MULTIFAMILY FAILURES

A Quantitative Analysis of Financial Failure in Multifamily Projects: A Disaggregated Comparative Analysis

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MULTIFAMILY FAILURES

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Prepared by: Berkeley Planning Associates
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I. INTRODUCTION

In two earlier reports on this research project, we have presented (1) preliminary results of a multivariate analysis of financial failure in a national sample of 618 multi-family subsidized housing projects gathered by HUD; and (2) the findings of a series of detailed case studies of a small number of both failing and non-failing projects. These very different approaches to understanding the causes of financial failure were deliberately chosen to provide complementary perspectives on the problem. Through statistical analysis of variables in a large sample of projects, it was sought to identify general factors at work and to test widely held hypotheses about failure. Case studies, on the other hand, provide an understanding of some of the complex interactions in a particular setting that aggregate analysis can hardly hope to capture. They also provide the opportunity for further insights about the failure process.

The results of the multivariate analysis on the full sample were disconcerting. We were unable to find simple and clear patterns of causation. No variable was strongly correlated with failure at the national scale, although several variables showed some degree of statistical association with it. Clusters of variables, each contributing a small amount to the explanation, similarly did not seem to emerge. Our tentative conclusion was that financial failure was a complex process in which contributory variables might have very different effects depending on the context in which they occurred.

Case studies confirmed this view to a considerable degree. The cases exhibited a high degree of complexity and disagreement as to the causes of failure. Similar preconditions did not necessarily lead to similar outcomes. Most striking was the degree to which almost every case suggested the potential for failure -- the fine edge on which all were poised. It seems evident that many immediate causes, ranging from an earthquake to a dishonest manager, can precipitate the financial crisis. Yet, there did also appear to be factors that render some projects more susceptible to failure than others.

This report aims to bridge the gap between the national sample analysis and the cases. As proposed in the Phase One Progress Report, we have

disaggregated the national sample and have examined failure behavior at the regional level and also by forms of sponsorship. By analyzing these subsamples we hope to obtain two kinds of useful information. First, if striking differences occur between subsamples in the values of important variables and their influence on failure, we have grounds for asserting that some predisposing factors are present but not universal. Second, if some factors are consistently significant across very different subsamples, we have stronger grounds for asserting that they are generally important. Thus, the heart of this phase of the work is the comparative analysis of failure and related variables. Originally we had hoped to be able to expand the data set to include variables on family composition, income and neighborhood not available in the original sample. Despite substantial effort, this has not proved possible. The absence of these variables, as pointed out in the Phase One Progress Report, remains a significant drawback. Wherever possible, proxy variables have been employed.

Structure of the Report

Since the purpose of this report is comparative, a consistent format for presentation of results is maintained throughout. Section II presents a brief reconsideration of the logic underlying the organization of explanatory variables in the text. Its purpose is theoretical and conceptual; specifically, to establish the basis for grouping explanatory variables that is used throughout the multivariate analysis. In Section III we examine summary statistics on failure and other project variables across regions and sponsorship types. The purpose of this section is not to provide a complete tabulation of variables in the original survey. That was largely achieved in the report, Multifamily Failures Study, published by the U.S. Department of Housing and Urban Development in 1973. As reported in the Phase One Progress Report, we have been unable to recover the sample weighting for each project used in that effort. Thus, the summary statistics in Section III are based on the unweighted sample and are appropriate mostly for purposes of comparison across subsamples.

The main concern of the research is to discover relationships between project variables and the incidence of failure. In Section IV, simple correlations between alternative definitions of failure and the possible explanatory variables are examined. These are the building blocks for the multi-

variate regression analysis in Section V, the concluding section, which considers variables in several combinations related to hypotheses about the failure process. As in the previous sections, the results of this work are presented in tabular form with a minimum of mathematical notation. Since disaggregation implies very large numbers of possible calculations, not all results have been included in the text. In particular, some interregional comparisons are relegated to appendices, together with detailed definitions of variables.

II. CONCEPTUALIZING THE PROCESS OF FINANCIAL FAILURE

Throughout this report a consistent structure is used to define financial failure and to classify the associated variables that were measured in the original national sample. Since the conceptual framework is fundamental, this section provides a brief rationale for its use. The discussion below is intended to complement the general treatment of methodological issues involved in analyzing failure in the Phase One Progress Report, emphasizing substantive questions about the factors at work in the process of financial failure.

