Paper prepared for session on "Business Demography: Functions, Quality, and Future" at the 1985 Meetings of the Population Association of America, Boston, MA, March 29, 1985. This research has benefited from a Population Center's Grant from the Center for Population Research of the National Institute of Child Health and Human Development (HD05875) to the Center for Demography and Ecology.
In this paper I discuss the use of demography in personnel/human resource management. The paper has three sections. First, I consider the purview of business demography and why I believe that demographic applications to human resource management fall within the area. Next, I present a model of human resource management, show how demography relates to it, and then present two applications. Finally, I address the question of why would academic researchers want to get involved in this type of work.

My impression of the area of business demography is based on the business demography session at last year's PAA meeting and on Russell's population bulletin article titled "The Business of Demographics." In both instances, business demography was portrayed as entailing the use of demographic data on population composition and size to estimate consumer demand.

A related area is population estimation (Rives and Serow, 1984). The task of population estimation is to calculate the size of a population using indirect measures when direct measures are not available. Work in this area often involves the development of sophisticated techniques which are used to do the estimation.

In both cases the application of demographic data to the estimation of consumer demand is emphasized. The data may be on the composition of the population or the size of the population, measured directly or indirectly. I believe that business demography can encompass a broader array of demographic applications.

I propose that business demography be defined simply as the use of demography, all that it entails, in organizational decisionmaking. Given this definition, business demography would include more than simply the use of demographic data for business purposes. Use of demographic concepts and demographic methods in organizational decisionmaking would also fall under
the purview of business demography. This definition also implies that business demography covers the use of demography by all types of organizations not only profit-oriented ones.

Whether the particular use of demography involves profit-oriented, public, or not-for-profit organizations and whether the use of demography involves concepts, methods, or data, the key element of business demography is that it brings the notion of a population into organizational decisionmaking. As demography is the study of populations, so too is business demography the study of populations. However, business demography is concerned with only those populations which are relevant to organizational decisions. Examples of these populations are the population which consists of the consumers of the organization's products, the population of organizations which compete in the organization's industry, and the population which consists of the employees of the organization.

Business demographers and population estimators have examined the consumer population. The concept of populations of organizations is currently subject to a good amount of attention in the academic sphere. Examples are Hamon and Freeman's article "The Population Ecology of Organizations" and Carroll's article in the Annual Review of Sociology. This work should find an application in the area of corporate strategic planning and should interact well with applications of industrial organization theory.

Employee or organizational populations have also received attention from the academic sphere. There seems to be two distinct approaches. The formal demography/operations research approach is exemplified by the work of Keyfitz (1973), Bartholomew (1973), and White (1970) as well as by the work of Stewan and Konda (1983). The social demography/social stratification approach is exemplified by the work of Halaby (1972), Baron
and Fielby (1980), Spilerman (1977), Stolzenberg (1978), Pfeffer (1977), and Rosenbaum (1988). Some of these authors concentrate on organization population processes only while others look at the impact of organization population processes on social stratification and labor market processes.

The formal demography approach has probably been applied to organizational decisionmaking more than has the social demography approach. However, the application of the formal approach is constrained by the mathematical knowledge required to understand it.

The popularity of consumer demography as an applied area is likely due to its straightforwardness. Researchers and decisionmakers within organizations probably can understand this type of information without too much trouble. The principle of strong ergodicity from stable population theory is not so easily understood. In applied work there are limits to conceptual complexity due to the knowledge base of the practitioners.

Before turning to a description of two applications of demography to human resource management, I will briefly discuss the nature of human resource management in organizations.

Human resource management is defined, according to Heneman et al. (1983) in a widely used text, as a set of activities or functions that are designed to influence the effectiveness of an organization's employees. In more demographic terms, human resource management is a set of functions or activities that are designed to influence the effectiveness of an organization's employee population. What are these activities and functions and how do they influence the employee population?
The key mechanism is the match between individuals who have certain abilities and motivations and jobs which have certain requirements and rewards. This match is made via evaluative activities, these include analyzing individuals and jobs, assessing outcomes, and personnel planning; and via functional activities, these include external staffing, internal staffing and development, compensation, labor relations, and shaping the work environment. The results of the matching process are the human resource outcomes, these include attraction of new employees to the organization, employee performance, retention of employees, attendance, and job satisfaction.

