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ABSTRACT

An economic framework that melds the theories of human capital and internal labor markets in a probabilistic matrix has been developed to analyze teacher mobility. This framework is general and could be applied to other labor markets possessing similar institutional structures, such as those in the Civil Service sector. Several important implications of the framework were confirmed when tested by regression analysis and Markovian analysis with data for the San Diego school system. Four of these implications are: (1) Internal mobility of teachers is based on nonpecuniary differences between assignments (e.g., teachers in San Diego tend to move from schools where student socioeconomic status (SES) is relatively low to schools where SES is relatively high); (2) newly hired teachers tend to be placed in the lower SES schools; (3) teachers with the most experience are least likely to move between assignments; and, (4) higher SES schools have faculties with relatively greater experience and educational attainment than do lower SES schools, largely as a consequence of the three mobility patterns noted above. (Author)

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ANALYSIS OF THE EDUCATIONAL PERSONNEL SYSTEM: I. TEACHER MOBILITY IN SAN DIEGO

PREPARED FOR THE DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

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PREFACE

Under Contract OEC-0-71-2533(099) with the U.S. Office of Education, The Rand Corporation has been conducting an analysis of the educational personnel system in the United States. This report focuses on the flows of teachers into, within, and out of the personnel system of a single large school district--the San Diego school system. The methodology and many of the results, however, should be directly applicable to personnel systems in large cities throughout the United States, and this report should be useful to persons concerned with the operation of such systems. The report should also be of interest to economists concerned with human capital and the operation of internal labor markets.

David H. Greenberg is a member of the Rand research staff. John J. McCall is a Rand consultant.

SUMMARY

The mobility of teachers to, from, and within school districts can be fully understood only through an examination of social, psychological, economic, and purely random components. Any theory attempting a complete explanation of teacher mobility would be as complicated as the phenomena themselves. On the other hand, an extremely simple theory would probably yield an inadequate explanation of teacher mobility. In this report, we hope to achieve a successful balance between simplicity of structure and power of explanation. For this reason we have concentrated on the economic aspects of the mobility decision. The economic framework is designed to analyze teacher mobility in general and to elicit specific hypotheses to be tested within the San Diego school system. Our data cover the movement of teachers in San Diego between the 1970-71 and 1971-72 school years.

The framework for analysis is a melding of the theory of human capital and the theory of internal labor markets within a probabilistic matrix. That is, we assume that economic factors combine with the institutional setting to affect decisionmaking in a probabilistic fashion. In particular, a change in an economic variable influences the probability of individual movement. The economic framework is quite general and should be applicable to other labor markets possessing similar institutional structures, such as those found throughout the civil service sector.

Several important implications of the economic framework received confirmation when they were tested against the San Diego school system data. First, since teaching assignments within the San Diego school system do not differ in terms of salary, the internal mobility of teachers should be partially based on nonpecuniary differences. One such nonpecuniary difference may be associated with the socioeconomic status (SES) of the students at each school and their families. Since most teachers presumably have a middle class orientation, it seems

likely that they will prefer high SES schools to lower SES schools.[1] In fact, we observed a significant tendency for teachers to move from relatively low SES schools to relatively high SES schools.

Second, newly hired teachers have the least knowledge of the school system--an investment in specific human capital--and as outsiders have the least control over the allocation of opportunity within the internal labor market. Thus, they should tend to be placed in the lower SES schools. This tendency was noted in the San Diego school system.

Third, teachers with the most experience should be least likely to move between assignments, since they will be most likely to have found an assignment with which they are satisfied. They are also likely to have a relatively large investment in specific human capital in their present assignment. This hypothesis was consistent with our findings.

Fourth, largely as a consequence of the three mobility patterns just noted, higher SES schools should have faculties with relatively greater experience and educational attainment than lower SES schools. This hypothesis was also verified by the San Diego data.

Finally, teachers with a relatively high number of college semester hours should be less likely to terminate, particularly to leave teaching, than those with a low number. This is because teachers with many semester hours above the bachelor's degree have made a considerable investment in specific human capital, an investment for which the highest return is obtained by remaining in teaching. This specific human capital should impede movement to the nonteaching sector. Similarly, young teachers, with relatively little experience and hence a relatively small investment in specific human capital, should be more likely to terminate.[2] Since females generally have greater opportunities to engage in useful activities outside the labor force than males, female teachers should be more likely to terminate. These implications were generally confirmed

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[1] As proxies for school SES ranking we use student ability as measured by standardized tests, the percentage of minority students, and the percentage of students from families on AFDC.

[2] Teachers who terminate to retire would, of course, be relatively older and more experienced.

by the San Diego data. However, the relation between termination and college semester hours was rather weak. Furthermore, we found that only relatively younger and older female teachers were more likely to terminate than their male counterparts, and then only at the elementary and junior high levels; middle-aged female teachers apparently are no more likely to terminate than middle-aged male teachers.

We also expected relatively higher termination rates at the lower SES schools. However, the San Diego data showed little difference in termination rates among schools. Presumably, teachers at lower SES schools preferred to wait for an internal transfer to a higher SES school rather than terminate and search for work in the tight labor market of 1970-1971.

ACKNOWLEDGMENTS

The authors are indebted to the San Diego City Schools Personnel Division for making available the data necessary to conduct this study. They are particularly grateful to Betty Spaeth of the Personnel Division, both for her efforts in securing the data and for the many invaluable insights she provided. The authors also wish to acknowledge the comments and suggestions of Rand colleagues Arthur J. Alexander, Stephen J. Carroll, Richard V. L. Cooper, Emmett B. Keeler, John Pincus, and Kenneth L. Ryder, and the able research assistance of Frank Berger.

CONTENTS

I. INTRODUCTION

This report presents some preliminary results from an examination of teacher flows in the San Diego school system. The focus is primarily on the mobility of teachers among schools within the San Diego system, the movement of teachers into and out of the system, and the impact of these teacher flows on the allocation of teachers among different types of schools. For two reasons, the results described here should be regarded as preliminary. First, they represent a first cut at available San Diego data. Those data are sufficiently rich to warrant further exploration. Second, we are in the process of developing data for other geographic areas. These additional data will be used to test the applicability of our theoretical framework to other personnel systems and to determine the extent to which the results obtained here are peculiar to the San Diego system.

In Section II, we derive a theoretical framework for analyzing teacher mobility from the extensive work of economists on internal labor markets and human capital. The framework is then used to generate hypotheses that can be tested within the context of the San Diego school system. In Section III, we describe some of the more pertinent aspects of the San Diego school system itself. Particular emphasis is placed on mobility channels open to San Diego teachers and the rules governing their mobility. The data and statistical tools we use to test the hypotheses are briefly discussed in Section IV. (A more detailed discussion of the data file appears in Appendix A.) The determinants of mobility are examined in Section V, with particular emphasis on why some teachers are more likely to terminate than others. The factors influencing transfers from one school to another are also investigated. Section VI contains an examination of some implications of mobility patterns on the allocation of teachers among different types of schools. The major conclusions of this study and brief comments on plans for further study are presented in Section VII.

II. AN ECONOMIC FRAMEWORK FOR ANALYZING TEACHER MOBILITY

The mobility of teachers among schools, among school districts, and between the school sector and other sectors of the economy can be fully understood only by unraveling a complicated web of social, psychological, economic, and purely random components. Any theory so extravagant as to attempt a complete explanation of teacher mobility would possess a structure as complicated as the phenomena to be understood. On the other hand, an extremely simple theory with a parsimonious structure would probably yield an inadequate explanation of teacher mobility. In the framework presented here we hope to achieve a successful balance between simplicity of structure and power of explanation. It is for this reason that we concentrate on the economic aspects of the mobility decision. The economic framework is designed to analyze teacher mobility in general and to elicit specific hypotheses to be tested within the San Diego school system. The framework for analysis is a melding of the theory of human capital and the theory of internal labor markets within a probabilistic matrix. That is, we assume that economic factors combine with the institutional setting to affect decisionmaking in a probabilistic fashion. In particular, a change in an economic variable influences the probability of individual movement. The economic framework is quite general and should be applicable to other labor markets possessing similar institutional structures, such as those found throughout the civil service sector.

INTERNAL LABOR MARKETS

The classical economists viewed labor markets as highly competitive arenas in which workers searched for high wage jobs and employers searched for highly productive workers.[1] Markets are highly fluid and structureless with wages primarily determined by the principle of "equalizing differences," described by Adam Smith in 1776:

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[1] A scholarly treatment of wage determination is contained in M. Bronfenbrenner, *Income Distribution Theory*, Aldine-Atherton, Inc., Chicago, 1971.

> The whole of the advantages and disadvantages of the different employments of labour and stock must, in the same neighborhood, be either perfectly equal or continually tending to equality. If in the same neighborhood, there was any employment evidently either more or less advantageous than the rest, so many people would crowd into it in the one case, and so many would desert it in the other, that its advantages would soon return to the level of other employment....
>
> Pecuniary wages and profit, indeed, are everywhere in Europe extremely different according to the different employments of labour and stock. But this difference arises partly from certain circumstances in the employments themselves, which, either really, or at least in the imaginations of men, make up for a small pecuniary gain in some, and counterbalance a great one in others....
>
> The five following are the principal circumstances which, so far as I have been able to observe, make up for a small pecuniary gain in some employments, and counter-balance a great one in others: first, the agreeableness or disagreeableness of the employments themselves; secondly, the easiness and cheapness, or the difficulty and expense, of learning them; thirdly, the constancy or inconstancy of employment in them; fourthly, the small or great trust which must be reposed in those who exercise them; and fifth, the probability or improbability of success in them.[1]

An alternative explanation of wage determination, based on the principle of "non-competing groups," was offered by John Stuart Mill, among others:

> So complete, indeed, has...been the separation, so strongly marked the line of demarcation, between the different grades of labourers, as to be almost equivalent to an hereditary distinction of caste; each employment being chiefly recruited from the children of those already employed in it, or in employments of the same rank with it in social estimation.... The liberal professions are mostly supplied by the sons of either the professional, or the idle classes: the more highly skilled manual employments are filled up from the sons of skilled artizans, or the class of tradesmen who rank with them; the lower classes of skilled employments are in a similar case; and unskilled labourers, with occasional exceptions, remain from father to son in their pristine condition.[2]

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[1] Adam Smith, *Wealth of Nations*, Modern Library, 1937, p. 99, as quoted in Bronfenbrenner.

[2] John Stuart Mill, *Principles of Political Economy*, p. 393, as quoted in Bronfenbrenner.

Workers and employers, therefore, are in this interpretation unable to engage in uninhibited search within a fluid and structureless labor market but instead are constrained by geographic, social, occupational, and institutional factors.

Clark Kerr was the first of modern day writers to introduce the concept of an internal labor market, a refinement of the principle of "non-competing groups."

> Labor markets are of two broad types: (1) the structureless and (2) the structured. In the structureless market, there is no attachment except the wage between the worker and the employer. No worker has any claim on any job and no employer has any hold on any man. Structure enters the market when different treatment is accorded to the "ins" and the "outs." In the structured market there always exists (1) the internal market and (2) the external market. The internal market may be the plant or the craft group, and preferment within it may be based on prejudice or merit or equality of opportunity or seniority or some combination of these. The external market consists of clusters of workers actively or passively available for new jobs lying within some meaningful geographical and occupational boundaries, and of the port or ports of entry which are open or are potentially open to them.... The more structured the market, the more precise will be the rules on allocation of opportunity within the internal market and the fewer will be the ports of entry and the more rigid will be the requirements for admission. Institutional rules do not usually introduce structure into a market--it often arises from the individual preferences of workers and employers--but they uniformly add to it.[1]

The internal labor market concept has been used to analyze the mobility of workers across industries, across firms in a particular industry, and across jobs in a specific firm.[2] Kerr identified three different types of internal labor markets: "open," "manorial," or "guild."[3] The open market is unstructured and competitive; all job openings are filled directly from the external labor market. Manorial

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[1]Clark Kerr, "The Balkanization of Labor Markets," in E. Wight Bakke *et al.*, *Labor Mobility and Economic Opportunity*, Wiley, New York, 1954, pp. 101-102.

[2]See P. B. Doeringer and M. J. Piore, *Internal Labor Markets and Manpower Analyses*, D. C. Heath, Boston, 1971; and A. Alexander, *Income, Experience, and the Structure of Internal Labor Markets*, P-4757, The Rand Corporation, January 1972.

[3]Kerr, p. 105.

markets emphasize vertical stratification. Ports of entry into this market are confined to the lower job classifications and movement within the market takes place along a job ladder. Guild markets are stratified horizontally. Admission into the guild system tends to be closely controlled through training and other requirements, and workers tend to be highly skilled. It would seem that in a formal sense internal labor markets within educational personnel systems are most closely approximated by the guild market; although some teachers do move up a promotional ladder, most movement within the internal labor market is lateral, from one teaching assignment to another.[1]

In developing this schema, Kerr was primarily interested in non-professional workers. He predicted that workers within a guild would move relatively freely from firm to firm so long as they had the proper credentials. The analogous situation within the teaching profession as a whole is movement among school districts. The analogous situation within a single school personnel system is movement among teaching assignments or schools. Movement within the second, more narrow internal labor market may be initiated at either the school district's request or the teacher's request. Examples of movements initiated by the district are transfers to alleviate performance problems, to provide leadership training, and to fill open slots, such as teaching positions at newly established schools. Internal movements initiated by teachers are similar to voluntary movements in the external labor market: the teacher presumably compares available alternatives and selects the most attractive from among these.

Although in practice the distinction is not always clear cut, exits from an internal market may also be voluntary or involuntary. Involuntary mobility includes dismissals and mandatory retirements. Voluntary mobility is on the basis of a comparison of available alternatives. Examples are a college student who selects teaching from among several

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[1]As will be seen later, however, if nonpecuniary as well as pecuniary differences between assignments are considered, these markets contain an important manorial element; although changes in salary are only infrequently associated with changes in assignments, the changes in nonpecuniary returns that frequently accompany assignment changes are often indicative of a hierarchy of teaching assignments.

potential occupations, a new college graduate who selects a particular school system from among several possibilities, and a teacher who terminates to take a job elsewhere or to engage in some other activity (travel or child rearing, for example).

THEORY OF HUMAN CAPITAL

The explanation of teacher mobility among schools within a school district, among districts, and between the school sector and the rest of the economy should be enhanced by human capital considerations.[1] One of the major contributions of human capital theory is the recognition that each individual has embodied within him a valuable economic resource, called "human capital," that yields returns over his entire lifetime. Investments in human capital include formal education, vocational training, on-the-job training, health care, migration, and information accumulation. The distinction between general and specific human capital is a key factor in understanding labor mobility in general and teacher mobility in particular. General human capital encompasses all those investments that bring the same return in all occupations. Specific human capital comprises those investments in human capital having a higher return in one occupation, or even in one specific teaching assignment, than in any other. In the limiting case, specific human capital has a positive return in only one occupation or assignment and is useless elsewhere. Learning the best travel route from home to job is an example of human capital that is specific to a particular company or school.

The concept of specific human capital is relative. Knowledge of the idiosyncracies of a certain school principal is a form of human capital specific to that school. It is, however, general human capital with respect to alternative assignments within that school. Information about the organizational peculiarities of a particular school district is specific human capital with respect to that district, but general human capital in a comparison of two assignments within that

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[1] For a complete description of the theory of human capital, see G. Becker, *Human Capital*, National Bureau of Economic Research, New York, 1964.

district. A master's degree in education is specific human capital relative to the education sector. However, it is general human capital when two jobs within the education sector are being evaluated.

Large investments in specific human capital impede movement from the set of jobs for which the investments are specific. Similarly, movement into this set of jobs is also inhibited by specific human capital requirements. As will be seen, it is precisely these human capital barriers to mobility that partition the labor markets into relatively autonomous sub-markets--that is, internal labor markets. These human capital considerations are immediately applicable to teacher mobility. An experienced teacher with graduate degrees in education is less likely to leave the education sector for a job elsewhere than an individual with a smaller investment in teaching. Likewise, a teacher who has acquired extensive knowledge about one school district is less likely to move to another district. And movements within a school district are more likely to be made by teachers with only modest investments in human capital specific to a single school in the district.