Financial Failure

Far from being a simple phenomenon, housing failure may encompass social, economic, political or physical dimensions. Within each of these, there is a range of possible meanings of the term. Neither physically nor financially does housing often collapse like the one-hoss shay. Rather, it changes progressively, the transformation often appearing to occur in stages as specific events occur. Thus, financial failure is itself a time-dependent variable, extending from a state best described as financial difficulty, in which cash flow is negative and adjustments may be made, through delay or default or mortgage payments, efforts to restructure the mortgage and, finally, foreclosure and assignment of the mortgage. For purposes of this study, we will define financial failure as a persistent inability on the part of a housing project to meet its financial obligations, leading eventually to default on mortgage payments and, ultimately, foreclosure and assignment.

Once we have a conceptual definition of the phenomenon, quantitative analysis can be carried out only if that definition can be translated into

an operational measurement. The national sample of projects provides a range of possible operational definitions of financial failure. In the analysis, we have adopted several variables as measures of financial difficulty and failure. They are as follows (each represented by its summary variable name used in tables later in the report):

Financial Failure Variables

FAILURE 1: Project in foreclosure or mortgage assignment.

FAILURE 2: Project in foreclosure, assignment or default.

DEFAULT: Project in default on mortgage payments.

Financial Difficulty Variables

NEGFLOW: Negative cash flow.

YRSNEG: Percentage of years with negative cash flow.

WAVREP: Waiver of contributions to the replacement reserve.

PRINMOD: Modification or waiver of principal payments.

In addition, default and negative cash flow have been classified according to the project age year in which they occurred. Only the first two of the failure variables were adopted for analysis since FAILURE 2 and DEFAULT are almost perfectly correlated. The central aim of the research, then, is to explain FAILURE 1 and FAILURE 2.

Among the difficulty variables, it should be noted that although all are symptomatic, the last two represent efforts to respond to financial difficulty while negative cash flow is a direct index of difficulty itself. The fact that waivers or modifications of payments may occur late in the failure process should make us cautious about considering them as predictive variables.

Conceptualizing The Failure Process

If financial failure is the inability of a project to meet its financial obligations, then the failure process finds its resolution in the confrontation between the revenues that a project can generate from whatever sources and the costs that it must bear. Since no one plans for financial failure, at least in theory, the imbalance between revenues and costs must arise from factors unforeseen or ignored in the planning of the project. Inevitably, as we seek to explain failure, we must look for potential causes of cost inflation, revenue shortfall or both.

To make this search simpler, it is convenient to break down each side of the cost-revenue equation into its component parts. Although many of these will be affected by the same factors, it is by no means evident that the direction or degree of influence will be the same for each component. A conventional breakdown of housing project costs might include the following:

Housing Cost Components:
- Operation -- Labor, utilities, etc.
- Maintenance -- Labor, materials, other.
- Replacement
- Management
- Taxes -- Real estate, other.
- Mortgage interest and amortization
- Return on investment
- Extraordinary expenses.

On the revenue side, we find:

Housing Revenue Components:
- Rents -- Residential, other.
- Subsidies -- Public, private (not included in rent).

In each case, there is a planned or potential level for the component and an actual, realized level. A complete analysis should explain the discrepancy between them.

Another way of thinking about multifamily subsidized housing is to consider who is involved in the process. At a minimum, we may identify ten groups involved in almost any project: the sponsor, HUD staff, consultants, architects, building contractors, local inspection agencies, mortgage finance entity, FNMA, tenants, and management. These, in turn, are rarely single entities with consistent policies, personnel and objectives over time. Their interests do not necessarily coincide, nor do they all have the same time horizon. Yet all of them have to make choices and decisions that can affect important financial components in a project.

Looking at the composition of housing projects from different perspectives suggests a huge number of possible hypotheses about factors that affect costs and revenues. Consider, for example, the question of why a project's maintenance costs might be higher than originally planned. Furthermore, it is evident that the components are not independent of each other. For

example, ineffective management may be costly in its own right, and allow inefficiencies and higher costs of operation and maintenance, while being unable to collect rents and ensure a moderate vacancy level.

To trace through paths of causality for a multitude of factors and housing finance components is beyond the resources of this study. Therefore, we have chosen to concentrate on the outcome, financial failure and on clusters of variables that might affect a project's financial status in similar ways. These clusters do have some theoretical foundation as well as corresponding with beliefs about financial failure by housing professionals. However, the implied model of failure does not explicitly estimate causal factors affecting cost separately from those affecting revenue. The rationale for the conceptual variable grouping is presented in the remainder of this section.

