorts for the type of analysis we intended.

2. The "first class" event record was identified by determining the first class event, in each respondent's sequence of class events, that lasted at least 10 months and was followed by a period unemployment (or out of the labor force) of no more than 9 months (including zero time) before the next class event began.

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Table 1: Class Categories.

1. All high-level professionals, self-employed or salaried; high-level administrators and officials in government and private enterprise; managers in large industrial establishments; and large-scale business proprietors.

2. Low-level professionals and high-level technicians; low-level administrators and officials; managers in small industrial and sevice businesses; and supervisors of nonmanual employees.

3. Routine nonmanual (largely clerical) employees in administration and commerce; sales personel; and other rank-and-file employees in services.

4. Small proprietors with employees, excluding farmers.

5. Small proprietors without employees, excluding farmers.

6. Farmers, with and without employees.

7. Low-level technicians; and supervisors of manual employees.

8. Skilled manual wage workers.

9. Semi-skilled and unskilled manual workers, except agriculture.

10. Manual wage employees in agriculture.

Table 2: First class by last class (class at age 50), Cohort 1:
Counts and outflow percentages (% by row).

First Class	Last Class 1	2	3	4	5	6	7	8	9	10	Total
1	26	1	1	0	0	0	0	0	0	0	28
	96.9	3.6	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2
2	19	17	4	0	0	0	0	1	0	0	41
	46.3	41.5	9.8	0.0	0.0	0.0	0.0	2.4	0.0	0.0	3.2
3	23	27	24	8	6	0	4	2	4	1	99
	23.2	27.3	24.2	8.1	6.1	0.0	4.0	2.0	4.0	1.0	7.8
4	0	1	0	0	0	0	0	0	0	0	1
	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
5	0	0	0	1	2	0	0	3	1	0	7
	0.0	0.0	0.0	14.3	28.6	0.0	0.0	42.9	14.3	0.0	0.5
6	0	1	1	0	1	15	2	2	3	2	27
	0.0	3.7	3.7	0.0	3.7	55.6	7.4	7.4	11.1	7.4	2.1
7	6	8	3	3	2	2	17	10	0	0	51
	11.8	15.7	5.9	5.9	3.9	3.9	33.3	19.6	0.0	0.0	4.0
8	11	16	15	16	8	10	27	70	22	2	197
	5.6	8.1	7.6	8.1	4.1	5.1	13.7	35.5	11.2	1.0	15.4
9	20	21	41	18	10	8	45	60	66	1	290
	6.9	7.2	14.1	6.2	3.4	2.8	15.5	20.7	22.8	0.3	22.7
10	20	33	27	18	21	116	42	141	87	30	535
	3.7	6.2	5.0	3.4	3.9	21.7	7.9	26.4	16.3	5.6	41.9
Total	125	125	116	64	50	151	137	289	183	36	1276
	9.8	9.8	9.1	5.0	3.9	11.8	10.7	22.6	14.3	2.8	100.0

Table 3: Cumulative table of origin by destination class for all transitions between first class and class at age 50, Cohort 1, Counts and outflow percentages (% by row).

Origin Class	Destination Class 1	2	3	4	5	6	7	8	9	10	Total
1	22	34	25	0	1	3	6	10	5	4	110
	20.2	30.9	22.7	0.0	0.9	2.7	5.5	9.1	4.5	3.6	1.8
2	60	10	39	13	15	4	15	33	13	39	241
	24.9	4.1	16.2	5.4	6.2	1.7	6.2	13.7	5.4	16.2	3.9
3	60	68	10	23	10	8	13	81	91	38	402
	14.9	16.9	2.5	5.7	2.5	2.0	3.2	20.1	22.6	9.5	6.5
4	2	14	12	0	6	6	9	35	37	9	130
	1.5	10.8	9.2	0.0	4.6	4.6	6.9	26.9	28.5	6.9	2.1
5	3	14	7	8	1	42	10	79	54	28	246
	1.2	5.7	2.8	3.3	0.4	17.1	4.1	32.1	22.0	11.4	3.9
6	2	3	8	11	45	8	19	78	98	161	433
	0.5	0.7	1.8	2.5	10.4	1.8	4.4	18.0	22.6	37.2	7.0
7	18	27	22	20	9	21	7	136	69	20	349
	5.2	7.7	6.3	5.7	2.6	6.0	2.0	39.0	19.8	5.7	5.6
8	23	64	97	54	93	74	176	30	427	374	1412
	1.6	4.5	6.9	3.8	6.6	5.2	12.5	2.1	30.2	26.5	22.7
9	6	42	131	47	58	96	137	499	15	344	1375
	0.4	3.1	9.5	3.4	4.2	7.0	10.0	36.3	1.1	25.0	22.1
10	13	54	69	17	53	294	44	518	459	11	1532
	0.8	3.5	4.5	1.1	3.5	19.2	2.9	33.8	30.0	0.7	24.6
Total	209	330	420	193	291	556	436	1499	1268	1028	6230
	3.4	5.3	6.7	3.1	4.7	8.9	7.0	24.1	20.4	16.5	100.0