HUMAN CAPITAL AND INTERNAL LABOR MARKETS

The analysis of teacher mobility is facilitated by observing the correspondence between internal labor markets and the barriers to mobility induced by specific human capital. Thus, the internal labor market notion is also a relative concept. Three distinct internal labor markets are discernible within the educational sector. Any of these three internal markets can be represented by the diagram in Figure 1.

The most general concept of an internal labor market embraces the entire primary and secondary teaching sector. At this level of generality the external labor market consists of all nonteaching occupations. Considerable diversity characterizes the operation of this internal labor market. Nevertheless, the hierarchical structure is sufficiently homogeneous and the human capital barriers to entry and exit sufficiently strong to justify this interpretation. Indeed, although this internal labor market is the most heterogeneous, the barriers to entry and exit are probably strongest. Furthermore, large districts frequently facilitate inter-district movement by granting credit in determining salaries

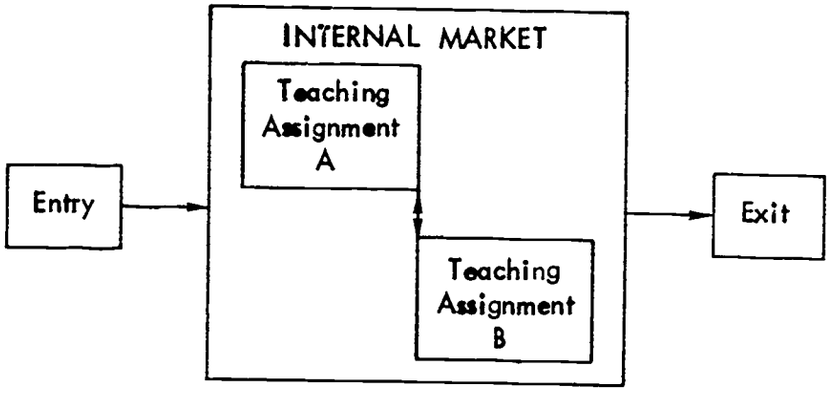

Fig. 1 — Teacher flows into, out of, and within an education internal labor market

to teaching experience gained elsewhere. Entrants to this market are recent college graduates and former teachers returning from other occupations, housekeeping being the most prominent. Departures are made by retiring teachers and those who change to nonteaching occupations.

At the next level of generality is the internal labor market associated with a particular school district. All other school districts are now included in the external labor market. Although these school districts do have analogous hierarchical structures, the flow of teachers across districts is obstructed by those investments in human capital that are specific to a single district. We contend that the segmentation of school districts into separate markets is explicable by investments in specific human capital. This segmentation is frequently reinforced by the secondary effects of specific human capital. For example, the vesting provisions of district retirement plans impede movement across districts.[1] State credential requirements have a similar effect.

[1] "Although quits and layoffs are influenced by considerations other than investment costs, some of these, such as pension plans, are more strongly related to investments than may appear at first blush. A pension plan with incomplete vesting privileges penalizes employees who quit before retirement and thus provides an incentive--often an extremely powerful one--not to quit. At the same time pension plans "insure" firms against quits for they are given a lump sum--the non-vested portion of payments--whenever a worker quits. Insurance is needed for

An internal labor market also exists at the individual school level. Every occupation outside this school constitutes the external labor market. Once again investments in human capital specific to the school create barriers to movement between the internal and external markets. From the general internal labor market of the teaching sector to that of the individual school, there is a progressive tendency for the barriers to mobility to weaken.

SPECIAL FEATURES OF A SCHOOL DISTRICT'S INTERNAL LABOR MARKET

In this report we analyze a single school district's internal labor market,[1] namely the market corresponding to the San Diego school system. The institutional features characterizing this particular market are discussed in Section III. Here, we elaborate on the more general characteristics of a school district's internal labor market.

From an economic perspective the most significant feature of a school district's internal labor market is the enormous difficulty of measuring output. In a standard economic market operating under a budget constraint, the assignment of individuals to jobs would be orchestrated to maximize output. Furthermore, an individual's wages would be entirely determined by his contribution to output. Within this standard setting it is relatively easy to interpret the movement of workers among jobs within the market and the flow of workers into and out of the market. The operation of a school district's internal labor market is complicated by the absence of a clear-cut objective function--an immediate consequence of the absence of generally acceptable measures of output. In this situation attention shifts from outputs to measurable inputs, with the hope that the latter are positively related to the

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specifically trained employees because their turnover would impose capital losses on firms. Firms can discourage such quits by sharing training costs and the return with employees, but they would have less need to discourage them and would be more willing to pay for training costs if insurance were provided. The effects on the incentive to invest in one's employees may have been a major stimulus to the development of pension plans with incomplete vesting." Becker, pp. 26-27.

[1] We will not further examine the internal labor market at the individual school level or the general internal labor market for the entire teaching sector in this report. Future plans to analyze inter-district mobility are briefly discussed in the concluding section.

former.[1] A teacher is paid according to his teaching experience and educational attainment. In the formal administration of the school system, teachers with identical experience and education tend to be regarded as perfect substitutes, *and* assignments with the same input requirements are considered identical. Thus "identical" assignments at different schools offer the same salaries. In the practical operation of the school system, however, numerous nonpecuniary differences among assignments make some assignments relatively more attractive to teachers than others. Moreover, even with the same education and experience, principals undoubtedly prefer some teachers to others. Some of the measurable nonpecuniary considerations that distinguish different schools include high student intellectual potential as evidenced by standardized tests; high socioeconomic status of student families; and modern, attractive school facilities.[2] Since pecuniary salaries are constant across schools within a district, these nonpecuniary differences should account for much of the voluntary teacher mobility within a school district. In most school districts the assignment preferences cannot be satisfied for all teachers. Usually the rationing of the preferred assignments is by education and experience, the more experienced and educated teachers being awarded the best assignments. Furthermore, turnover in unappealing assignments will be relatively high; teachers at schools that they rate low on the basis of nonpecuniary factors will tend to move away, while those at highly ranked schools will remain and accumulate experience and education.

The outcome of mobility patterns of this kind is that the more experienced and highly educated teachers will be located at the high socioeconomic status schools, and young and relatively inexperienced

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[1]This measurement problem is not peculiar to the teaching establishment. It is also present in the defense organization, the civil service, and, indeed, in many large private corporations.

[2]Some teachers may, of course, consider some of these factors more important than other teachers. Moreover, some teachers may prefer to teach certain types of students that others would not. There are undoubtedly teachers, for example, who prefer students who do poorly on standardized reading and math tests to students who need less help. For reasons that are discussed later, however, we assume that *on the average* nonpecuniary returns to teachers are higher the better students perform on tests and the higher their socioeconomic status.

teachers will staff the low socioeconomic status schools. The effects of this on educational effectiveness are unclear. Does it make any difference, for example, if the most experienced, most educated teachers teach middle class children, and teachers with the least experience and formal education tend to teach lower class students? The subject of educational effectiveness is very complex, and research results have been extremely ambiguous and inconsistent;[1] attempts to provide definite answers to questions such as the one posed above are well beyond the scope of the present study.

IMPLICATIONS FOR THE SAN DIEGO SCHOOL SYSTEM

The *raison d'être* of any theoretical framework is to enhance understanding of the behavior of real world phenomena. The success of a theory must be judged by the accuracy of its predictions regarding these phenomena. The framework we have just outlined has several definite implications for the behavior of teacher mobility. We will test the validity of the theoretical framework by confronting these implications with the teacher mobility actually experienced in the San Diego school system. These statistical tests are presented in Sections V and VI. We shall now enumerate the major implications or hypotheses that are immediate consequences of the human capital and internal labor market theory of mobility within the institutional setting of the San Diego school system.

(1) Since teaching assignments within the San Diego school system do not differ in terms of salary, the internal movement of teachers will be partially based on nonpecuniary differences. One such nonpecuniary difference may be associated with the socioeconomic status of the students at each school and their families. Since most teachers presumably have a middle class orientation, it seems likely that they will prefer

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[1] See, for example, Harvey Averch, Stephen J. Carroll, Theodore S. Donaldson, Herbert J. Kiesling, and John Pincus, *How Effective is Schooling: A Critical Review and Synthesis of Research Findings*, R-956-PCSF/RC, The Rand Corporation, March 1972.

high SES schools to low SES schools.[1] Furthermore, at least for white teachers, assignment to low SES schools, most of which tend to be located in the inner city, may reqire longer commuting than assignment to high SES schools. Teachers should tend to move from relatively low SES schools to relatively high SES schools. Teachers may also tend to move toward schools with superior physical plants.

(2) Everything else being equal, teachers assigned to low SES schools should also be more likely to terminate than those at high SES schools, where the nonpecuniary returns are greater.[2] Note that hypotheses (1) and (2) are interrelated. The number of terminations resulting from job dissatisfaction should be inversely related to the potential for obtaining more satisfactory assignments through internal movement.

(3) Newly hired teachers have the least knowledge of the school system--an investment in specific human capital--and as outsiders have the least control over the allocation of opportunity within the internal labor market. Thus, they should tend to be placed in the low SES schools.

(4) Relatively experienced teachers should be less likely to change assignments because they are more likely to be located in an satisfactory assignment. Moreover, their investment in human capital specific to their particular assignment is likely to be relatively larger than that of teachers with less experience.

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[1]See John D. Owen, "The Distribution of Educational Resources in Large American Cities," *Journal of Human Resources*, Vol. VII, No. 1 Winter 1972, pp. 26-38.

[2]Unfortunately, focusing on a single school system necessarily limits our analysis of entry into and flow from the internal labor market. For example, although we possess considerable knowledge of a terminating teacher's situation before leaving the San Diego system, our knowledge of the teacher's new situation is limited. If a teacher takes a new job, for example, it would be very useful to be able to compare his old and new wage rates. (Such information is available in data files we plan to use in the future. These files are briefly described in Section VII.) Nevertheless, although we have only limited information about possible forces "pulling" teachers from the San Diego system, we can test to see if there are forces that tend to "push" teachers from the system. Similarly, we have little knowledge of why a new teacher chooses San Diego over other available opportunities.

(5) A consequence of hypotheses (1) through (4) is that high SES schools should tend to have faculties with relatively greater experience (and probably greater educational attainment) than low SES schools. Since student achievement, as measured by standardized tests, may be associated with nonpecuniary differences among schools, rather than teaching experience positively affecting student test scores, the causality may run in the opposite direction; teachers mav tend to transfer to schools attended by superior test takers, where they remain accumulating experience and college semester hours.

(6) Teachers with many semester hours above the bachelor's degree have made a considerable investment in specific human capital, for which the highest return is obtained by remaining in teaching. This specific human capital should impede movement to the nonteaching sector. Thus, teachers with a relatively high number of college semester hours should be less likely to terminate, particularly to leave teaching, than those with a low number. Similarly, young teachers with relatively little experience and, hence, a relatively small investment in specific human capital should be more likely to terminate.[1] Since females generally have greater opportunities to engage in useful activities outside the labor force than males, female teachers should be more likely to terminate.

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[1]Teachers who terminate to retire would, of course, be relativelv older and more experienced.

III. THE SAN DIEGO SCHOOL SYSTEM

SOME DIMENSIONS OF THE SAN DIEGO SYSTEM

The San Diego City Schools District is among the 20 largest employers of teachers in the nation. Of the large urban districts in California, San Diego is considered one of the best administered. Table 1 summarizes some pertinent dimensions of the system. For the purposes of the table and the empirical analysis, the school system has been divided into various teaching sectors. The largest of these in terms of teachers, students, and schools--the "ordinary" sector--includes the three standard teaching levels: elementary, junior high, and senior high. The three special sectors include four new elementary schools opened in San Diego during the period covered by the analysis (1970-1972); six schools that exclusively enroll students with special problems, such as grade school students with severe physical or educational handicaps and junior and senior high school students who present special discipline problems; and a sector devoted to various support services. Teachers assigned to the support services sector are not physically located at a single school. Examples of support services include speech and hearing, the exceptional child service, the Spanish Curriculum Development Center, testing services, and program development.

During the 1950s and 1960s, San Diego was one of the fastest growing cities in the nation and its school system grew concomitantly. For example, enrollment increased at a rate of about four percent each year, and during the five years between 1966 and 1970 over 1000 teachers were added to the system. Recently, this growth has not only begun to taper off, but has actually been reversed. Between the 1970-71 and 1971-72 school years, for example, enrollment fell by about one percent, the decline taking place entirely within the elementary level. The absolute number of teachers also declined slightly. Among the explanations for this decline are the reduction in the birth rate and the fact that San Diego is no longer growing as fast as it did during the 1960s. Moreover, much of the growth that is taking place nowadays is in suburbs outside the City School District's jurisdiction.

Table 1

SCHOOLS, ENROLLMENT, AND TEACHERS IN THE SAN DIEGO UNIFIED SCHOOL DISTRICT, DECEMBER 1971

	Number of Schools	Enrollment	Number of Teachers
Ordinary school sector			
Elementary (Kindergarten through grade 6)	109	68,892	2,584
Junior High (grades 7 through 9)	18	29,445	1,326
Senior High (grades 10 through 12)	12	26,110	1,115
Special sectors			
New schools	4	1,977	69
Special schools	6	1,531	120
Support services	--	--	458
Total	149	127,955	5,672

TYPES OF TEACHER FLOWS IN SAN DIEGO

Numerous avenues of movement are open to teachers in San Diego. Some, but by no means all, are represented in Figure 2. Figure 2 is similar to Figure 1, except that it has been expanded to represent the situation in San Diego. Incoming flows are from three sources: new hires, movement from an administrative position back to a teacher position, and teachers returning from leaves of absence. Outflows, similarly, are attributable to three sources: terminations, movement to an administrative position such as vice-principal, and leaves of absence. Movement within the active teacher status includes interschool mobility, either at the same teaching level or at a different teaching level, and flows between the three special sectors and an ordinary school.

Because the flows are small and difficult to interpret meaningfully, we ignore movements within or among the three special sectors. Because of data limitations, intraschool movements (grade changes, for example) are also excluded from the analysis. The remaining flows are listed in Table 2, along with the percentage of San Diego teachers who made each of the indicated moves between the 1970-71 and the 1971-72 school years.

Table 2 indicates there are more than four times as many stayers as movers. It must be emphasized, however, that the tabulation is limited to movements that occur between only two school years; over several years this rate of flow is sufficient to bring about important changes within the San Diego school system. The tabulation suggests, for example, that over a tenth of a typical ordinary school's faculty leaves each year and is replaced mostly by teachers who are new to the school. If the new teachers differ in important respects from the outgoing teachers, it would not take more than a few years for the character of the faculty to change substantially. The tabulation also indicates that if nonpecuniary differences are ignored almost all internal movement in San Diego is lateral or guild-like; only a negligible percentage of teachers move to and from administrative positions.[1]

[1]The movements of teachers indicated in Table 2 also appear consistent with Alexander's definition of guild industries. (See Alexander, p. 6.)