Explaining Failure: Conceptual Areas

In order to reduce the research problem to manageable proportions, with the help of HUD staff we have defined eight groups of variables that might affect the financial viability of project. The groups are not completely exhaustive or unambiguous. Rather, they are intended to provide a usable and reasonably coherent framework within which to locate the large numbers of data items gathered in the survey. The assignment of operationally defined items in the sample to conceptual groups was done initially on the basis of theory and univariate analyses, and confirmed by factor analysis that, in turn, helped to redefine the conceptual groups.* Each group is discussed below with some illustrative examples of factors at work. These are hypotheses not conclusions. They form the basis for the subsequent analysis.

Locational Environment. Under this grouping are included a broad range of variables that define the setting within which a project functions. Although they are diverse, all are relevant to the critical policy decisions of where a project should be located. Since location determines the housing sub-market within which a project must survive, the principal effects here might be expected on the revenue side. It is a truism in housing marketing that the maximum rent that a unit can command depends as much on the social,

*See Phase One Progress Report, pp. 10-13.

physical and income characteristics of the neighborhood in which it is located as on the unit's physical quality. People look for access to jobs and services, the assurances of similar people and environmental quality as well as housing itself. For subsidized housing this poses a problem. On the one hand, typically a substantial proportion of tenants well able to pay their rent is desirable for financial stability; on the other hand, the programmatic objective of the housing is to serve low income people, and to do this it may be necessary to locate it where they are.

Besides generally affecting the rent levels that can be commanded in a project, the neighborhood may influence financial viability in a variety of other ways. If there are large numbers of highly competitive units, the project may find it difficult to rent up in a reasonable time and encounter revenue shortfalls due to a high vacancy rate. If a weak market is combined with adverse physical or social conditions, especially high crime rates and vandalism, tenants may be tempted to move out unless the project provides an "island" in the neighborhood. The result is a higher turnover rate and revenue loss, or else high expenses for upkeep and security. Investors, sensing risk, may require a higher return on their investment in such areas, while mortgage lenders are reluctant and demand premiums. Costs may also be driven up by difficulty in attracting stable and productive employees or managers. On the other hand, real estate taxes might be somewhat lower.

The pattern of neighborhood influences is potentially complex and tangled. But from a policy perspective, this is not the sole locational consideration. In a larger setting, projects may be affected for example by their location within metropolitan areas, by location in large or small cities and by location in different parts of the U.S. The effects of these choices on financial viability will be difficult to separate out from the neighborhood influences. Nonetheless, they should not be ignored.

Project Social Characteristics. Focusing on the project itself, we can identify several groups of influences, among them its social characteristics. Note that this grouping does not include the social class, demographic and ethnic makeup of the tenants, which are considered in a separate category. Rather, we are concerned with behavior and social functioning.

A project's social functioning can affect both revenues and costs. For example, vandalism, both outside and inside apartments, may increase

increase maintenance costs and generate increased security expenditures. It may also contribute to an atmosphere of insecurity in the project, increasing tenant turnover and causing more stable tenants to go elsewhere. Higher turnover may also be associated with non-payment of rent, delinquencies and evictions, the latter itself a costly process. Adequate social services and recreation opportunities, on the other hand, may mitigate these problems.

In summary, our concern in this group of variables is with the social climate in a project, a difficult thing to measure, but important in more than just a financial sense to success. A successful project depends to an extraordinary degree upon the implicit, often unrecognized, cooperation among tenants and between tenants and managers. If a project is characterized by mutual distrust, unwillingness to take responsibility for the collective well being, and even hostility, the results may be rent strikes, delinquency and higher costs. More importantly, this state of affairs is extremely difficult to reverse. Yet at the same time, it is necessary to be careful in interpreting social variables. An active tenant council in one situation, for example, may be evidence of the complete collapse of relations with management; in another, it may reflect a high degree of participation and cooperation, ensuring that the project provides high quality housing.

Project Physical Characteristics. Arguments have raged for years among architects and housing professionals about the role of physical design in the functioning of housing. We cannot resolve those issues, but we can consider them in relation to financial viability. Decisions about design and construction are important in the creation of a housing project. They directly affect cost, but may also have more subtle results.

Design decisions may be thought of as broad or detailed. Broad design characteristics such as project scale, gross density, apartment mix and high or low rise construction blend imperceptibly into programmatic decisions, such as tenant income and family size mix. They may affect costs directly through construction, or indirectly, through maintenance, for example, in high rise buildings where children cannot be easily supervised outside the apartment. High density with larger families suggests heavy wear and tear on public spaces, especially if recreation facilities are minimal. More subtle are issues such as the relationship of design (high rise buildings, for example) to the incidence of crime, feelings of safety and resulting

tenant instability, vacancies and security expenditures. Similarly, the questions of density, crowding, project scale and alienation leading to anti-social behavior cannot be ignored.