The employee population is the link between the human resource activities and human resource outcomes. The activities can be viewed as interventions into the employee population process and the results of these interventions are the human resource outcomes. Thus, the outcomes of human resource management activities are attributes of a population process. To illustrate this point, I have taken the human resource management outcomes from Heneman et al. (1983) and have defined them with this population process conception in mind.

The first outcome is attraction of employees. Attraction is the quantity and quality of the flow into the employee population compared to organizational goals for this flow. Attraction is measured by the number of newly hired employees compared to numerical goals and by the compositional characteristics of the newly hired employees compared to compositional goals.

The second outcome is performance which is the amount of organizationally desired work behavior produced by the employee population. In other words, are the employees productive in quantity and quality of work?
The third human resource management outcome is retention. Retention is the quantity and quality of the flow out of the employee population compared to organizational goals for this flow. Retention, like attraction, is measured by the number of terminating employees compared to numerical goals and by the compositional characteristics of the terminated employees compared to compositional goals. The relevant question is was turnover too large and did the organization lose too many good performers.

The fourth outcome is attendance. Attendance is the exposure of the employee population to the workplace. The question here is what proportion of employees are present at work and for what proportion of the workday.

The last outcome is job satisfaction which can be defined as the level of need fulfillment of the employee population.

Demographers who study human populations in general are concerned with flows, births and deaths, and composition, sex and age. Likewise, demographers who study organizational populations are concerned with flows, hires and terminations, and composition, performance and job satisfaction.

I will now consider two applications of demography to human resource management. Freeman and Rossi (1984) differentiate applied social science into three types:

1) mapping and social indicator research which is essentially descriptive in character and purpose; it is designed mainly to provide estimates of the extent to which some phenomenon exists, how the phenomenon is distributed in physical and social space and/or plots trends in that phenomenon over time. The consumer population approach to business demography is an example of this type.
2) The second type of applied work is modeling social phenomenon which involves developing reasonable general models of some social process. The applications to human resource management which I will discuss next are of this type.

3) A third type is the evaluation of purposive action.

The first application of demography to human resource management is the use of Markov methods to project the size and characteristics of the employee population. While Markov methods are not strictly demographic, I consider this use demographic in that it is a population modeling technique. The second application involves disaggregating termination rates and the use of standardization.

In the first application, Markov methods are used to do a sensitivity analysis. The sensitivity analysis in this case involves examining the effects of various hiring, promotion, and termination regimes on the size and structure of the employee population. The motivation for this application is from two articles which appeared in Land and Spilerman's Volume SOCIAL INDICATOR MODELS. The articles are Stone's "Transition and Admission Models in Social Indicator Analysis" and Matras' "Models and Indicators of Organizational Growth, Changes, and Transformations."

The application involves taking a data matrix which describes the size and structure of the employee population, adding a matrix which represents an estimate of one year's hires, and then multiplying by a third matrix which represents one year's promotion and termination probabilities. The result of this procedure would be an estimate of the size and structure of the employee population one year hence, assuming the stated conditions. A five year projection would involve repeating the procedure five times. If the procedure is repeated enough times then the growth rate and structure of
the projected population will stabilize.

The sensitivity analysis aspect of this procedure involves the determination of what goes into the hiring, promotion, and termination matrices. Two approaches stand out. First, matrices describing hiring, promotion, and termination practices during the preceding year or an average of the preceding five years could be used. This projection would indicate what the future employee population would look like if recent hiring, promotion, and termination practices were to continue into the future. In particular, the growth rate and structure implied in the practices could be determined. This procedure is similar to one which demographers carry out when using age-specific mortality and fertility schedules to determine stable population structure and growth.