Table 4: Immobility in the First-Last and Cumulative mobility tables for First class to class at age 50, Cohort 1.

	First-Last table		Cumulative table		
Class	Count	% of origin class	Count	% of origin class	Ratio of FL to C
1	26	92.9	22	20.0	1.18
2	17	41.5	10	4.1	1.70
3	24	24.2	10	2.5	2.40
4	0	0.0	0	0.0	0.00
5	2	28.5	1	0.4	2.00
6	15	55.6	8	1.8	1.88
7	17	33.3	7	2.0	2.43
8	70	35.5	30	2.1	2.33
9	66	22.8	15	1.1	4.40
10	30	5.6	11	0.7	2.73

Table 5: Models of Inflow and Outflow Equality in the Combined First-Last and Adjusted Cumulative Tables, With and Without Main-Diagonals. 1921 Cohort.

	Model	L	df	p
Inflow Models:				
1. With Main Diagonal	A) OD, DT	616.2	90	< 0.001
	B) OD, DT, OT	444.8	81	< 0.001
	C) A-B: OT=0	171.4	9	< 0.001
2. Without Main Diagonal	A) OD, DT	305.8	80	< 0.001
	B) OD, DT, OT	64.3	71	> 0.50
	C) A-B: OT=0	241.5	9	< 0.001
Outflow Models:				
3. With Main Diagonal	A) OD, OT	683.9	90	< 0.001
	B) OD, OT, DT	462.8	81	< 0.001
	C) A-B: DT=0	221.1	9	< 0.001
4. Without Main Diagonal	A) OD, OT	245.2	80	< 0.001
	B) OD, OT, DT	44.4	71	> 0.990
	C) A-B: DT=0	200.8	9	< 0.001

Note: O=Origin
D=Destination
T=Table

Table 6: Standardized residuals from the model of equal outflow proportions for the First-Last table in model 4A in Table 5.

Origin Class	Destination Class 1	2	3	4	5	6	7	8	9	10
1		+	+	-	-	-	-	-	-	-
2	1.8		-	-	-	-	-	-	-	-1.4
3	1.4	1.6		+	1.0	-	+	-2.3	-2.1	-1.5
4	-	+	-		-	-	-	-	-	-
5	-	-	-	+		-	-	+	-	-
6	-	+	+	-	-		+	-	+	-
7	1.1	1.1	+	+	+	-		-	-1.9	-1.0
8	1.7	1.5	+	1.7	-	+	1.2		-1.6	-3.8
9	+	+	+	+	+	-	+	-		-2.1
10	2.3	1.5	+	1.8	+	+	2.6	-1.2	-3.0	

Note: Residuals with absolute values less than 1.0 are represented by a positive or negative sign only. A positive residual indicates that the observed count in the First-Last table is larger than the expected count under the model. Negative residuals indicate observed counts that are smaller than the expected count. Blank cells were excluded from the fit.

Table 7: Quasi-Symmetry in the Combined First-Last and Cumulative Mobility Tables of First Class to Class at Age 50.

Model		L	df	p
1. Quasi-symmetry with heterogeneous off-diagonal interaction across tables:	ODT, OT, DT	84.9	72	=0.100
2. Quasi-symmetry with homogeneous off-diagonal interaction across tables:	OD, OT, DT	154.6	108	<0.001
3. Model A versus Model B:	ODT=0	69.7	36	<0.001

Note: O= origin class
D= destination class
T= table (first-last or cumulative)

Table 8: Structural Shift Models for Combined First-Last and Cumulative Tables.