Detailed design characteristics, especially in the provision of amenities and interior apartment quality may significantly affect the competitive marketability of a project. If it cannot provide what tenants want, no matter how aesthetically pleasing, those who can afford to will go elsewhere. Detailed decisions about the quality and nature of materials and design of facilities may also seriously affect maintenance costs later in a project's lifetime.

These questions are intimately connected to the quality and management of construction itself. Construction delays and errors that delay rentup can cause revenue shortfalls and cost increases at a time when projects are financially most vulnerable, faced with the unavoidable necessity to meet mortgage and tax commitments. Major construction problems can be particularly disastrous to financial viability.

Design and construction decisions in subsidized housing are finely drawn compromises between cost and quality within the constraints that a project must satisfy in order to be within the subsidized rent-paying ability of its potential tenants. It might be argued that these prior constraints are the really critical decisions. Nevertheless, it remains important to see whether the variations among projects' physical characteristics do indeed contribute to financial failure.

Tenant Characteristics. Treating tenant variables separately from social characteristics is somewhat arbitrary, but nevertheless justifiable since they are a key group of people involved in any project. The focus of concern here is with tenants as individuals or family members having particular income and social characteristics. Theory about tenants in relation to financial failure is lacking, but some common sense hypotheses and many discriminatory judgments exist. Landlord's views of tenants in particular tend toward broad risk avoiding characteristics.

At the individual and family level, some connections with financial viability seem worth pursuing. Large families demand large units, often with diminishing rentals per unit of space. Children will tend to cause heavy wear and tear both on apartments and public spaces, resulting in higher

maintenance costs. This effect might be compounded by reduced parental supervision in single parent families and inadequate day-care and recreation opportunities. Elderly tenants, on the other hand, may cause little damage but need special services and have very limited incomes.

Family income should be important in two ways. Its absolute level, together with family size, sets limits to tenants' ability to pay rents and absorb necessary increases. Perhaps as important is the degree of stability of income. To the extent that low income families experience more dislocation and interruption of income due to job instability, projects serving them may be faced with higher levels of rent delinquency, vacancies and eviction costs. Welfare payments may offset this to some degree.

Much has been written about class and cultural traits in relation to behavior, especially about "problem" families. To separate such influences from the effects of income and other household characteristics is extremely difficult, however. As a proxy for culture and income, ethnicity may be considered as a potential tenant variable, though it must be emphasized that its use in this way carries no other connotations. As we shall see below, the available data on tenants is quite minimal and yields little in the way of significant conclusions.

Ownership and Financial Characteristics of Projects. The ownership and financial structure of housing projects are intimately connected, for whoever owns a project determines its financial objectives and plays a major role in their achievement. Both their goals and the effectiveness with which owners pursue them might be expected to affect the financial viability of projects.

Among housing professionals, the effect of the form of sponsorship has often been reduced to the assertion that nonprofit sponsors tend to be inefficient and "unbusinesslike" in contrast to their limited dividend competitors. Some characteristics would tend to support this view. Nonprofit sponsors have often been church related or community action groups with relatively little management experience and even less capital resources. They would tend then to suffer from poor decisions about site selection, design, construction and management leading to higher costs or reduced revenues. On the other hand, nonprofit groups may have a dedication to providing low cost housing to very low income people that is muted in limited dividend sponsors by their desire for return on investment and tax shelters.

Furthermore, limited dividend sponsors' experience in supplying housing for middle- and upper-income groups may not carry over simply to the tighter financial circumstances of subsidized projects.

To the extent that we can find variables that account for differences attributable to sponsorship, then, the explanatory power of the simple distinction will be improved upon. In particular, it should be important to examine potential causes of financial instability such as a sponsor's prior experience, degree of concern and control over day-to-day project management, and objectives for the project.

The actual financial structure of a project may also provide clues to its financial viability. Questions have been raised about the degree to which sponsors have been able to extract returns from projects through concealed methods such as inflated land costs that increase total carrying costs. Analysis should be able to reveal whether significant aggregate variations in such variables exist. Similarly, the structure of expenses should show whether, for example, nonprofit sponsors' projects tend to pay excessive real estate taxes.

Since financial failure is a process that takes time, we should also consider under this heading the efficiency with which projects have been developed and rented and the measures that have been taken to alleviate financial distress. Clearly, such variables overlap with project management and the accuracy of the initial cost and revenue estimates. These are dealt with separately below.

The case studies suggested that a critical, though elusive, element of financial success was the degree to which all interested parties, the project sponsor, tenants, management, the mortgage holder, local agencies, HUD and FNMA were significantly involved in the project's welfare and concerned about it. The absence of a sense of responsibility seemed especially evident in case histories of the path to failure. Unfortunately, we have no data that can provide proxy variables for this hypothesis in the quantitative analysis.