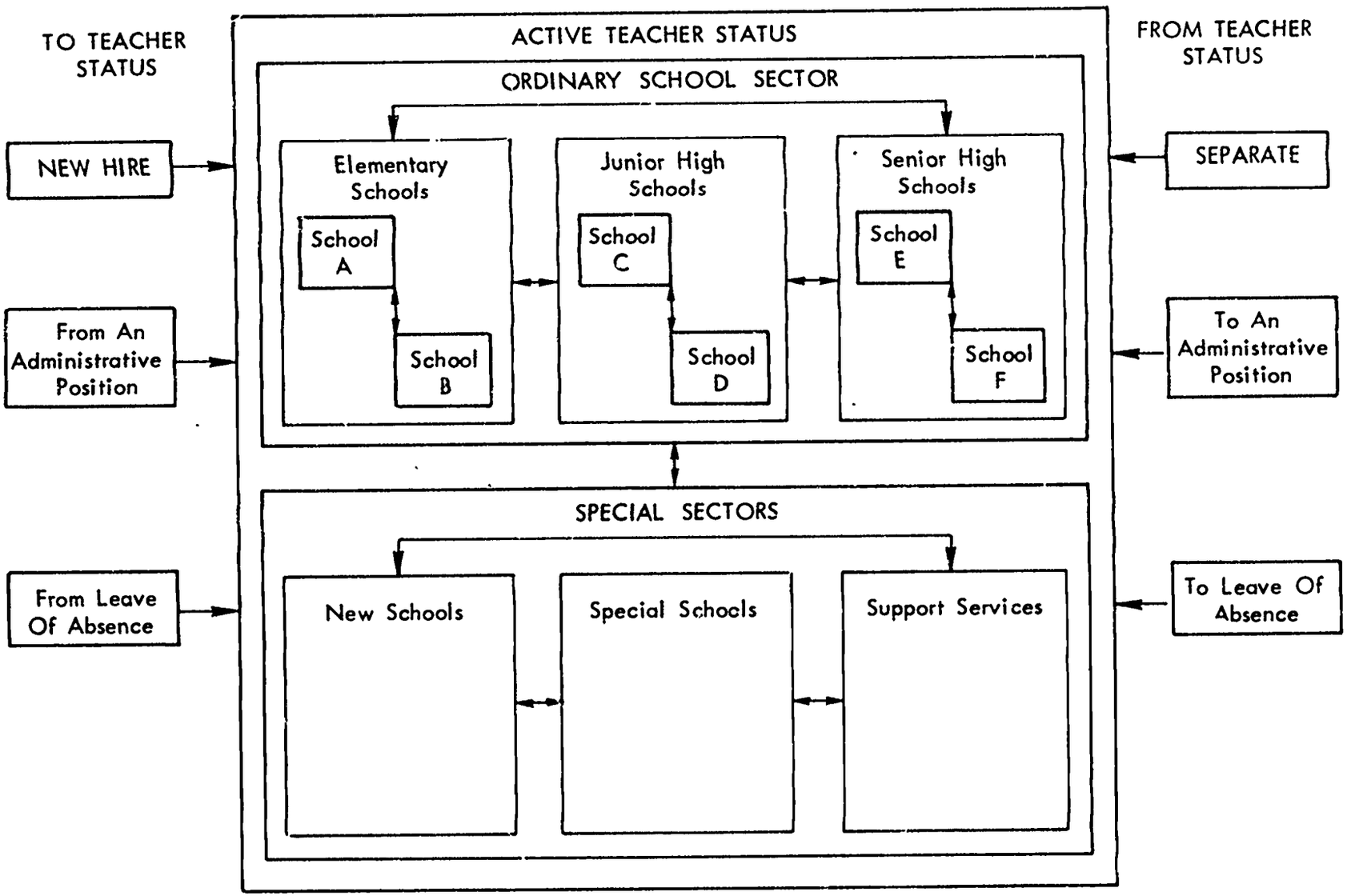

Fig. 2 — Teacher flows in the San Diego City School District

Table 2

TEACHER FLOWS IN SAN DIEGO BETWEEN THE 1970-71 AND 1971-72 SCHOOL YEARS
(percent)

To	Teacher status		5.6
	New hires	4.6	
	From an administrative position	0.1	
	From leave of absence	0.9	
From	Teacher status		5.8
	Separations	4.2	
	Promotions	0.2	
	To leave of absence	1.4	
Moves	Within the ordinary school sector		4.9
	Moved to different school at same level	4.1	
	Moved to different school at different level	0.8	
Moves	Between ordinary and special sectors		1.7
	Moved to ordinary school sector	0.6	
	Moved from ordinary school sector	1.1	
Stayed			82.0
	At same ordinary school	73.6	
	Within special school sector	8.4	
Number of teachers			5984

As noted earlier, the additional teachers added to the system between the 1970-71 and 1971-72 school years (5.6 percent) were slightly exceeded by those lost (5.8 percent). The fact that more new teachers were hired (4.6 percent) than directly terminated from an active teaching assignment (4.2 percent) is offset by the fact that more teachers apparently went on a leave of absence (1.4 percent) than returned (0.9 percent). This suggests that some teachers terminate while on leave of absence rather than directly from an active teaching assignment.

A greater number of teachers moved from the ordinary school sector to one of the special sectors (1.1 percent) than moved in the opposite direction (0.6 percent). This difference is entirely accounted for by the flow of teachers from established schools to the four new schools.

Since school systems are usually highly structured internal labor markets, teacher movements like those described by Figure 2 occur, as Kerr suggests, within well-established frameworks of rules. In San Diego some of these rules are informal while others are very formal, many having been ratified by the Board of Education. An example of the more formal rules are those that relate to the 81 separate teaching positions established within the school system. Although all teachers must have at least a bachelor's degree, each position is associated with a unique set of explicit minimum qualifications with respect to California credential requirements, degree level, specific course work, hours of student teaching, and so on. This list of minimum qualifications is applicable to all potential applicants for a particular position, whether new or transferring teachers. From the system's perspective it is desirable, of course, that the qualifications of the person selected to fill an opening exceed the position's minimum requirements. The extent to which this is possible naturally depends on the availability of applicants and the program needs of the district, such as ethnic staff balance. It also depends on the specific position considered. For example, although teachers with only bachelor's degrees are not formally precluded from filling many positions at the upper grade levels, a teacher's chances of getting these positions increase with the number of semester hours completed.

Teachers who remain within the San Diego system for at least three years are granted tenure. Prior to receipt of tenure, termination may occur at either the teacher's or the system's initiative. Except in rare instances of grave misconduct or gross incompetence, only the teacher can initiate a separation once he is tenured.

Subject to appeal through a grievance procedure, internal transfers may be initiated by a teacher's principal or by the superintendent's office. In practice, however, most internal transfers, particularly those for tenured teachers, are requested by the teacher himself.[1] Nevertheless, the teacher may not be able to determine the precise nature of his new assignment but only indicate general preferences. A teacher is usually expected to remain in a new assignment for at least two years.

Except for moves to and from administrative positions which, as Table 2 indicates, account for a very small proportion of total internal movement in San Diego, changes in assignment do not result in changes in salary. Indeed, it is not the job that carries a particular salary, but the teacher; except for additional compensation paid for responsibility associated with certain specific teaching jobs, such as teaching educationally handicapped children, salary is *entirely* a function of years of teaching experience (both within and outside of San Diego) and educational attainment.[2]

In filling vacancies at their schools, San Diego principals must work within certain important constraints. One of these involves quotas on the amount of experience teachers at a given school may have. Teachers are divided into three categories: ignoring a few exceptions, those

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[1]Only about 21 percent of all transfers between 1970-71 and 1971-72 were at a principal's or the district's request.

[2]Teachers are assigned to one of six salary classes on the basis of their educational attainment and to one of 10 to 15 salary steps on the basis of their years of experience. (Each year of teaching experience generally increases a teacher's salary *steps* by one, until the teacher has reached the maximum step level--10 for a teacher in the lowest salary *class* and 15 for a teacher in the highest class.) Movement to a higher salary class increases a teacher's annual salary by $500. Movement to a higher salary step increases annual salary by over $300 at the lower end of the range and by over $500 at the upper end.

with less than five years of experience are placed in the first category: those with five to ten years of experience in the second category; and those with more than ten years of experience in the third category. Schools are divided into two divisions, elementary and secondary. Normally, the percentage of teachers within each category at a particular school is expected to be within ten percentage points of the division's average. Although mandatory transfers are not usually made to bring a school within its quota, transfers that result in a school falling outside its quota are usually precluded.

Vacancies for the next school year that are known before mid-April of the current school year are filled in the following priority order:

(1) By reassignment of a qualified teacher at the same school site.

(2) By transfer of a qualified employee who has submitted a formal bid for the position.

(3) By transfer of a qualified employee who has submitted a general transfer request.

(4) By assignment of a new teacher.

The fact that newly hired teachers are at the bottom of this priority order ensures that they will be placed in those assignments teachers already in the system are often most reluctant to accept. Step 2 refers to a formal bidding procedure. If an opening is listed under the bidding system, the principal is required to accept the qualified bidding teacher with the longest unbroken span of service within the school district. Step 3 allows a principal a considerably wider range of choice. Since Step 2 is no longer applicable after mid-April, there is a tendency for principals to preserve their options by not reporting vacancies until the teacher gives formal notice. As a result, most vacancies, particularly the relatively attractive ones, are filled outside the formal bidding procedure.[1]

The rules relating to teacher mobility in San Diego appear not to preclude the operation of a reasonably "competitive" internal labor

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[1] About 13 percent of all transfers between 1970-71 and 1971-72 occurred under the bidding procedure.

market: within limits, teachers can move toward the positions they feel offer the highest nonpecuniary returns and principals can fill vacancies by selecting the teachers they prefer from available applicants. As was stressed in Section II, however, we have no way of knowing whether a labor market that operates in this way is consistent with educational effectiveness.

IV. DATA AND STATISTICAL PROCEDURE

In this section, we briefly summarize the data and statistical techniques that are used to test the hypotheses discussed in Section II. A detailed description of the data appears in Appendix A.

THE DATA

The empirical analysis is based on the San Diego Teacher File (SDTF). This file was constructed at Rand from data provided by the San Diego City Schools Personnel Division.

The SDTF includes all persons who had teaching assignments within the San Diego school system in June 1971 or December 1971. The information includes each teacher's age, sex, race or ethnic background, number of semester hours completed, and number of years of teaching experience, both within and outside the San Diego school system. The file also indicates whether or not each teacher is tenured. In addition, complete information is available on whether a teacher made one of the moves indicated in Figure 2. Moreover, teachers who terminated or changed the physical location of their primary assignment between 1970-71 and 1971-72 school years are classified as to the reason why. Finally, each teacher who taught at an ordinary school in 1970-71 or 1971-72 was assigned a set of values that quantitatively describe the school. If a teacher changed schools between the two years, a separate set of values for each school was used.

The data available on ordinary schools include enrollment information, test scores, ethnic composition, socioeconomic information on the students' families, and data on the physical plant. A large number of school variables can be constructed from these data. For the purpose of this report, the following variables are used:

Type of School

Schools were coded as to whether they are at the elementary, junior high, or senior high level. Because teacher movement is somewhat more fluid within than between each of these levels, each may be thought of

as constituting a sub-market within the overall internal labor market. For this reason each teaching level is treated separately throughout much of the empirical analysis.

Total Enrollment

Change in Enrollment

The percentage changes in the size of enrollment between the 1970-71 and 1971-72 school years.

Minority Enrollment

The percentage of the student body composed of black or Spanish-surnamed students.

Welfare

The percentage of the student body composed of students in families on AFDC.

Reading Ability

The percentage of students whose score on a standardized reading test exceeded the national median score. For elementary schools, test results for grade 3 were used; for junior high schools, the results for grade 8; and for the senior high schools, the results for grade 11.

Median I.Q.

The I.Q. ratings are all based on national norms. For elementary schools the median I.Q. rating for grade 6 was used; for junior high schools, the rating is for grade 8; and for senior high schools, the rating is for grade 11.

Subjective Ranking

In the summer of 1971, a panel of school administrators was convened. Each member subjectively rated each school within his experience level as to the difficulties associated with administering the school

as a function of the intensity of school and community problems. Individual ratings were combined and averaged to determine an overall rating for each school.[1]

Portable Classrooms

Portable classrooms as a percentage of a school's total classrooms. This variable is available only for elementary schools and is intended as an index of physical plant quality.

The last six school variables are particularly important because they represent quantifiable dimensions of factors that may influence a teacher's preference for teaching in one school rather than another. Of these variables, all but the portable classroom measure are highly correlated;[2] schools that tend to rank well in terms of one usually rank well on all. This implies that none of the five highly related variables are likely to provide much information the others do not; to the extent one of these variables does, in fact, reflect teachers' perceptions about nonpecuniary differences among schools, so may the remaining four.[3] Because the results for these five variables are usually very similar, we frequently report findings for only one or two.

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[1]To test the validity of this procedure, a second committee of administrators was asked to repeat the rating procedure. The statistical correlation between the two ratings was found to be very high; Spearman rank-correlation coefficients for the three teaching levels were between .82 and .90. This suggests that the subjective ranking can be used with considerable confidence.

[2]The simple correlations between these six school variables appear in Table B-1. The simple correlation coefficients for the correlations between the minority enrollment, welfare, reading ability, and median I.Q. variables are never below .79 and most are above .9. The coefficients for the correlations between the subjective ranking and the four variables just mentioned range between .6 and .81.

[3]A possible exception to this generalization concerns black and Mexican-American teachers. Although it seems likely that these teachers and their white counterparts will feel similarly about schools with a high percentage of students on welfare, low reading and I.Q. scores, and low subjective rankings, perceptions may very well differ about schools with a high percentage of minority students.

STATISTICAL METHODS

The principal statistical tools we use are simple tabular comparisons, multiple regression analysis, and Markovian analysis. Each technique is useful, but each is also subject to important limitations.

Considerable information can be obtained simply by comparing averages; for example, the average values of various characteristics of terminees or teachers who transfer are usefully contrasted with those of teachers who remained at the same school. Sometimes, however, averages may obscure more than they reveal. For instance, the possibility that terminators include *both* more young teachers and more old teachers than nonterminators will not be apparent in a comparison of the average ages of the two groups. Although it is possible to incorporate such "nonlinearities" into a tabular analysis, computationally it is very awkward.

Tabular comparisons are also inefficient whenever one wishes to isolate the influence of one factor on mobility by controlling for the effects of other factors. Such controls are important when there is a reason to suspect that termination or transferring is influenced by several factors (or independent variables) that are also related to one another. For example, to isolate the influence of age on the probability of terminating from the San Diego school system, it may be necessary to control for the possibility that the age distribution may differ between high SES and low SES schools and that student SES may exert an independent influence on the probability of terminating. We turned to regression analysis to help verify our tabular results, to test for more complex relations, and to examine the effect of a single independent variable upon a dependent variable, while adjusting or controlling for the influence of other independent variables.

In addition to providing a convenient tool for isolating the partial effects of independent variables, regression analysis provides tests of whether measured relationships between variables are statistically significant. Strictly speaking, however, these tests cannot be interpreted in the traditional sense. The observations used in the regressions consist of all teachers in San Diego. They do not constitute a randomly drawn sample, unless one considers San Diego as

representative of all teachers in somewhat similar school districts. Nevertheless, the significance tests should be indicative of the confidence that can be placed on the various results.

The problem of interpreting the tests of statistical significance is somewhat peculiar to this study. Several more general methodological problems, however, are encountered whenever regression analysis is used to study an area with modest theoretical underpinnings. These are largely a consequence of a major advantage of regression analysis, the relative ease with which it may be used. Its application presupposes little, if any, sophistication on the part of the user. On the other hand, the interpretation of regression results does require a great deal of experience and statistical refinement. It is not surprising, then, that the empirical literature is replete with misinterpretations of regression results. We will restrict our discussion to two of the most egregious.

The first is attributing causality to a statistical relationship discovered by means of regression analysis: if Y and X are the dependent and independent variables, respectively, and there is a statistically significant relation between them, then it is concluded that X causes Y. The conclusion may be unwarranted. For example, Y might cause X, or both X and Y may be influenced by some third factor that has been left out of the analysis. Causality is much too profound to be discovered by statistical methods alone. If, however, we hypothesize that X caused Y, we can state that a statistically significant relation between X and Y is consistent with our hypothesis.

A second prominent misuse is to report that a particular variable is statistically significant when other variables have been discarded because they weren't significant. This misuse is common in those disciplines where the theory is weak while the data are abundant. A diligent analyst can always uncover a "significant" relationship. In these circumstances, tests of significance are better measures of indefatigability of the researcher rather than of any fundamental behavioral

relationship. Only additional research on different data can disentangle the relative importance of each.[1]

Markovian analysis, the third statistical tool we use, provides a somewhat different perspective from tabular comparisons or regression analysis.[2] It is particularly useful in evaluating the long-run impact of existing policy. Although a thorough Markovian analysis of teacher flows requires more extensive longitudinal data than we use in the present study, and therefore must be postponed for the future,[3] we feel that the technique is sufficiently promising for understanding and administering school systems to warrant presentation of an illustrative example of its use in Section VI.

A Markov chain is one of the simplest dependent stochastic processes. The basic assumption is that the transition probability of an individual moving from one assignment to another is not influenced by his behavior previous to the first assignment. The future manifestations of a Markov chain are treated as completely determined by the present state of the system--that is, as independent of the past.