Model	L	df	p
1. T, B	5200.0	189	<0.001
2. T, B, A	4584.0	180	<0.001
3. T, B, A, TB	4431.0	171	<0.001
4. T, B, A, TB, TA	3924.0	162	<0.001
5. T, B, A, TB, TA, D	176.6	116	<0.001
6. T, B, A, TB, TA, TD	84.8	72	=0.100
7. T, B, A, TA, TD	281.6	81	<0.001
8. T, B, A, TB, TD	664.3	81	<0.001
9. 1 VS 2 A=0	616.0	9	<0.001
10. 2 VS 3 TB=0	153.0	9	<0.001
11. 3 VS 4 TA=0	507.0	9	<0.001
12. 4 VS 5 D=0	3747.4	45	<0.001
13. 5 VS 6 TD=0	91.8	45	<0.001
14. 7 VS 6 TB=0	196.8	9	<0.001
15. 8 VS 6 TA=0	579.5	9	<0.001

T: TABLE
B: BETA
A: ALPHA
D: DELTA

Table 9: Symmetry and Structural Shift Models for First-last and Cumulative Tables.

Table	Model		L	df	p
A. First-Last:					
	1. Symmetry:	B, D	1054.0	45	<.001
	2. Structural Shift:	B, D A	38.8	36	>.100
	3. 1 vs 2	A=0	1015.1	9	<.001
B. Cumulative:					
	4. Symmetry:	B, D	252.8	45	<.001
	5. Structural Shift:	B, D, A	45.9	36	>.100
	6. 4 vs 5	B=0	206.9	9	>.001

B: beta
D: Delta
A: Alpha

Table 10: Parameters of Structural Shift model for the First-Last Table (Model 2 in Table 9).

	Destination									
	1	2	3	4	5	6	7	8	9	10
A. Alpha J	88.6	7.9	.9	23.3	2.2	.5	.9	.2	.9	.0003
B. Beta J	.5	1.5	5.1	.002	1.0	5.7	4.3	16.8	27.2	97.7

C. Aj/Ai below the diagonal. Dij above the diagonal.

Origin Class	Destination Class									
1.	-	.26	.10	.01	.01	.01	.03	.01	.01	.01
2.	11.2	-	.47	13.4	.01	.01	.14	.09	.07	.03
3.	96.2	8.6	-	39.7	.39	.25	.17	.17	.32	.06
4.	3.8	.3	.04	-	25.4	.01	17.8	24.9	17.4	4.9
5.	40.0	3.6	.40	10.5	-	.07	.16	.28	.18	.10
6.	192.4	17.2	2.0	50.6	4.8	-	.12	.18	.13	.46
7.	95.2	8.5	1.0	25.0	2.4	.49	-	.44	.38	.11
8.	354.0	31.6	3.7	93.1	8.8	1.8	3.7	-	.53	.35
9.	99.4	8.9	1.0	26.2	2.5	.52	1.1	.28	-	.36
10.	-	-	-	-	-	-	-	-	-	-

Note: The value of Aj/Ai for class 10 are not shown in the table because the very small value of alpha for class 10 results in extremely large ratios. Effectively this means that there was virtually no structural mobility into class 10.

Table 11: Parameters of the Structural Shift model for the Cumulative Table (Model 5 in Table 9).

	Destination									
	1	2	3	4	5	6	7	8	9	10
A. Alpha J	2.2	1.3	1.0	1.3	1.0	.9	1.0	.8	.7	.6
B. Beta I	3.2	2.7	3.2	.02	1.0	3.0	2.6	6.1	4.6	4.5

C. Aj/Ai below the diagonal. Dij above the diagonal.

Origin Class	Destination Class									
1.	-	3.1	2.6	9.6	.39	.17	.90	.57	.26	.43
2.	1.6	-	5.3	199.8	4.5	.38	2.4	2.7	2.1	4.0
3.	2.3	1.4	-	256.8	2.6	.89	2.1	5.1	8.9	4.9
4.	1.7	1.1	.8	-	324.0	138.7	255.6	371.5	488.5	169.2
5.	2.3	1.4	1.0	1.3	-	15.4	3.5	15.6	14.3	11.8
6.	2.5	1.5	1.1	1.4	1.1	-	2.7	4.9	8.8	23.6
7.	2.1	1.3	.9	1.2	.9	.9	-	10.1	9.9	3.5
8.	2.7	1.7	1.2	1.5	1.2	1.1	1.3	-	21.8	24.1
9.	3.0	1.9	1.3	1.7	1.3	1.2	1.4	1.1	-	31.0
10.	3.9	2.5	1.8	2.3	1.7	1.6	1.9	1.5	1.3	-

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