The second approach would involve determining an employee population size and structure desired at some time point in the future. Then, hiring, promotion, and termination matrices would be manipulated so that the employee population with the desired characteristics could be achieved. Necessary tradeoffs between hires, promotions, and terminations could be determined.

The second example of an application of demography to human resource management involves the decomposition of termination rates. A termination rate is the number of individuals leaving employment with an organization in a year (whether voluntary or involuntary) divided by the mid-year population of the organization.

Consider a termination rate for employees holding managerial or professional jobs in an organization. This rate may go up or down from year to year. The question of interest is whether or not the change in the rate is due to a real increase or to a real decrease in the propensity of
employees to terminate.

If subgroups within the group of employees who hold managerial or professional jobs in the organization have termination rates of different magnitudes, then the overall rate for the group may fluctuate due to changes in the representation of subgroups in the total group rather than to changes in the termination rate for any subgroup. Examples of sources of variation for subgroups within the total group are job level and job tenure.

The first step in analyzing the termination rates for the subgroups is to look at two time series. One series is the trend in the proportion each group comprises in the total group. The second series is the trend in the termination rate for each subgroup. Examination of these series will show what is behind the trend in the termination rate for the total group.

In order to get a single number which summarizes the subgroup termination and distribution effects, the demographic technique of standardization can be used. This technique can applied in two ways. One approach involves taking a weighted average of the subgroup termination rates in each year where one set of weights, the standard, is used in calculating the weighted average for each year. Using this technique, the effects of changing distributions can be eliminated and the effects of changing subgroup termination rates can be isolated. A second approach involves taking a weighted average of a standard set of termination rates for each year where the weights are the actual proportions which each subgroup comprised in the total group in each year. Using this approach, the effects of changing subgroup termination rates can be eliminated and the effects of a changing distribution across subgroups can be isolated. Thus, one approach uses a standard subgroup distribution and yearly termination rates while the other
approach uses a standard set of termination rates and yearly subgroup distributions.

These examples, the Markov method and standardization, are not offered as being new or original applications. They are offered to show how basic demographic techniques, those straightforward enough so that one does not need to be a mathematical demographer to understand them, can be used to analyze employee population processes.

I would like to conclude by addressing the following question: why would academic demographers be interested in this type of applied work?

Applied demographic work as I have defined it involves assisting organizations in achieving their objectives by providing relevant information about the internal or external environment of the organization. This type of work is quite limited in scope when compared to the pursuit of more general knowledge which academic demography involves.

However, as I mentioned earlier, academics have paid attention to organizational populations and this interest seems to have increased in recent years. I believe the primary reason that research in this area has not been more abundant is limited access to data. One reason may be a general distrust for academics, especially non-business school ones, by the corporate hierarchy. Another reason may be a fear on the part of the corporate hierarchy that analysis of organizational data may create a legal liability for the corporation. Academic researchers might reasonably seek to explain organizational population processes using variables such as sex, race, and age. Each of these variables represents a group protected from discrimination by law. If, for example, a corporation learns from academic research that in the past there were differences in promotion probabilities due to a pure sex effect, then, by law, the corporation must remedy the
problem or be negligent. Ignorance is not as great a liability as knowledge without action.

Still, discrimination or alleged discrimination on the part of corporations has indirectly allowed academic research on organizational populations. This has occurred because academic researchers have been able to gain access to corporate data as a result of consulting relationships. The researcher would assist a corporation in a discrimination case and as part of compensation would get access to the corporate data on the employee population as long as the corporation's identity was not disclosed.

The large scale government legal activity against corporations due to employment discrimination has decreased in recent years due to two causes. One is that under the current administration the amount of enforcement activity has decreased. The second cause is that non-discrimination in regard to race, sex, age, and handicap has been institutionalized in corporations, more so in large ones than small ones, through changes in personnel practices. Non-discrimination is a principle of professional human resource management these days. This is not to say that discrimination has been eliminated but there has been a dramatic reduction during the 70's and 80's. Compare 1965 to 1985.