If, in a study of teacher mobility, schools are categorized as high SES (H) or low SES (L) and movements between these categories during a time period are measured, the following transition probability matrix can be calculated:

$$\begin{bmatrix} P_{HH} & P_{HL} \\ P_{LH} & P_{LL} \end{bmatrix}$$

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[1]Three more technical objections to the use of ordinary least squares regression are: First, strong relations among the independent variables (multicollinearity) can camouflage an important relation between an independent and dependent variable. Second, the independent variables may also be correlated with the discurbance term, thus violating one of the key assumptions of regression analysis and giving rise to inconsistent estimators. Finally, the disturbance term may possess stochastic properties different from those assumed by the linear regression model. For example, the disturbances may be auto-correlated rather than uncorrelated. For a thorough discussion, see J. Kmenta, *Elements of Econometrics*, The Macmillan Company, New York, 1971.

[2]The basic elements of Markov analysis are presented in Appendix C.

[3]Several data sets that will support a more thorough Markovian analysis of teacher mobility are briefly discussed in Section VII.

where, for example, P_{HL} is the probability of moving from a high SES school to a low SES school during the time period and P_{HH} is the probability of staying at a high SES school during the same period. Separate matrixes could be calculated for different types of teachers (for example, men and women or young and old) and compared. Furthermore, should the matrix persist over time, Markovian analysis would allow its long-run effects to be estimated. Thus, one could estimate how teachers now in the San Diego system would be distributed between high and low SES schools in the future. If the long-run behavior is unacceptable, different methods could be considered for altering the transition matrix. Markovian models could then be used to predict the effects of these changes.

Obviously, misallocation of teachers within a school district can be determined without the use of Markov models. The point is that models like these quickly signal the onset of misallocations and may give the decisionmaker time to correct the system before it goes completely out of balance. More important, the characterization of a school district in a systematic manner like this suggests how the decisionmaker might control the mobility process. In particular, the transition probabilities are functions of two different kinds of variables--those related to the schools in question and those related to the teacher. When a time series of transition probabilities is available, regression methods can be used to calculate the relationship between the transition probabilities and each of these variables. In some cases teacher variables such as pay, promotion, and so on will be easier to control than school variables, such as the socioeconomic status of students and modernity of the school facilities. In other circumstances the reverse may be true. For example, it may be impossible to have salary differentials based on location of school, but changes in physical plant may be feasible. Whatever change is contemplated, its immediate and long term effects can be assessed using the Markovian analysis.

V. DETERMINANTS OF TEACHER MOBILITY

As noted in Section II, we expect the allocation of teachers among schools to be strongly influenced by the nonpecuniary factors characterizing different schools in the San Diego system. This expectation is founded on the uniformity of the salary schedule across assignments. Since teacher compensation is independent of location, we expect the high SES schools to be staffed by teachers possessing the most control over their assignments. New teachers have little control over assignments, but this situation changes as the teacher accumulates experience and graduate semester hours. Furthermore, attainment of a preferred assignment is delayed until the teacher obtains sufficient knowledge of the school system and until decisionmakers within the school system learn more about the teacher's qualifications. As the counterpart of movement toward high SES schools, we also anticipate movement away from low SES schools. These movements will be to other assignments within the San Diego system and termination or movement out of the San Diego system.

To investigate the influence of nonpecuniary differentials and other factors on teacher mobility in San Diego, we compare "stayers"--teachers who taught at the same ordinary school in both 1970-71 and 1971-72 or teachers who remained in the special sector during both 1970-71 and 1971-72--with the following types of "movers":[1]

1. *New Hires.* Teachers who were not employed by the San Diego school system in 1970-71 but were in 1971-72.

2. *Terminators.* Teachers who were employed by the San Diego school system in 1970-71 but not in 1971-72.

3. *Movers within the ordinary sector.* Teachers who taught at one ordinary school in 1970-71 and another ordinary school in 1971-72.

4. *Movers to the special sectors.* Teachers who were assigned to an ordinary school in 1970-71 and to one of the special sectors in 1971-72.

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[1]Several small categories of movers are not considered in this analysis: teachers moving to or from an administrative position and teachers going on or returning from leaves of absence.

5. *Movers to an ordinary school.* Teachers who were assigned to one of the special sectors in 1970-71 and to an ordinary school in 1971-72.

The comparison is based on both teacher characteristics and on the characteristics of the schools to which the teachers are assigned. These variables were listed in Section IV. The school characteristic variables for new hires refer to these teachers' first assignments in San Diego. Except when otherwise indicated, the school variables for the other categories of movers pertain to their assignments before moving. A tabular comparison of stayers with the various categories of movers is presented in Table 3.

NEW HIRES

As expected, Table 3 indicates that newly hired teachers are younger and less experienced than stayers. Because the San Diego school system is attempting to increase minority representation on their teaching staff, the percentage of black and Mexican-American new hires is much higher than the percentage of black and Mexican-American stayers. The prediction that new hires tend to be assigned to the low SES schools is strongly supported by the evidence; compared with stayers, new hires were located at schools with lower subjective rankings, a higher percentage of minority students,[1] a higher percentage of students from AFDC families, and students with lower measured I.Q. and reading ability. The one unexpected result was that new teachers at the elementary level tend to be sent to schools with relatively few portable classroom units. We had anticipated that this variable would serve as a proxy for the quality of the physical plant of schools and that schools with a large percentage of portable classrooms would be unattractive to teachers.[2]

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[1]The relatively large percentage of black and Mexican-American new hires suggests one potential explanation for this result; because of community pressures and personal preferences, minority new hires tend to be assigned to schools with predominantly minority enrollments. However, separate (unreported) tabulations show the same pattern for non-minority new hires.

[2]Throughout our examination of the data, we were unable to discern a consistent or reasonable pattern of relations between the portable classrooms variable and various types of teacher movements even when

Table 3

MEAN VALUES OF SELECTED TEACHER AND SCHOOL VARIABLES

	Elementary Schools				
				Movers[a]	
	Stayers	Terminators	New Hires	Within Ordinary Sector	To the Special Sectors
Teacher Characteristics					
Semester hours completed	157.5	145.7	133.7	160.1	156.2
Years of teaching experience	8.9	7.9	3.6	7.6	8.7
Age	39.9	36.6	29.0	37.2	39.1
Tenured[b]	65.9	43.3	5.5[c]	50.3	57.9
Black[b]	5.5	1.6	20.9	6.3	2.6
Mexican-American[b]	2.0	.8	12.1	3.2	2.6
Male[b]	15.3	3.9	11.0	23.6	7.9
School Characteristics[d]					
Minority enrollment	26.4	25.2	53.9	35.6	21.6
Welfare	11.0	11.7	20.7	14.6	10.5
Reading ability	37.3	37.0	23.0	32.5	40.3
Median I.Q.	98.5	98.6	93.6	97.6	100.3
Portable classrooms	20.7	19.1	17.3	16.4	17.6
Subjective ranking[e]	51.5	50.5	28.8	45.4	53.0
Total enrollment	751.9	747.2	702.1	715.7	722.0
Change in enrollment	-2.7	-3.4	-0.7	-3.2	-1.0
Number of teachers	2264	127	91	191	38

Table 3 (continued)

	Junior High Schools				
				Movers[a]	
	Stayers	Terminators	New Hires	Within Ordinary Sector	To the Special Sectors
Teacher Characteristics					
Semester hours completed	173.3	158.8	146.0	163.8	179.0
Years of teaching experience	9.7	11.2	2.4	6.1	9.8
Age	41.0	41.2	27.3	35.0	38.8
Tenured[b]	69.6	55.8	0.0	45.3	91.7
Black[b]	4.8	0.0	10.7	3.1	8.3
Mexican-American[b]	3.2	0.0	9.5	1.6	0.0
Male[b]	52.3	25.0	36.9	51.6	58.3
School Characteristics[d]					
Minority enrollment	24.6	20.1	38.1	42.4	36.1
Welfare	9.3	7.7	13.9	15.0	13.5
Reading ability	50.2	53.1	42.7	40.4	43.0
Median I.Q.	98.8	99.6	95.6	95.2	96.2
Portable classrooms	NA	NA	NA	NA	NA
Subjective ranking[e]	9.6	10.0	8.1	7.3	9.3
Total enrollment	1728.1	1753.0	1601.5	1594.1	1484.8
Change in enrollment	+0.2	-0.1	+0.5	-0.5	+1.8
Number of teachers	1175	52	84	64	12

Table 3 (continued)

	Senior High Schools				
				Movers[a]	
	Stayers	Terminators	New Hires	Within Ordinary Sector	To the Special Sectors
Teacher Characteristics					
Semester hours completed	182.9	171.8	194.0	177.5	181.2
Years of teaching experience	10.4	9.4	3.1	8.3	10.2
Age	41.6	39.5	29.8	37.3	39.7
Tenured[b]	77.4	57.5	2.9[c]	66.7	90.0
Black[b]	3.9	12.5	11.8	10.3	0.0
Mexican-American[b]	2.3	2.5	11.8	5.1	10.0
Male[b]	62.8	47.5	48.5	71.8	70.0
School Characteristics[d]					
Minority enrollment	20.6	30.6	32.0	32.4	23.9
Welfare	6.0	8.2	8.4	9.1	7.4
Reading abi	55.8	49.0	48.0	49.2	52.4
Median I.Q.	104.1	101.5	101.1	101.8	102.1
Portable classrooms	NA	NA	NA	NA	NA
Subjective ranking[e]	6.6	5.5	5.3	5.3	6.5
Total enrollment	2294.4	2155.8	2164.4	1989.0	2223.8
Change in enrollment	-0.5	-1.1	-0.8	-2.6	+0.5
Number of teachers	971	40	68	39	10

Table 3 (continued)

	Special Sectors			
	Stayers	Terminators	New Hires	Movers to Ordinary Sector
Teacher Characteristics				
Semester hours completed	174.4	169.7	143.3	168.0
Years of teaching experience	13.1	10.3	4.0	8.7
Age	45.3	41.2	33.1	38.8
Tenured[b]	77.5	54.8	2.9[c]	73.0
Black[b]	3.7	9.7	11.4	0.0
Mexican-American[b]	1.7	0.0	11.4	13.5
Male[b]	34.8	25.8	22.9	40.5
Number of teachers	520	31	35	37

[a]The school characteristic results for movers pertain to school of origin.

[b]Reported as the percentage of all teachers in each category.

[c]A few "new hires" were actually rehires.

[d]The values for school characteristics have been assigned to the individual teachers at each school. Thus, the mean values for school characteristics are weighted by the number of teachers in a given mover or stayer category at each school. For example, each ordinary school teacher has been assigned a value equal to the percentage of minority students at the school to which he is assigned. The 26.4 mean minority enrollment figure for elementary school stayers is calculated by first summing these values for all the teachers in this category and then dividing this sum by the number of teachers in the category.

[e]The subjective rankings are scaled differently at the elementary, junior high, and senior high levels and therefore are not directly comparable between school levels.

NA--not available.

TERMINATORS

The suggestion in Section II that except for retirees, terminators would tend to be younger and less experienced and with less educational attainment than stayers is supported by the results in Table 3 for elementary schools, senior high schools, and the special sectors. Although terminators at junior high schools are on the average more experienced and slightly older than stayers, they do have somewhat fewer completed semester hours and are less likely to have tenure.[1] Table 3 also indicates, as expected, that male teachers are less likely to terminate than female teachers.

The hypothesis that terminating teachers would tend to be assigned to relatively low SES schools is apparently *not* supported by the evidence presented in Table 3, except at the senior high school level. Compared with stayers, terminators from senior highs are from schools with lower subjective rankings, larger minority enrollments, more students from families receiving AFDC, and lower student ability as measured by standard tests. At the elementary level, on the other hand, there is very little difference between the schools to which terminators and stayers were assigned. And at the junior high level, terminator assignments appear on the average to be somewhat superior to stayer assignments.[2]

Further perspective on these relationships is obtained from Table 4. This table is calculated from regression estimates reported in Table B-2. Table 4 presents estimates of the probability that teachers with various specified characteristics will terminate over the period

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school SES level was controlled for. This variable was also not systematically related to the other school characteristic measures. We concluded from this that, in their decisionmaking, teachers take little account of the percentage of a school's classrooms that are portable. For this reason, we have dropped this variable from the remaining reported results.

[1] As will become apparent when the regression analysis is presented, these results for junior high schools are largely explained by the bimodal nature of terminator category; although most terminators are younger and less experienced, retirees are older and very experienced. Retirement was the cause of only one of every five terminations at the elementary and senior high levels, but it accounted for one-third of all terminations at the junior high level.

[2] Some explanations for these findings are suggested later in this section.

Table 4

ESTIMATED PROBABILITY OF TERMINATION FOR SELECTED CATEGORIES OF TEACHERS

	Teacher and School Characteristics			Probability of Terminating (percent)		
	Sex/Age	Educational Attainment[a]	Race of Teacher/School SES[b]	Elementary Schools	Junior High Schools	Senior High Schools
1.	Male/30-53	Middle	Majority/Average	1.5	2.4	0.1
2.	Male/under 30	"	"	2.0	3.4	4.3[c]
3.	Male/over 53	"	"	4.8	4.8[c]	4.8[d]
4.	Female/30-53	"	"	1.9	1.8	2.1[c]
5.	Female/under 30	"	"	10.0[d]	8.3[d]	4.9[d]
6.	Female/over 53	"	"	8.3[d]	15.2[d]	5.5[d]
7.	Male/30-53	"	"	2.5[c]	8.0[d]	1.6
8.	"	High	"	0.3	2.2	0.0
9.	"	Middle	Majority/below Average	1.3	0.2[c]	3.8[d]
10.	"	"	Majority/Above Average	1.4	0.8[c]	2.3[c]
11.	"	"	Minority/Below Average	0.0[d]	0.0[d]	6.0[d]
12.	"	"	Minority/Average and Above Average	0.7	0.0[c]	3.5
	Mean Value for Total Sample			4.8	3.9	3.7
	Number of Observations			2,673	1,327	1,079

Source: Table B-2.

[a]Teachers are assigned to the following three educational attainment categories:
LOW: at least a BA, but no MA and no more than 35 semester hours completed after receipt of BA.
MIDDLE: at least an MA *or* BA plus 36 semester hours completed after receipt of BA, but no more than 71 semester hours completed after receipt of BA.
HIGH: at least an MA *with* a total of 72 semester hours completed after receipt of BA.

[b]Teachers are assigned to the following five race/school SES categories:
Majority/Average: white teachers assigned to schools that ranked in middle third of all schools in the teaching level on the reading test.
Majority/Below Average: white teachers assigned to schools that ranked in the bottom third of all schools in the teaching level on the reading test.
Majority/Above Average: white teachers assigned to schools that ranked in the top third of all schools in the teaching level on the reading test.
Minority/Below Average: Mexican-American and black teachers assigned to schools that ranked in the bottom third of all schools in the reading test.
Minority/Average and Above Average: Mexican-American and black teachers assigned to schools that ranked in the top two-thirds of all schools in the teaching level on the reading test.

[c]Based on a regression coefficient at least as large as its standard error.

[d]Based on a regression coefficient at least twice as large as its standard error. In terms of Table 4, the significance tests pertain to the *difference* between the probability prediction (on line 1) for the base group and those for the remaining teacher categories.

of a year. For example, the 10 percent probability estimate for elementary schools on line 5 signifies that during a year, of every ten white female teachers under 30 years of age who reached the middle level of educational attainment and taught at an average SES elementary school, one terminated.

For the purposes of estimating the regression equations, teachers have been assigned on the basis of three sets of characteristics to six age/sex categories, three education categories, and five categories defined by race or ethnicity and school SES level. Age and sex have been treated in combination because the relative attachment of men and women to the labor force varies over the life cycle. Young women teachers, for example, may terminate because of various home responsibilities, such as child rearing; young males, on the other hand, do not usually leave the labor force, but terminate to take a job elsewhere. If the reasons for terminating for these two groups differ, so may their probabilities of terminating.

A school's SES category was determined by ranking the schools within each teaching level on the basis of results from standardized reading tests and then dividing the schools into three groups of equal size.[1] Since the schools that are ranked in the below average category on this basis also tend to have a high proportion of minority students, the attitudes of Mexican-American and black teachers toward these schools may differ from those of white teachers. To take account of this possibility, the race or ethnicity of the teacher and the SES category of the teacher's school have been treated jointly.

Before we discuss the results presented in Table 4, we should mention two limitations. First, some of the categories considered have relatively few teachers. For example, no more than eight percent of the teachers at any teaching level are black or Mexican-American. Moreover, as the mean value of the total sample indicates, the percentage

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[1]Similar regressions were estimated where the schools were ranked on the basis of two other criteria--the percentage of minority students and the percentage of students from AFDC families. These results, which are reported in Table B-2, are very similar to those that use the reading ability criteria. This similarity is not surprising since, as noted in Section IV, these variables are highly correlated.

of teachers who terminated between the 1970-71 and 1971-72 school years is rather small. As a consequence, the results for some of the small categories would have differed substantially had only one or two more teachers terminated or not terminated. Second, the results are based on teacher movements over only a one year period. One could have greater confidence in the results as predictions for future years had they been based on data pooled across several time periods. Furthermore, the underlying economic conditions that influence termination decisions change over time. Particularly important during the period covered by the data is the relatively high level of overall unemployment and the apparent change in market conditions for teachers from one of excess demand to one of excess supply. Even with these limitations, however, the estimates in Table 4 provide considerable insight into which categories of teachers have a high probability of terminating and which have a low probability.

Because the estimates in Table 4 are based upon regression equations, one can see how the probabilities of terminating change when one of the three sets of characteristics is varied and the other two are (statistically) held constant. Accordingly, the categories of teachers depicted on lines 2 through 6 of the table differ from the "base group" category described on line 1 with respect to age or sex, but not with respect to education or race/school SES. The categories delineated on lines 7 and 8 differ from the base group in terms of educational attainment. And those shown on lines 9 through 12 differ from the base group in terms of race, ethnicity, or school SES.

For example, the estimates on lines 1 through 6 imply that, controlling for educational attainment and race/school SES, younger and older teachers, both men and women, are more likely to terminate than their middle-aged counterparts. Except at the senior high level, however, these age differences tend to be considerably larger for women than for men. Viewed from a slightly different perspective, these estimates indicate that at the elementary and junior high levels, younger and older women teachers have a much higher probability of terminating than male teachers in the corresponding age groups, but that women teachers in the middle-age category behave very much like

male teachers in the same age group. That is, between the ages of 30 and 53, the turnover rates for men and women teachers are both very low. At the high school level, where teachers' investments in education and experience are the highest, male and female behavior is very similar at each stage of the life cycle.

The comparison between teachers with different levels of educational attainment (lines 1, 7, and 8) suggests that although the expected inverse relation between termination and a teacher's investment in education probably does exist, it is generally very weak. Only at the junior high level, where teachers in the lowest educational group appear substantially more likely to terminate than teachers in the middle or the highest educational groups, does the influence of education seem important.

The estimated effect of school SES level on the probability that majority (white) teachers will terminate (lines 1, 9, and 10) differs at each school level. At the elementary level, school SES evidently has virtually no influence on majority teachers. At the junior high level, majority teachers at above average and below average SES schools both appear less likely to terminate than teachers at average schools. The opposite relationship is found at the high school level. Except for the comparison between average and below average schools at the high school level, however, these differences are rather small and by conventional tests statistically insignificant. With the possible exception of majority teachers at the lowest ranked senior high schools, school SES apparently has little systematic influence on termination decisions.[1]

One explanation for these results is that teachers, especially those at the elementary and junior high levels, simply transfer to assignments they prefer rather than terminate. There is some evidence that teachers

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[1]One initially plausible explanation for these results seemed to be that terminators included persons who retired. Teachers who retire are often from relatively high SES schools. It seemed possible that this offset the expected negative relation between school SES and termination for younger teachers. However, when the regressions were recalculated omitting retirees, the estimated relation between SES ranking and termination was virtually unchanged. (See Table B-2.)

at the elementary and junior high levels have greater opportunity to make such transfers than do teachers at the senior high level: 8.4 and 5.5 percent of the teachers who taught at the elementary and junior high levels, respectively, in 1970-71 moved either to another school or to one of the special sectors; only 4.4 percent of the senior high school teachers made such a move. Furthermore, teachers may have less tolerance for older students whose socioeconomic status differs from their own than for younger students with a different socioeconomic background.

If the propensity to terminate is indeed conditioned by the opportunity for internal movement, our empirical results may strongly reflect the time period covered by the data. As noted earlier, the San Diego school system is no longer expanding at its previous rapid rate. If, as a consequence, there are fewer openings in preferred assignments within the system, terminations by young teachers in less preferred assignments could increase substantially in the future. On the other hand, opportunities for teachers outside the San Diego system have already become substantially less favorable than in the past, thereby tending to reduce terminations by teacher seeking more attractive opportunities in the external labor market. Thus, from the perspective of teachers in San Diego, conditions in both the external and the internal labor markets may be deteriorating. The net influence on future turnover rates of these offsetting effects remains to be seen.

Another partial explanation for the absence of the predicted relation between school characteristics and termination below the high school level is that many terminations have little to do with teachers' satisfactions with their particular assignments. Information on the reasons San Diego teachers have terminated is provided in Table 5. In some cases the reasons listed may not adequately capture the actual cause of termination. For example, although only 2.4 percent of all terminators were formally dismissed, an unknown number of others terminated after being informally told that they were unlikely to receive tenure. Retirement from teaching, on the other hand, probably contains a strong element of choice; although all the retirees were at least 54 years old, almost half were less than 62. In any event, Table 5

Table 5

DISTRIBUTION OF TERMINATING TEACHERS BY REASON FOR TERMINATION
(percent)

Domestic reasons		44.4
Home responsibility	6.0	
Husband transferred	20.4	
Moved	6.8	
Marriage	7.2	
Maternity	2.8	
Personal reasons	1.2	
Other jobs or activities		21.6
Other teaching positions	8.0	
Nonteaching positions	4.4	
Travel	4.4	
Professional study	4.8	
Dissatisfied with assignment		2.4
Death		3.2
Health		2.0
Retirement		24.0
Dismissal		2.4
Total		100
Number of terminators, 250		

suggests that job dissatisfaction was of little importance in a substantial number of terminations.

The results in Table 4 for minority (black and Mexican-American) teachers are somewhat confusing. The estimates on lines 11 and 12 indicate that the probability that a middle-aged, male, minority teacher will terminate from an elementary or junior high school is negligible, regardless of school SES, but the probability that such a teacher will terminate from a senior high school is relatively high. These results could be a consequence of efforts in San Diego to increase minority representation throughout the school system; minority elementary and

junior high teachers may have greater opportunity for movement within the system than their white counterparts. On the other hand, because of efforts throughout the country to reverse historic patterns of economic discrimination, the demand for the most highly qualified minority professional is exceedingly high, and these teachers are most likely found at the senior high school level. However, as previously mentioned, the estimates for minority teachers are based on relatively few observations. Thus, only limited confidence can be placed in them.

MOVERS WITHIN THE ORDINARY SECTOR

We suggested earlier that to the extent internal mobility is voluntary, teachers would move away from less preferred assignments toward assignments that offer high nonpecuniary rewards. Less than 21 percent of all transfers among ordinary schools or between schools and the special sector were at the school district's request, and about 60 percent of these involved transfers to or from the various support services. Thus, it would appear that movement within the ordinary sector is largely voluntary.

It is evident from Table 3 that, as measured by minority enrollment, the percentage of students from families on welfare, test scores, and the subjective ranking, teachers who transferred from one ordinary school to another were more likely to be in lower SES schools before moving than teachers who remained at the same school. It also seems clear that these teachers were able to move to schools they preferred. This is indicated by Table 6, which compares the initial assignments and the new assignments of ordinary school teachers who moved but remained at the same teaching level.

Teachers who moved from one teaching level to another are not considered in Table 6. Compared with movers within the same teaching level, relatively few teachers made such a move. Two-thirds of those who did, however, moved from junior to senior highs, presumably a move most would consider an improvement in their relative position.[1]

[1] Of the 50 teachers who moved from an ordinary school at one teaching level to an ordinary school at another level, 34 moved from a junior high to a senior high, 15 from a senior high to a junior high, and one from an elementary school to a junior high school.

Table 6

A COMPARISON OF OLD AND NEW ASSIGNMENTS FOR ORDINARY SCHOOL TEACHERS WHO MOVED WITHIN THE SAME TEACHING LEVEL
(mean values of selected school characteristics)

	Elementary Schools		Junior High Schools		Senior High Schools	
	Old School	New School	Old School	New School	Old School	New School
School characteristics						
Minority enrollment	35.7	27.3	42.8	18.7	27.7	17.0
Welfare	14.6	11.2	15.0	6.3	8.1	4.4
Reading ability	32.6	37.3	40.2	53.2	53.0	58.2
Median I.Q.	97.6	99.5	95.2	99.6	102.5	105.3
Subjective ranking[a]	45.1	50.8	7.3	10.5	5.7	6.6
Total enrollment	717.3	716.4	1549.5	1851.5	2021.8	2350.0
Change in enrollment	-3.2	-0.3	-0.4	1.7	-1.7	2.9
Number of teachers	190		30		24	

[a]The subjective rankings are scaled differently at the elementary, junior, and senior high levels and are therefore not comparable across school levels.

Table 6 also implies that teachers move from schools with declining enrollments and toward schools where enrollments are increasing or at least not decreasing as fast. This indicates that the ability of teachers to move toward more attractive schools depends upon the availablity of appropriate openings. As the San Diego school system ceases to expand as rapidly as it did during the 1960s, there may, as suggested earlier, be fewer opportunities for teachers to transfer to more attractive assignments and, consequently, an increase in the rate at which teachers at low SES schools terminate.

Table 7 compares the initial and new assignments of male and female teachers and majority and minority teachers who moved from one elementary school to another. The table indicates that male and minority movers were initially located at lower SES schools than female and majority movers, respectively, and that by most criteria they also tend to end up at lower SES schools. All four groups, however, appear to have improved their relative positions. The most interesting result in Table 7 is for minority movers, although it must be emphasized that this result is based on only 18 teachers. These teachers apparently have been able to move to schools that are slightly higher ranked in terms of students on welfare, reading and I.Q. tests, and the subjective ranking but at the same time have a substantially higher percentage of minority students. Majority teachers moved to schools with substantially fewer minority students. This implies that interpretation of the minority enrollment criterion differs for majority and minority teachers, although their assignment preferences are otherwise similar.

Table 8 reports estimates of the probability that an ordinary school teacher with given characteristics will move to another ordinary school during the year. It is almost entirely analogous to Table 4 and is subject to the same limitations. The underlying regression equations are reported in Table B-3. In interpreting Table 8, the reader should note that the base group is somewhat different from that in Table 4. Furthermore, years of experience has been used instead of age, because the former seems a more pertinent determinant of a teacher's ability

Table 7

A COMPARISON OF OLD AND NEW ASSIGNMENTS FOR TEACHERS WHO MOVED BETWEEN ELEMENTARY SCHOOLS, BY SEX AND BY RACE/ETHNICITY
(mean values of selected school characteristics)

	Male Teachers		Female Teachers		Minority Teachers		Majority Teachers	
	Old	New	Old	New	Old	New	Old	New
School characteristics								
Minority enrollment	42.1	31.4	33.6	26.1	51.4	57.2	34.0	24.0
Welfare	16.5	12.3	14.0	10.9	19.9	19.5	14.0	10.3
Reading ability	30.0	34.8	33.4	38.0	22.9	23.1	33.6	38.8
Medium I.Q.	97.2	98.5	97.8	99.8	93.5	93.9	98.1	100.0
Subjective ranking	39.8	53.8	46.8	49.9	24.4	31.4	47.3	52.8
Total enrollment	704.7	679.3	721.2	728.0	881.7	649.4	700.1	723.5
Change in enrollment	-2.9	-2.4	-3.3	-0.4	-1.7	-0.2	-3.4	-0.3
Number of teachers	45		145		18		172	

Table 8

ESTIMATED PROBABILITY OF MOVING WITHIN ORDINARY SECTOR
FOR SELECTED CATEGORIES OF TEACHERS

	Teacher and School Characteristics				Probability of Moving Within Ordinary Sector (percent)		
	Sex	Years of Teaching Experience	Educational Attainment[a]	Race of Teacher/ School SES[b]	Elementary Schools	Junior High Schools	Senior High Schools
1.	Female	over 8	Middle	Majority/Average	3.5	1.4	0.5
2.	Male	"	"	"	7.6[d]	3.2[c]	2.7[c]
3.	Female	1	"	"	11.8[d]	10.6[d]	7.8[c]
4.	"	2	"	"	2.5	7.3[d]	6.2[c]
5.	"	3	"	"	8.9[d]	6.3[c]	0.0
6.	"	4	"	"	2.4	5.2[c]	1.8
7.	"	5 to 8	"	"	3.9	6.3[d]	1.6
8.	"	over 8	Low	"	4.4	1.8	0.0
9.	"	"	High	"	9.8[d]	0.5	0.0
10.	"	"	Middle	Majority/ Below Average	6.2[d]	3.8[c]	4.2[d]
11.	"	"	"	Majority/ Above Average	3.3	1.1	2.0[c]
12.	"	"	"	Minority/ Below Average	6.9[c]	0.0	5.0[c]
13.	"	"	"	Minority/Average and Above Average	6.5	0.0[c]	9.4[c]
	Mean Value of Total Sample				7.2	4.8	3.6
	Number of Observations				2,673	1,327	1,079

Source: Table B-3
See notes to Table 4.

and desire to move within the internal labor market.[1] Because there was no strong *a priori* reason to expect the influence of experience on moving within the system to differ for men and women teachers, experience and sex were treated as separate variables.[2]

Table 8 adds some precision to the finding that teachers who move within the ordinary sector tend to move away from the lower SES schools. The estimates on lines 1, 10, and 11 indicate that majority teachers at schools in the above average SES category and those at average schools have approximately the same (low) propensity to move; the majority teachers with a relatively high probability of moving are those located at schools ranked in the bottom third.

The estimates in Table 8 also suggest that male teachers, particularly at the elementary level, have a higher probability of moving within the ordinary sector than women (compare lines 1 and 2) and that, regardless of school SES ranking, minority teachers at the elementary and senior high (but not junior high) levels have a higher probability of moving than majority teachers (compare lines 1, 12, and 13). Except at the elementary level, where there are relatively few teachers in the highest educational group, educational attainment appears to have little relation to the probability of moving within the ordinary sector.

There is apparently a very strong relation between experience and the probability of moving (compare line 1 and lines 3 through 7). At all three teaching levels, teachers with one year of experience are the most likely to move. The estimates on line 3 indicate that roughly one of every ten white female teachers at an average SES school will

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[1] It would be useful to measure the separate effects of age and experience on the probability of moving (or on the probability of terminating, for that matter). Statistically, however, this is very difficult to do since age and experience are very highly correlated. (The simple correlation coefficients for these two variables are above .7 at the elementary, junior high, and senior high levels. See Table B-1.)

[2] It did seem possible that the influence of experience on internal mobility might be conditioned by a teacher's educational attainment. A test of this possibility with a set of joint educational attainment/experience variables, however, indicated this was not the case. In fact, although experience seems to have a strong influence on the probability of moving within the ordinary sector, educational attainment appears to have practically none.

move to another ordinary school in the system only a year after being hired. Third year elementary school teachers; second, third, and fourth year junior high teachers; and second year high school teachers also have a relatively high probability of moving. On the other hand, teachers with over eight years of experience are among the least likely to move. The rapidity with which many teachers move after being hired suggests that the information needed to seek out and attain preferred assignments is rather quickly obtained. It is also consistent with the possibility that if a principal reports that a first year teacher's performance was marginal, the teacher is given a second chance in an alternative assignment before the decision on whether to grant tenure must be made. The relative reluctance to move on the part of highly experienced teachers suggests that these teachers have an important investment in a specific school and that they have found an assignment with which they are relatively satisfied.[1]

MOVERS TO THE SPECIAL SECTORS

Table 3 indicates that although teachers who move within the ordinary sector are considerably less experienced than stayers, teachers who move from an ordinary school to one of the special sectors are about equally experienced. Moreover, on the average, movers to the special sectors leave higher SES schools than do movers who stay within the ordinary sector. This suggests that many special sector assignments are viewed as prime opportunities and what movement to such assignments frequently occurs in two stages: Teachers first move from a relatively low SES school to a relatively high one; then several years later, they move to one of the special sectors.