On the one hand, given the decreased amount of government enforcement activity corporations may be more open to academic research on their employee populations. On the other hand, the decreased amount of enforcement activity leads to fewer discrimination cases for which corporations would need academic consultants.
Given this corporate atmosphere, I see applied work as a means by which a researcher can gain access to a corporation in order to do more academically oriented work. However, the applied work in this instance would not be concerned with employment discrimination but with general employment processes. I believe that a research proposal which includes applied analysis which could be useful to the corporation in addition to strictly academic oriented analysis would have a better chance of acceptance than a strictly academic oriented research proposal. While applied work can certainly be undertaken as an end in itself, it can also provide access to a research site where academic research can be conducted.
REFERENCES

Baron, J.N. and W.T. Bielby 1980  
"Bringing the Firms Back In: Stratification, Segmentation, and the Organization of Work"  
AMERICAN SOCIOLOGICAL REVIEW 43:737-65

Bartholomew, D.J. 1973  
STOCHASTIC MODELS FOR SOCIAL PROCESSES  
New York: Wiley

Carroll, G.R. 1984  
"Organizational Ecology"  
ANNUAL REVIEW OF SOCIOLOGY 10:71-93

Freeman, H.E. and P.H. Rossi 1984  
"Furthering the Applied Side of Sociology"  
AMERICAN SOCIOLOGICAL REVIEW 49:571-80

Halaby, C.N. 1978  
"Bureaucratic Promotion Criteria"  
ADMINISTRATIVE SCIENCE QUARTERLY 23:466-84

Hannon, M.T. and J. Freeman 1977  
"The Population Ecology of Organizations"  
AMERICAN JOURNAL OF SOCIOLOGY 82:929-48

PERSONNEL/HUMAN RESOURCE MANAGEMENT  
Homewood, IL: Irwin

Keyfitz, N. 1973  
"Individual Mobility in a Stationary Population"  
POPULATION STUDIES 27:335-52

Matza, J. 1975  
"Models and Indicators of Organizational Growth, Changes, and Transformations"  
K.C. Land and S. Spilerman (eds.)  
SOCIAL INDICATOR MODELS  
New York: Russell Sage Foundation

Pfeffer, J. 1977  
"Toward an Examination of Stratification in Organizations"  
ADMINISTRATIVE SCIENCE QUARTERLY 22: 553-67

Rives, N.W., Jr. and W.J. Serow 1984  
INTRODUCTION TO APPLIED DEMOGRAPHY: DATA SOURCES AND ESTIMATION TECHNIQUES  
Beverly Hills, CA: Sage
Rosenbaum, J.E. 1984
CAREER MOBILITY IN A CORPORATE HIERARCHY
Orlando, FL: Academic Press

Russell, C. 1984
"The Business of Demographics"
POPULATION BULLETIN 39(3)

Spilerman, S. 1977
"Careers, Labor Market Structure, and Socioeconomic Achievement"
AMERICAN JOURNAL OF SOCIOLOGY 83: 551-93

Steman, S. and S.L. Konda 1983
"Careers and Organizational Labor Markets: Demographic Models of Organizational Behavior"
AMERICAN JOURNAL OF SOCIOLOGY 88:637-85

Stolzenberg, R.M. 1978
"Bringing the Boss Back In: Employer Size, Employee Schooling, and Socioeconomic Achievement"
AMERICAN SOCIOLOGICAL REVIEW 43: 813-28

Stone, R. 1975
"Transition and Admission Models in Social Indicator Analysis"
K.C. Land and S. Spilerman (eds.)
SOCIAL INDICATOR MODELS
New York: Russell Sage Foundation

White, H. 1970
CHAIN OF OPPORTUNITY: SYSTEM MODELS OF MOBILITY IN ORGANIZATIONS
Cambridge, MA: Harvard University Press