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[1]Both terminator and mover regressions have dichotomous dependent variables; that is, a teacher either terminates or stays and either moves to another school or remains where he is. In these circumstances a logit analysis of the data is usually performed. However, logit analysis tends to be unreliable when the probabilities (of terminating or moving) are as small as they are here. An alternative technique for analyzing dichotomous variables has been developed at Rand by M. Nerlove and S. J. Press and is currently being programmed. We are planning to apply their technique to the San Diego data.

VI. THE EFFECTS OF MOBILITY

ALLOCATION OF TEACHERS BETWEEN SCHOOLS

To examine how teachers are allocated among San Diego schools, schools at each teaching level have been ranked on the basis of each school SES variable and then divided into three groups of equal size. In Table 9 we report the mean values of selected characteristics for teachers who, according to each of the school criteria, were assigned in 1970-71 to "above average," "average," and "below average" schools.

Table 9 indicates that the percentage of Mexican-American and, especially, black teachers at schools that rank in the bottom third within each teaching level is much higher than at schools ranked in the upper two-thirds. Because of their own preferences and community pressures, minority teachers tend to be assigned to minority schools. Accordingly, this finding merely reflects the relatively large number of minority students that attend schools classified on the basis of most criteria as "below average." Another result from Table 9 is the absence of any consistent pattern in the proportion of male teachers assigned to schools within the three SES categories.

The most important results in Table 9 relate to how teachers are allocated among schools by experience and education. In general, teachers at the above average schools *do not* tend to have substantially greater formal education or more years of experience than teachers assigned to the average schools. In fact, not infrequently the latter are found to have somewhat higher average years of experience and more completed semester hours than the former. Substantial and consistent differences are not found until teachers assigned to schools ranked in the top *two-thirds* are compared with those assigned to schools ranked in the bottom third. Teachers at the below average schools are consistently younger, less experienced, and less likely to be tenured; and they have fewer completed semester hours than teachers at other San Diego schools. As suggested earlier, this results from new hires first being assigned to low SES schools and then, after one or more years, moving to relatively higher ranked schools where they accumulate

Table 9

MEAN VALUES OF SELECTED MEASURES OF TEACHER CHARACTERISTICS
BY SCHOOL SES CATEGORY
(based on teacher assignments during 1970-71 school year)

School and Teacher Characteristics	Elementary Schools			Junior High Schools			Senior High Schools		
	Above Average	Average	Below Average	Above Average	Average	Below Average	Above Average	Average	Below Average
Minority Enrollment									
Semester hours completed	160.2	156.7	154.3	175.7	173.4	168.3	185.5	185.2	175.4
Years of teaching experience	9.4	9.4	7.6	10.0	10.4	8.5	10.1	10.8	9.5
Age	40.4	40.4	37.5	41.3	41.3	39.4	40.7	42.2	40.1
Tenured[a]	70.2	68.8	52.4	76.6	76.3	55.9	82.2	81.5	65.4
Black[a]	1.5	2.3	11.7	1.0	1.8	9.3	0.0	1.0	13.5
Mexican-American[a]	1.5	1.1	3.6	1.6	2.3	4.8	3.8	.8	4.1
Male[a]	15.3	14.0	16.0	51.0	50.8	50.6	65.7	61.5	61.6
Number of teachers	872	855	946	384	396	547	213	525	341
Welfare									
Semester hours completed	159.0	156.1	155.6	174.4	174.4	167.5	183.6	187.1	175.4
Years of teaching experience	9.2	8.9	8.1	9.8	10.6	8.2	9.6	11.6	9.5
Age	40.0	39.6	38.4	40.7	42.2	38.9	40.0	43.6	40.1
Tenured	69.8	63.8	56.3	75.3	77.4	42.7	78.7	85.0	65.4
Black	1.8	3.4	11.3	1.1	1.7	10.7	.3	1.1	13.5
Mexican-American	1.5	1.3	3.6	1.6	2.4	5.1	2.6	.6	4.1
Male	15.7	13.5	16.1	52.9	48.0	51.4	62.1	63.5	61.6
Number of teachers	938	864	871	437	421	469	385	353	341
Reading Ability									
Semester hours completed	159.3	158.8	153.6	173.7	174.8	167.6	185.3	185.2	172.5
Years of teaching experience	9.8	9.2	7.6	10.3	10.2	8.1	10.0	11.3	8.5
Age	40.9	40.2	37.4	41.5	41.4	38.9	40.7	42.9	38.5
Tenured	70.4	68.8	53.5	78.6	75.3	52.8	81.9	83.4	57.0
Black	1.8	2.3	10.7	1.7	1.3	10.5	0.0	1.2	17.1
Mexican-American	1.2	1.3	3.4	2.0	2.2	4.8	2.9	.6	5.3
Male	14.3	15.3	15.6	51.8	49.9	51.2	65.1	60.9	62.0
Number of teachers	764	894	1015	299	551	477	315	501	263

Table 9 (continued)

Teacher Characteristics	Elementary Schools			Junior High Schools			Senior High Schools		
	Above Average	Average	Below Average	Above Average	Average	Below Average	Above Average	Average	Below Average
Median I.Q.									
Semester hours completed	159.8	156.4	154.6	173.1	175.5	165.3	185.7	184.9	175.4
Years of teaching experience	9.9	8.7	7.7	10.2	10.6	7.2	10.4	10.7	9.5
Age	41.1	39.1	37.8	40.8	42.3	37.3	41.0	42.4	40.1
Tenured	72.9	63.7	53.2	77.0	76.4	48.6	82.7	80.9	65.4
Black	1.4	3.0	11.9	2.3	1.3	11.8	0	1.3	13.5
Mexican-American	1.4	1.1	3.8	2.3	2.1	5.2	2.0	1.3	4.1
Male	15.0	14.1	16.2	51.2	49.9	52.1	63.9	61.7	61.6
Number of teachers	948	831	894	217	407	407	346	392	341
Subjective Ranking									
Semester hours completed	158.7	158.5	153.2	174.4	174.4	167.5	184.8	185.2	176.5
Years of teaching experience	9.4	9.2	7.5	9.7	10.6	8.2	10.3	11.3	8.8
Age	40.4	40.4	37.0	40.2	42.4	38.9	41.7	42.8	38.9
Tenured	69.8	67.3	51.9	72.4	79.6	52.7	77.3	85.4	65.3
Black	1.5	2.6	12.9	1.6	1.3	10.7	.4	1.1	12.3
Mexican-American	1.3	1.0	4.3	1.8	2.1	5.1	1.9	.9	4.6
Male	14.9	14.2	16.5	48.6	52.0	51.4	61.0	62.2	63.7
Number of teachers	871	989	813	387	471	469	269	444	366

[a]Reported as the percentage of all teachers in each category.

additional experience and college credit units. A more precise understanding of how this mechanism operates can be obtained through Markovian analysis.

AN ILLUSTRATIVE APPLICATION OF MARKOV ANALYSIS[1]

For the purposes of this section, schools within the ordinary school sector in San Diego are divided into two subsectors on the basis of the standardized reading tests. The below average schools on the basis of the reading criterion were assigned to the low SES subsector. The average or above average schools were assigned to the high SES subsector. During the 1970-71 school year, 65.5 percent of all ordinary school teachers were in the high subsector and 34.5 percent were in the low subsector. The movement of teachers between these two subsectors from 1970-71 to 1971-72 is summarized by the Markov transition matrix presented in Table 10. The matrix has the following interpretation: The probability of a teacher in the high SES subsector moving to the low SES subsector between 1970-71 and 1971-72 was .014, and the probability of remaining in the high SES subsector was .986; the probability of teachers in the low SES subsector moving to the high SES subsector was .053, and their probability of staying was .947. Thus, the probability of staying in one's initial subsector between school years is much greater than the probability of moving. Nevertheless, among

Table 10

TRANSITION MATRIX FOR ORDINARY SECTOR TEACHERS

	High Subsector	Low Subsector
High subsector	.986	.014
Low subsector	.053	.947

[1] Appendix C presents the basic mathematics underlying Markov chain analysis together with additional applications to teacher mobility.

those who do move, the chances of going from the low to the high SES subsector is almost four times greater than the chances of moving in the opposite direction.[1]

Over the years, if the probabilities constituting the transition matrix do not change, the proportion of teachers now in the ordinary sector who will be at schools in the high SES subsector will steadily increase. The net outcome of these flows toward the high SES subsector is described in Table 11.

After five years the proportion of teachers in the high subsector has risen from .655 to .695, with a corresponding decline in the proportion of teachers in the low SES subsector. The proportion of teachers

Table 11

CHANGE IN THE INITIAL DISTRIBUTION OF TEACHERS WHEN MOBILITY IS GOVERNED BY THE MATRIX IN TABLE 10

Period[a]	Percent in the High SES Subsector	Percent in the Low SES Subsector
0	65.5	34.5
1	66.4	33.6
2	67.3	32.7
3	68.1	31.9
4	68.8	31.2
5	69.5	30.5
10	72.3	27.7
15	74.3	25.7
20	75.7	24.3
∞	79.2	20.8

[a]Period 0 represents the 1970-71 school year, period 1 represents the 1971-72 school year, and so on.

[1]Around half of this difference is because there are about twice as many assignments in the high SES subsector as in the low SES subsector.

in the high subsector increases to .757 after 20 years. And if the transition matrix presented in Table 10 is allowed to operate indefinitely, this proportion achieves a steady-state value of .792; that is, 79.2 percent of the teachers who were in the ordinary school sector in 1970-71 and who remain within that sector will be in the high SES subsector, and only 20.8 percent will be in the low SES subsector.

In the Markov analysis presented here, we have not taken explicit account of teachers who leave the ordinary school sector, for example to terminate or to transfer to one of the special sectors. Although such movement could be incorporated into the analysis, the resulting increase in computational complexity does not seem warranted by the illustrative nature of the present discussion. Moreover, if teachers who leave the ordinary sector are *not* more likely to leave from low SES schools than from high SES schools--a proposition that is reasonably consistent with the findings presented in Section V--the results in Table 11 will be unaffected. If teachers who leave the ordinary sector are more likely to leave from low SES schools, the proportion of teachers in the high SES subsector will be understated.

Table 11 is based on the assumption that the probabilities in the transition matrix will be unchanged.[1] However, if changes in these probabilities can be reasonably predicted, the consequences of these changes can be readily calculated. (See Appendix C.) Furthermore, if the distributional outcomes implied by Table 11 are considered undesirable, Markov analysis could be used to help evaluate policies to change the underlying probabilities (for example, extra pay for teaching at low SES schools). However, the outcomes predicted in Table 11 are not very sensitive to relatively small changes in the *underlying probabilities*. For example, if the probability of moving from the low to the high SES subsector is reduced from .053 to .043, the proportion of teachers in the high SES subsector after 20 years would be reduced from .757 to .724. Similarly, if this probability were increased from .053

[1] One factor that seems likely to reduce the rate of flow from the low to the high SES subsector is an increase in the proportion of black and Mexican-American teachers, an increase that is now happening in San Diego.

to .063, the proportion of teachers in the high SES subsector after 20 years would be .783, rather than .757.

The tendency of teachers to move from low to high SES schools suggests a probabilistic explanation of why educational researchers have frequently found that when student family background characteristics are uncontrolled for, there is a positive relation between the experience or educational attainment of teachers and the measured achievement of their students.[1] Such a relation for San Diego schools, for example, is found in Table 9 and also in the following tabulation:

Simple Correlation Coefficients Between Student Reading Ability[a] and

	Teachers' Years of Teaching Experience	Teachers' Age	Teachers' Semester Hours Completed
Elementary Schools	.14	.10	.07
Junior High Schools	.23	.16	.18
Senior High Schools	.15	.12	.22

[a]All correlation coefficients are significant at the .001 level.

Since teachers are paid on the basis of their experience and educational attainment, it is important to know whether these correlations imply that experience or semester hours affect what students learn. Definitively answering such a complex question would require a much more extensive investigation than is conducted here, but our results do suggest that the causality runs in the opposite direction at least in part. That is, rather than teaching experience or teacher education affecting student test scores, the average reading ability of a school is a basic determinant of the faculty's average level of experience; teachers move to schools attended by superior test takers; and once there, their probability of returning to a poor reading school is near zero. This behavior is feasible as long as the positions vacated at the low SES schools are filled by new, relatively inexperienced teachers, a policy that is followed in San Diego.

[1]See, for example, Averch, Carroll, Donaldson, Kiesling, and Pincus (1972).

VII. CONCLUSIONS

This report has developed a methodology for studying the mobility of teachers among schools within a school district, among school districts, and between the school sector and other sectors of the economy. The methodology was constructed from concepts derived from both human capital theory and the theory of internal labor markets. Some of the implications of this methodology were tested against data for the San Diego school system.

We examined two types of teacher mobility within the context of the San Diego school system: (1) external mobility, or movement into and out of the school system; and (2) internal mobility, particularly internal movement between ordinary schools or between an ordinary school and one of the special sectors. We have found considerable evidence that these two types of mobility are highly interrelated.

Our evidence indicates that upon being hired by the San Diego school system, teachers tend to be assigned to low SES schools, schools they apparently feel offer relatively small nonpecuniary returns. If incoming teachers were confined to such schools (as long as they remained within the San Diego system), it seems likely that many would eventually seek more attractive opportunities outside the system. As we have seen, however, this is not the case. Opportunities within the system that offer high nonpecuniary returns soon become available. There is also evidence that some teachers make several internal transfers: first from a relatively low SES school to a higher ranked one and then to a presumably even more appealing assignment in one of the special sectors.[1] Highly experienced teachers appear to be the least likely to move to another school, presumably because they have already found an assignment to their liking and because the time they have spent in their

[1] Since our data only allowed us to observe teacher movement between two school years--1970-71 and 1971-72--this last conclusion must remain highly tentative until more data are available. San Diego has provided us data on the cohort of the 530 teachers who were hired in 1967-68, traced to separation or current status. These data should allow further testing of this finding and of several additional hypotheses.

current assignment represents an important investment in specific human capital.

Partially as a consequence of the "escape valve" provided by the internal transfer mechanism, but also perhaps because many terminations are more or less nonvoluntary and external labor market conditions for teachers were unfavorable in 1970-71, our evidence indicates that, with the exception of senior high school teachers, few teachers leave the San Diego system because they are dissatisfied with their particular assignment. This is not to say that teachers do not leave for opportunities *outside* the system that are more appealing than those within the system--clearly many do--but only that few teachers terminate because their assignment is unsatisfactory relative to others *within* the system.

The human capital/internal labor market mechanism that operates in San Diego has obvious implications for the allocation of teachers between schools: The oldest, most experienced, most educated teachers tend to be located at relatively high SES schools or in special sector positions. This, in turn, has important implications for recent studies of educational effectiveness. Much of the controversy in this literature involves whether the simple positive statistical relation frequently found between measures of student achievement, such as reading ability and teaching experience or teacher education, implies that experience or teacher education improves student performance. In this study we have suggested that this empirical relation may be due instead to nonpecuniary factors affecting the allocation of teachers among schools. In particular, it appears that new and inexperienced teachers are first assigned to schools where students, for reasons having little to do with teacher quality, perform poorly on achievement tests. Many of these teachers soon move to schools they prefer; that is, middle-class schools where students perform better on achievement tests. Many then remain at these schools accumulating experience and college credit units. The simple mechanics of this mobility pattern was illustrated by use of a simple probabilistic model--the Markov chain.

It must be emphasized, however, that the relationships among teacher characteristics, mobility patterns, and educational effectiveness are

undoubtedly much more complex than just suggested. Excessive teacher mobility probably has an adverse effect on student performance and, as we have just argued, student performance influences teacher mobility. The relative importance of these causal influences can be ascertained only after the parameters of this highly interrelated system have been estimated. Such estimation requires much more sophisticated techniques than those used here. We plan to present these estimates in a subsequent report. Till then, the implications of the previous paragraph must be treated tentatively.[1]

Another implication of internal labor market operation within the San Diego school system is that a teacher's assignment becomes part of his remuneration. Like most school systems, San Diego's formally rewards experience and education through its salary structure. A San Diego teacher's salary, in fact, is solely a function of the number of years of experience and the number of semester hours accumulated. Our results suggest, however, that in addition to salary, experience and formal education are rewarded in terms of assignment satisfaction.

Thus, in both pecuniary and nonpecuniary terms, years of teaching and graduate work in education represent considerable personal investments. Partially because the returns to such specific investments are much higher within the educational field than outside it, we find that the more semester hours and, at least to retirement age, the more years of experience a teacher has, the less likely he is to terminate.

We also found that at the senior high level, where investments in education and experience are highest, female teachers were not more likely to terminate than male teachers. At the elementary and junior high levels, on the other hand, younger and older women teachers were more likely to terminate than men teachers in the same age group. However, middle-aged women were no more likely to terminate than middle-aged men.

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[1] It is encouraging, though, that in a preliminary analysis at Rand making use of these more sophisticated statistical techniques, E. Keeler has concluded "that the major reason for the relationship between experience and achievement is the ability of experienced teachers to get to the schools of high achievers."

San Diego schools are undergoing several changes that may modify existing mobility patterns. One example is an apparent reduction in school system growth. If as a consequence of this reduction there are fewer openings in assignments offering high nonpecuniary returns, terminations by young teachers could increase substantially.

Another important change may result from San Diego's attempt to increase minority representation among its teachers. As minority representation increases, San Diego teachers may exhibit less of a tendency to move from low to high SES schools. Minority teachers, unlike white teachers, may prefer schools with large minority enrollments, and these schools also tend to have relatively low SES rankings on the basis of other criteria.

One very important potential determinant of teacher mobility that we have not and cannot thoroughly examine with San Diego data is teacher salaries. Although we have noted that teacher experience and education is positively related to salary and, hence, negatively related to termination, we have focused on nonpecuniary factors such as the attractiveness of schools. Direct investigation of the influence of salary requires a set of observations for which salary differs even when experience or semester hours do not. Such a set of observations cannot be found in a single school system but only in several contiguous school systems. We have fortunately obtained data that include information on inter-district mobility within the State of Michigan. These data will enable us to examine the effects of inter-district salary differentials upon inter-district mobility.

Appendix A

DESCRIPTION OF THE SAN DIEGO TEACHER FILE

The Rand Corporation has used data provided by the San Diego City Schools Personnel Division to generate a data file on individual teachers within the San Diego school system. This data file, which we call the San Diego Teacher File (SDTF), can be used to investigate movements of primary and secondary teachers within the San Diego system and between the San Diego system and other activities, such as to other districts or occupations and withdrawal from the labor force. Not all the data available in the file have been used in the present report. Although the SDTF is important and useful in its own right, it should also be viewed as the prototype for data files that can be developed for other school systems. Analysis of these files should permit validation of a variety of hypotheses about teacher movements and allocation and should eventually suggest methods for improving the educational system.

The SDTF has been assembled from three separate input sources:

1. Tape A: personnel data on San Diego teachers employed or on leave in June 1971.
2. Tape B: personnel data on San Diego teachers employed or on leave in December 1971.
3. Data on school characteristics.

The information from the first two sources is contained on machine-readable tape; that from the third source, in various published and unpublished documents. Tapes A and B contain data on teacher characteristics and descriptive information on active assignments. For most teachers, the characteristics information is identical on both tapes, but the assignment information may differ. A comparison of the assignment data on the two tapes yields information on various dimensions of teacher mobility between the 1970-71 and 1971-72 school years. The SDTF was generated by matching data from the three input sources for each individual teacher. The format of the SDTF is presented in Table A-1.

Table A-1

FORMAT OF THE SAN DIEGO TEACHER FILE

Teacher Characteristics

- Social Security number
- Sex
- Ethnicity
- Birth Date
- Marital status
- Federal tax exemptions
- Zip code of residence
- Date of hire

Primary Assignment in 1970-71

- Location (school or office to which assigned)
- Position
- Teaching level (elementary, junior high, senior high)
- Subject area/grade level
- Percentage of time spent in assignment
- Salary class
- Salary step
- Monthly salary
- Employee status (permanent, probation, substitute, etc.)

Secondary Assignment(s) in 1970-71

Same data elements as for Primary Assignment in 1970-71.

Primary Assignment in 1971-72

Same data elements as for Primary Assignment in 1970-71.

Secondary Assignment(s) in 1971-72

Same data elements as for Primary Assignment in 1970-71.

Changes Between 1970-71 and 1971-72 (if applicable)

- Termination date
- Reason for termination
- Reason for transfer in location

Table A-1 (continued)

Characteristics of School to Which Primarily Assigned in 1970-71

Type of school (elementary, junior high, senior high, new school, special school)
Total enrollment
Ethnic composition of student body
Percentage of students from families on AFDC
Portable classrooms
Standardized test achievement
Subjective rankings

Characteristics of School to Which Primarily Assigned in 1971-72

Same data elements as for school to which primarily assigned in 1970-71.

TEACHER CHARACTERISTICS

So that each teacher may be uniquely identified, the SDTF contains Social Security numbers. The file also includes each teacher's sex, date of birth, and date of hire. Dates are given by month and year. Teachers are categorized by those who are living with a spouse and those who are not. The number of federally claimed tax exemptions are provided. Although this seems like a useful rough measure of the number of dependents for male and single women teachers, it is probably unreliable for married women teachers. There are six ethnicity categories: Spanish; other white; black; Chinese, Japanese and Korean; American Indian; and other nonwhite. By itself, the zip code is not useful, but this variable can potentially be used to generate information on the type of neighborhood in which teachers live and the distance they must travel to their place of work.

TEACHER ASSIGNMENTS

Tapes A and B contain information on all assignments that were active in June 1971 and in December 1971, respectively. In cases where teachers hold two or more assignments simultaneously, the primary assignment is defined as the assignment to which the greatest amount of the teacher's time is budgeted; any additional assignments are designated as secondary. The data available on secondary assignments are the same as the data on the primary assignment.

Location

For most teachers, this variable provides a code referring to the particular school where they are teaching. It can also accommodate teachers who may be assigned to various central offices or centers, or who may be specialists going to a number of schools.

Positions

There are well over 100 teacher position account codes. The most frequently used by far is the code for "regular teacher." Other position titles include driver training teacher, visually handicapped teacher, gifted elementary typing teacher, and librarian.

Teaching Level

This refers to whether a teacher is at the elementary, junior high, or senior high school level.

Subject Area or Grade Level

This variable provides information on the subject area(s) taught by secondary school teachers and the grade level(s) taught by primary school teachers. Unfortunately, the San Diego City Schools Personnel Division does not yet use a standardized system of numeric codes to record this information. Instead, grade level or subject area is described by up to 30 alphabetic characters. Use of this variable would require considerable standardization, much of which would have to be done manually.

Percentage of Time Spent in Assignment

It was noted above that a teacher may hold several assignments simultaneously. Information is provided on the percentage of time budgeted to each assignment.

Salary Class

To determine a teacher's salary, the teacher is assigned to one of the following six classes on the basis of his educational attainment:

Class	Education Attainment
A	BA
B	BA + 11 semester hours
C	BA + 36 semester hours or MA
D	BA + 60 semester hours or BA + 54 semester hours with MA
E	BA + 72 semester hours with MA
F	BA + 90 semester hours with MA

A teacher's salary class is the only computerized information now available in San Diego on educational attainment.

Salary Step

The only other determinant of a teacher's salary is prior teaching experience, both within and outside the San Diego Unified School System. In general, although there are exceptions, each year of teaching experience increases the teacher's salary step by one, until the teacher has reached the maximum step level--10 for a Class A teacher and 15 for a Class F teacher. Since years of teaching experience *within* the San Diego system can be directly calculated from the date of hire variable, the salary step variable may be used to provide some information on years of teaching experience outside of San Diego.

Monthly Salary

Employee Status

This variable indicates whether a teacher has tenure, is still on probation, has been hired only on a temporary basis, is a substitute teacher, and so on. Most of this information can also be obtained elsewhere in the file.

Termination Date

For teachers who left the San Diego school system after the 1970-71 school year, the month of termination is provided.

Reason for Termination

Teachers who terminate are classified into one of 29 categories, depending on the reason given. A considerable effort has been made to see that terminees are accurately categorized. Following is a partial list of reasons for termination:

Home or family responsibilities
Husband transferred
Marriage
In lieu of dismissal
Other teaching position
Nonteaching position
Professional study
Dismissal for cause
Maternity
Retirement

Reason for Change in Location

Teachers who changed the location of their primary assignment between the 1970-71 and the 1971-72 school years are coded according to the reason for their transfer. Examples of these reasons follow:

Transfer at employee request
Administrative transfer (decision of district, often because of unsatisfactory employee performance)
Transfer to or from resource or support position
Promotion to administrative position
Demotion from administrative position
Return to active status from leave of absence

SCHOOL CHARACTERISTICS

Each teacher whose primary assignment during the 1970-71 school year or during the 1971-72 school year is at a given elementary, junior, or senior high school is assigned a set of values that quantitatively describe the school. Before we discuss the resulting variables, note that a number of additional school characteristic variables can be constructed from the data elements discussed earlier. Examples of such variables are staff turnover rates, percentage of probationary teachers, and the percentage of minority ethnic-group teachers for each school.

Type of School

This code indicates whether the school is at the elementary, junior high, or senior high level. Also indicated is whether the school is a special school or a new school.

Total Enrollment

Enrollment for both the 1970-71 and 1971-72 school years is included.

Ethnic Composition of the Student Body

This is a series of variables indicating the percentage of the student body falling into each of the following four categories: (1) Spanish surname; (2) other white; (3) black; and (4) Oriental, Indian, and other nonwhite.

Percentage of Students from Families on AFDC

Standardized Test Achievement

We have very extensive results from various standardized tests given to students at every school within the San Diego school system. Those included in the file are the percentage of students in grades 1, 3, 6, 8, 10, 11, and 12 whose score on a standardized reading test exceeded the national median score; the percentage of students in grades 6, 8, and 11 whose score on a standardized arithmetic or math test exceeded the national median; the measured median IQ levels based on national norms for students in grades 3, 6, 8, 10, and 12.

Portable Classrooms

Portable classrooms as a percentage of a school's total classrooms are included in the file as the only available measure of the quality of the school's physical plant. This variable is available only for elementary schools.

Subjective Rankings

In the summer of 1971, a panel of school administrators was convened. Each member subjectively rated each school (within his experience level) on a scale of one to five as to the difficulties associated with administering the school as a function of the intensity of school and community problems. Individual ratings were combined and averaged to determine an overall rating for each school. To test the validity of this procedure, a second committee of administrators was asked to repeat the rating procedure. The Spearman rank-correlation coefficients between the two ratings were from .82 to .90 for the three teaching levels, suggesting that the subjective rankings can be used with confidence.

Appendix B

REGRESSION RESULTS AND CORREI ATION COEFFICIENTS

Table B-1

MATRIX OF CORRELATION COEFFICIENTS BETWEEN SELECTED TEACHER AND SCHOOL CHARACTERISTIC VARIABLES

	Minority Enrollment	Welfare	Reading Ability	Median I.Q.	Subjective Ranking	Portable Classrooms	Semester Hours Completed	Years of Teaching Experience	Age	Number of Observations
Elementary Schools										
Minority enrollment	1.000									
Welfare	.8961	1.000								
Reading ability	-.8226	-.7931	1.000							
Median I.Q.	-.8592	-.8070	.8857	1.000						
Subjective ranking	-.7539	-.7072	.7033	.6891	1.000					
Portable classrooms	.0560	-.0329	-.0204[a]	-.0544	-.1140	1.000				
Semester hours completed	-.0572	-.0433	.0752	.0658	.0755	-.0578	1.000			
Years of teaching experience	-.1349	-.0958	.1377	.1550	.1272	-.0766	.7482	1.000		
Age	-.1099	-.0719	.1036	.1246	.1114	-.0824	.4728	.7482	1.000	
Number of observations										2673
Junior High Schools										
Minority enrollment	1.000									
Welfare	.9708	1.000								
Reading ability	-.9433	-.9284	1.000							
Median I.Q.	-.9482	-.9157	.9785	1.000						
Subjective ranking	-.8033	-.8100	.7447	.6783	1.000					
Semester hours completed	-.1867	-.1736	.1771	.1696	.1251	N.A.	1.000			
Years of teaching experience	-.2283	-.2053	.2283	.2348	.1447	N.A.	.5347	1.000		
Age	-.1640	-.1486	.1600	.1692	.0810	N.A.	.4682	.7317	1.000	
Number of observations										1327
Senior High Schools										
Minority enrollment	1.000									
Welfare	.9698	1.000								
Reading ability	-.9572	-.9047	1.000							
Median I.Q.	-.9681	-.9537	.9756	1.000						
Subjective ranking	-.7081	-.6439	.5993	.6242	1.000					
Semester hours completed	-.2249	-.2105	.2182	.2158	.1510	N.A.	1.000			
Years of teaching experience	-.1507	-.1112	.1517	.1409	.1203	N.A.	.4963	1.000		
Age	-.1204	-.0783	.1153	.1032	.1195	N.A.	.4564	.7111	1.000	
Number of observations										1079

[a]Coefficient is *not* statistically significant at, at least, the .05 level.
N.A.: not available.

Table B-2

REGRESSIONS ON TERMINATION[a]
(standard errors of the coefficients in parentheses)

Independent Variables[b]	Elementary Schools					
	Welfare		Minority Enrollment		Reading Ability	
	Retirees		Retirees		Retirees	
	Included	Excluded	Included	Excluded	Included	Excluded
Sex/Age						
Male/under 30	.004	.006	.004	.005	.005	.007
	(.031)	(.028)	(.031)	(.028)	(.031)	(.028)
Male/over 53	.033	-.008	.033	-.008	.033	-.008
	(.043)	(.040)	(.043)	(.040)	(.043)	(.040)
Female/30-53	.004	.005	.004	.006	.004	.005
	(.014)	(.012)	(.014)	(.012)	(.013)	(.012)
Female/under 30	.084[h]	.087[h]	.084[h]	.087[h]	.085[h]	.088[h]
	(.015)	(.014)	(.015)	(.014)	(.015)	(.014)
Female/over 53	.067[h]	-.004	.067[h]	-.004	.068[h]	-.003
	(.016)	(.015)	(.016)	(.015)	(.016)	(.015)
Educational attainment						
Low[c]	.010	.007	.010[g]	.006	.010[g]	.006
	(.010)	(.008)	(.009)	(.008)	(.009)	(.008)
High[d]	-.011	-.007	-.012	-.007	-.012	-.007
	(.013)	(.012)	(.013)	(.012)	(.013)	(.012)
Race of teacher/school SES[e]						
Majority/below average	-.004	-.005	-.001	.004	-.002	.002
	(.011)	(.010)	(.010)	(.009)	(.010)	(.009)
Majority/above average	-.017[g]	-.014[g]	-.014[g]	-.012[g]	-.001	-.002
	(.010)	(.009)	(.010)	(.009)	(.010)	(.009)
Minority[f]/below average	-.044[h]	-.035[g]	-.043[h]	-.032[g]	-.039[h]	-.030[g]
	(.020)	(.018)	(.019)	(.017)	(.019)	(.017)
Minority[f]/average and above average	-.024	-.012	-.013	.001	-.008	.004
	(.026)	(.023)	(.029)	(.026)	(.029)	(.026)
Constant	.021	.019	.019	.015	.015	.012
R^2	.039	.046	.039	.047	.038	.046
F	9.709	11.661	9.686	11.803	9.474	11.510
Number of observations	2,673	2,647	2,673	2,647	2,673	2,647

Table B-2 (continued)

Independent Variables[b]	Junior High Schools					
	Welfare		Minority Enrollment		Reading Ability	
	Retirees		Retirees		Retirees	
	Included	Excluded	Included	Excluded	Included	Excluded
Sex/Age						
Male/under 30	.011	.012	.009	.010	.010	.010
	(.023)	(.019)	(.022)	(.019)	(.022)	(.012)
Male/over 53	.023[g]	-.011	.023[g]	-.011	.024[g]	-.011
	(.022)	(.018)	(.022)	(.018)	(.022)	(.018)
Female/30-53	-.006	-.007	-.005	-.006	-.006	-.007
	(.014)	(.012)	(.014)	(.012)	(.014)	(.012)
Female/under 30	.060[h]	.062[h]	.060[h]	.062[h]	.059[h]	.061[h]
	(.018)	(.015)	(.013)	(.015)	(.018)	(.015)
Female/over 53	.130[h]	-.001	.129[h]	-.003	.128[h]	-.003
	(.020)	(.018)	(.020)	(.018)	(.020)	(.018)
Educational attainment						
Low[c]	.056[h]	.047[h]	.056[h]	.047[h]	.056[h]	.047[h]
	(.015)	(.012)	(.015)	(.012)	(.015)	(.012)
High[d]	-.001	-.005	.0001	-.004	-.002	-.006
	(.013)	(.011)	(.013)	(.011)	(.013)	(.011)
Race of teacher/school SES[e]						
Majority/below average	-.013	-.016[g]	-.023[g]	-.029[g]	-.022[g]	-.026[g]
	(.013)	(.011)	(.013)	(.011)	(.013)	(.011)
Majority/above average	-.002	.005	-.029[h]	-.030[h]	-.016[g]	-.011
	(.013)	(.011)	(.014)	(.012)	(.014)	(.012)
Minority[f]/below average	-.054[h]	-.043[h]	-.068[h]	-.060[h]	-.062[h]	-.049[h]
	(.024)	(.020)	(.024)	(.020)	(.024)	(.020)
Minority[f]/average and above average	-.054[g]	-.041[g]	-.065[g]	-.060[g]	-.058[g]	-.049
	(.037)	(.031)	(.039)	(.032)	(.036)	(.030)
Constant	.017	.018	.030	.035	.024	.024
R^2	.060	.051	.063	.055	.062	.051
F	7.673	6.373	8.069	6.876	7.897	6.356
Number of observations	1,327	1,310	1,327	1,310	1,327	1,310

Table B-2 (continued)

Independent Variables[b]	Senior High Schools					
	Welfare		Minority Enrollment		Reading Ability	
	Retirees		Retirees		Retirees	
	Included	Excluded	Included	Excluded	Included	Excluded
Sex/Age						
Male/under 30	.043[g]	.042[g]	.044[g]	.043[g]	.042[g]	.040[g]
	(.025)	(.023)	(.025)	(.023)	(.025)	(.023)
Male/over 53	.046[g]	.012	.046[h]	.012	.047[h]	.014
	(.022)	(.021)	(.022)	(.021)	(.022)	(.021)
Female/30-53	.019[g]	.018[g]	.019[g]	.018[g]	.020[g]	.019[g]
	(.015)	(.014)	(.015)	(.014)	(.015)	(.014)
Female/under 30	.048[h]	.045[h]	.050[h]	.048[h]	.048[h]	.045[h]
	(.024)	(.022)	(.024)	(.022)	(.024)	(.022)
Female/over 53	.048[g]	-.016	.046[g]	-.018	.054[h]	-.012
	(.026)	(.024)	(.025)	(.024)	(.026)	(.024)
Educational attainment						
Low[c]	.017	.018	.016	.017	.015	.016
	(.021)	(.020)	(.021)	(.020)	(.021)	(.020)
High[d]	-.0004	-.004	-.001	-.004	-.001	-.004
	(.013)	(.012)	(.013)	(.012)	(.013)	(.012)
Race of teacher/school SES[e]						
Majority/below average	.026[g]	.023[g]	.028[g]	.018[g]	.037[h]	.038[h]
	(.015)	(.014)	(.014)	(.013)	(.016)	(.015)
Majority/above average	.014	.015[g]	.005	.010	.022[g]	.024[g]
	(.014)	(.013)	(.016)	(.014)	(.014)	(.013)
Minority[f]/below average	.055[h]	.055[h]	.049[g]	.049[h]	.059[h]	.059[h]
	(.027)	(.025)	(.023)	(.024)	(.027)	(.024)
Minority[f]/average and above average	.036	.044[g]	.030	.039	.034	.043[g]
	(.047)	(.043)	(.046)	(.042)	(.045)	(.041)
Constant	.002	.005	.009	.010	.001	.001
R^2	.020	.023	.019	.022	.023	.028
F	1.996	2.273	1.913	2.190	2.286	2.766
Number of observations	1,079	1,072	1,079	1,072	1,079	1,072

[a]The dependent variable equals one if the teacher terminated; zero otherwise.

[b]The independent variables are all dummies. That is, they equal one if the teacher has the indicated characteristics; zero otherwise.

[c]Teachers with "low" educational attainment have at least a BA, but do not have a MA and have completed no more than 35 semester hours since receiving a BA.

[d]Teachers with "high" educational attainment have at least an MA and have completed a minimum of 72 semester hours since receiving a BA.

[e]School SES is determined by ranking the school at which teacher is assigned according to criterion listed in column heading, i.e., "welfare" or "minority enrollment" or "reading ability." "Below average" schools are ranked in the bottom third of all schools within the teaching level; "above average" schools are ranked in the top third.

[f]"Minority teachers" are black or Mexican-American.

[g]Regression coefficient is at least as large as its standard error.

[h]Regression coefficient is at least twice as large as its standard error.

Table B-3

REGRESSIONS ON MOVES WITHIN THE ORDINARY SECTOR[a]
(standard errors of the coefficients in parentheses)

Independent Variables[b]	Elementary Schools			Junior High Schools			Senior High Schools		
	Welfare	Minority Enrollment	Reading Ability	Welfare	Minority Enrollment	Reading Ability	Welfare	Minority Enrollment	Reading Ability
Sex									
Male	.042[h]	.042[h]	.041[h]	.018[g]	.019[g]	.018[g]	.023[g]	.022[g]	.022[g]
	(.014)	(.014)	(.014)	(.013)	(.013)	(.013)	(.012)	(.012)	(.012)
Years of teaching experience									
One	.086[h]	.083[h]	.083[h]	.091[h]	.094[h]	.092[h]	.074[g]	.074[g]	.073[g]
	(.021)	(.021)	(.021)	(.027)	(.027)	(.027)	(.038)	(.038)	(.038)
Two	-.009	-.010	-.010	.057[h]	.061[h]	.059[h]	.057[g]	.057[g]	.057[g]
	(.020)	(.020)	(.020)	(.028)	(.028)	(.028)	(.035)	(.035)	(.035)
Three	.054[h]	.053[h]	.054[h]	.047[g]	.051[g]	.049[g]	-.002	-.001	-.005
	(.022)	(.022)	(.022)	(.027)	(.027)	(.027)	(.031)	(.031)	(.031)
Four	-.010	-.010	-.011	.036[g]	.039[g]	.038[g]	.014	.016	.013
	(.023)	(.023)	(.023)	(.029)	(.029)	(.029)	(.031)	(.031)	(.031)
Five-eight	.003	.004	.004	.047[h]	.049[h]	.049[h]	.013	.012	.011
	(.013)	(.013)	(.013)	(.017)	(.017)	(.017)	(.017)	(.017)	(.017)
Educational attainment									
Low[c]	.007	.006	.005	.004	.004	.004	-.008	-.007	-.009
	(.012)	(.012)	(.012)	(.017)	(.017)	(.017)	(.021)	(.021)	(.021)
High[d]	.063[h]	.062[h]	.063[h]	-.010	-.009	-.009	-.004	-.004	-.006
	(.016)	(.016)	(.016)	(.015)	(.015)	(.015)	(.014)	(.014)	(.014)
Race of teacher/school SES[e]									
Majority/below average	.025[g]	.032[g]	.027[g]	.036[h]	.018[g]	.024[g]	.043[h]	.045[h]	.037[h]
	(.013)	(.013)	(.012)	(.015)	(.015)	(.014)	(.015)	(.014)	(.016)
Majority/above average	-.006	.010	-.002	.009	-.006	-.003	.009	.023[g]	.015[g]
	(.012)	(.013)	(.013)	(.015)	(.016)	(.016)	(.014)	(.015)	(.014)
Minority[f]/below average	.016	.038[g]	.034[g]	-.009	-.020	-.016	.047[g]	.049[g]	.045[g]
	(.024)	(.023)	(.023)	(.027)	(.027)	(.027)	(.027)	(.026)	(.027)
Minority[f]/average and above averag	.053[g]	.038[g]	.030	-.033	-.042	-.040	.098[h]	.100[h]	.089[g]
	(.032)	(.036)	(.035)	(.041)	(.043)	(.040)	(.046)	(.046)	(.045)
Constant	.038	.030	.035	.008	.016	.014	-.001	-.002	.005
R^2	.022	.022	.022	.028	.026	.026	.024	.025	.021
F	5.097	5.028	5.038	2.173	2.885	2.975	2.155	2.305	1.865
Number of observations	2,673	2,673	2,673	1,327	1,327	1,327	1,079	1,079	1,079

[a]The dependent variable equals one if the teacher moved to another school in the ordinary sector; zero otherwise.

[b]The independent variables are all dummies. That is, they equal one if the teacher has the indicated characteristic; zero otherwise.

[c]Teachers with "low" educational attainment have at least a BA but do not have an MA and have completed no more than 35 semester hours since receiving a BA.

[d]Teachers with "high" educational attainment have at least an MA and have completed a minimum of 12 semester hours since receiving a BA.

[e]School SES is determined by ranking the school at which teacher is assigned according to criterion listed in column heading, i.e., "welfare" or "minority enrollment" or "reading ability." "Below average" schools are ranked in the bottom third of all schools within the teaching level; "above average" schools are ranked in the top third.

[f]"Minority teachers" are black or Mexican-American.

[g]Regression coefficient at least as large as its standard error.

[h]Regression coefficient at least twice as large as its standard error.

Appendix C
THE ELEMENTS OF MARKOV ANALYSIS

Analysis of teacher mobility within a school system is greatly facilitated by the use of Markov models. A thorough Markovian analysis of lateral teacher flows in the San Diego school system would require more extensive longitudinal data than is currently available,[1] although a simple illustration of the uses of this probabilistic process appears in Section VI.

The stochastic process X(t) is a Markov chain if X(t) assumes only a finite number of values as t runs over the positive integers *and* the following condition (Markov property) is satisfied:

$$P\{X(t_n) = x_n \mid X(t_1) = x_1, \ldots, X(t_{n-1}) = x_{n-1}\} =$$

$$P\{X(t_n) = x_n \mid X(t_{n-1}) = x_{n-1}\}$$

The conditional probabilities, $P(X(t_n) = j \mid X(t_{n-1}) = 1) = p_{ij}(t)$ are called the transition probabiiities of the Markov chain. If the transition probabilities are independent of t,

$$P_{ij}(t) = p_{ij}, \text{ for all } t,$$

the chain is said to be stationary.

The properties of Markov chains and their usefulness in the analysis of teacher mobility can best be illustrated by a simple two state example. Suppose that a teacher is assigned to one of two types of schools in a particular school system. The first class of schools is designated high SES and the second low SES. If a teacher is at a high SES school in the nth period, the probability of transiting to a low

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[1] A five year longitudinal sample of teachers in San Diego has been assembled. A Markovian analysis of this sample will be reported in a future study.

SES school in the (n+1)st period is p_1; if a teacher is at a low SES school in period n, the probability is p_2 that he will be assigned to a high SES school in period n+1. Let X_n be a random variable denoting the state of the system at period n. A high (low) SES assignment corresponds to the state $X_n = 0$ ($X_n = 1$). The transition probabilities of this two state model are:

$$P(X_{n+1} = 1 \mid X_n = 0) = p_1$$
$$P(X_{n+1} = 0 \mid X_n = 0) = 1 - p_1 = q_1$$
$$P(X_{n+1} = 1 \mid X_n = 1) = 1 - p_2 = q_2$$
$$P(X_{n+1} = 0 \mid X_n = 1) = p_2$$

The transition probabilities of a Markov chain can be compactly described by the transition probability matrix.

$$P = \begin{array}{c} \\ 0 \\ 1 \end{array} \begin{array}{c} \begin{array}{cc} 0 & 1 \end{array} \\ \begin{pmatrix} 1-p_1 & p_1 \\ p_2 & 1-p_2 \end{pmatrix} \end{array}$$

The probabilities of being in high and low SES schools initially are

$$P(X_o = 0) = \pi_o(0) \text{ and}$$
$$P(X_o = 1) = \pi_o(1) = 1 - \pi_o(0),$$

respectively. The initial distribution of the chain can be compactly represented by the vector

$$\pi_o = (\pi_o(0), \pi_o(1))$$

Given the initial probability distribution π_o and the transition matrix P, the probabilities of high and low SES assignments can be calculated for any future period n.

In matrix notation, the distribution, $\pi_n = (\pi_n(0), \pi_n(1))$, of the Markov chain at the nth period is given by

$$\pi_n = \pi_{n-1} P$$

which on iteration reduces to

$$\pi_n = \pi_o P^n,$$

where P^n is the matrix of n step transition probabilities. The (i, j) entry of P^n, say $p_{ij}^{(n)}$, is simply

$$P_{ij}^{(n)} = p(X_n = j \mid X_o = i).$$

A Markov chain is said to be regular if *some* power of the Markov transition matrix is composed of only strictly positive elements. When the Markov chain is regular, an equilibrium or steady state probability distribution exists and is the solution to

$$\pi = \pi P$$
$$\Sigma \pi (i) = 1$$

In the two state example, this is a system of three equations in two unknowns and under the assumptions made has the following solution

$$\pi(0) = \frac{P_1}{P_1 + P_2}$$

$$\pi(1) = \frac{P_2}{P_1 + P_2}$$

In a study of teacher mobility, the equilibrium distribution associated with a particular Markov transition matrix can be interpreted as the proportion of teachers who will be at a high SES school at some future time *when* teacher mobility is regulated by that particular

transition matrix. By its immediate indication of long run effects, the equilibrium distribution is a convenient measure of the feasibility and desirability of a specific transition matrix. If the long run behavior is unacceptable, different methods could be considered for altering the transition matrix. The choice among these different methods is again facilitated by studying their implications in terms of the equilibrium distribution.

For a numerical illustration of the two state Markov model, suppose the transition matrix between teaching (T) and not teaching (N) is given by:

$$P = \begin{array}{c} \\ T \\ N \end{array} \begin{array}{c} \begin{array}{cc} T & N \end{array} \\ \begin{pmatrix} 7/10 & 3/10 \\ 2/10 & 8/10 \end{pmatrix} \end{array}$$

For this Markov matrix, the long run proportion of teachers in teaching is

$$\pi_1 = \frac{2/10}{3/10 + 2/10} = 2/5,$$

and the long run proportion of teachers in nonteaching activities is

$$\pi_2 = \frac{3/10}{3/10 + 2/10} = 3/5.$$

This Markov methodology can be used to measure the influence of alternative policies on teacher retention. For example, suppose that by increasing salaries, reducing class sizes, or altering some other control variable, the transition matrix P could be changed to

$$P' = \begin{array}{c} \\ T \\ N \end{array} \begin{array}{c} \begin{array}{cc} T & N \end{array} \\ \begin{pmatrix} 8/10 & 2/10 \\ 2/10 & 7/10 \end{pmatrix} \end{array}$$

The long run proportion of teachers in teaching would be increased from

$$\pi_1 = 2/5 \text{ to } \pi_1' = 3/5.$$

Correspondingly, the long run proportion of teachers in nonteaching activities would be reduced from

$$\pi_2 = 3/5 \text{ to } \pi_2' = 2/5.$$

Whether or not such a change should be implemented depends on the cost of changing the control variables relative to the benefits derived from the modified steady-state proportions.

More complicated Markov models could be constructed to address the problems of mobility, retention, and recruitment within a growing school system. Given the present data limitations, such an undertaking would be premature at this time. The main point is that with the appropriate data Markov analysis is a promising methodology for understanding and administering school systems.