Project Management. Financial failure rarely occurs before a housing project has been occupied by tenants. Although it may be made more likely by prior decisions about location, design, ownership and tenancy, the operating management is the medium through which those predispositions are

translated into failure or redeemed for success. It is not surprising, then, that so many observers have focused on management as critical to the failure process.

The direct relationship of management to financial status is fairly evident. Within the financial and physical constraints of a project, good management may make a significant difference in rental aggressiveness to reduce vacancies, make rent collections prompt and curb delinquency. At the same time effective use of resources many improve maintenance and services, raising tenant satisfaction and reducing turnovers. However, the case studies have shown that we should be cautious about attributing all these virtues to a particular management style. Effective management for subsidized housing may not necessarily be identical to that for other types.

A number of management characteristics have been suggested as influencing financial status. They include experience, professionalism, continuity of management, a resident manager, and evidence of skill in allocating resources and selecting and relating to tenants. Beyond these, we might ask about the real resources and flexibility allowed to the management and the relationship between on-site manager and the financial and sponsorship entity.

A final note of caution on the role of management is in order. Because evident financial consequences flow from good or poor management, it does not necessarily follow that financial failure is thereby affected in more than a marginal way. The prior question of whether any <u>significant</u> relationship exists between management quality and failure should be asked first.

<u>HUD Programs and Processing</u>. Subsidized housing is made available through a federal government agency with all the ramifications that implies about program constraints and formal and informal processing and approval. For financial viability, the heart of this process lies in (1) the allowable subsidies, cost and rent limits, (2) the degree to which estimates of expected project costs and revenues have been accurate, and (3) the efficiency of processing.

Broad program characteristics may be subsumed into program variables (221d(3) or 236), although the form of their effects on costs or revenues can hardly be anticipated. To some extent, project participation in special programs such as Rent Supplements can improve upon the broad program variables.

To analyze accuracy of estimation, we would like to consider estimates

cost and revenue separately, together with a combined estimate of their net error. The implications for failure are quite direct, although this procedure begs the questions of why erroneous estimates may have been made and whether anything could have been done to prevent them. In one sense, estimation errors are only a cause of financial failure in a negative sense; they allow projects to be built that perhaps should not have been.

Processing inefficiencies or delays might have the same effect, for example, through inability to screen out poor sponsors. More directly, they may contribute to cost pressure through delay of approval while construction costs increase. The resulting adjustments may remove important design features and contribute to later problems.

Time. Financial failure can occur at many points in a project's lifetime. Although it may not occur with equal probability at every point, in general, the older a project becomes, the more likely it is to have failed, other things being equal. If we look at a sample of projects of different ages, then we should take account of this likelihood by including age itself as an explanatory variable. Time is also a convenient proxy for the influence of inflation on costs. The inability of low or fixed income people to generate increased incomes to match cost inflation may be a significant component of projects' financial difficulty.

Conclusion

In this brief discussion, we have considered only a small number of the potential hypotheses about failure that might be generated. However, the framework does permit us to go on to examine the quantitative information in the national sample. In the following sections, summary statistics on many of the variables discussed above are presented and their simple and multiple relationships with financial failure are examined.

III. THE MULTIFAMILY HOUSING PROJECT SAMPLE: SUMMARY INDICATORS OF FAILURE AND PERFORMANCE

In the next three sections, the results of statistical analyses of the disaggregated national sample of housing projects are discussed. We first present summary statistics on all the major variables used in the study. Next, the simple correlations between project variables and financial failure measures are examined. Finally, the simultaneous relationships between project, variables and failure, as revealed by multiple regression analysis are considered.

Data and Variables

The data gathered in the national sample were extensively discussed in the Phase One Progress Report. Despite the problems documented there, it has been possible to do a considerable amount with the available information. This section presents summary measures on the variables employed in the later analyses of financial failure. There are two objectives in looking at summary statistics. First, the description of variables and the table formats show precisely what measures are employed later and relate them to the conceptual framework. Second, the summary statistics provide insights into the nature and performance of housing projects in the sample. They are also suggestive about the quality of the data itself.

No attempt is made in this report to reproduce the extensive cross-tabulations performed by HUD staff in the original study. For this reason, as well as the problem of recovering sampling weights discussed above, all the statistics refer to the unweighted project sample, the basic data set used throughout. It is therefore necessary to be cautious in drawing direct inferences about the universe of housing projects from the sample data. Given the large size of the sample, such inferences are certainly not unwarranted. However, the additional weighting given to projects with negative cash flow should be borne in mind. This stricture does not apply to the estimates of parameters in the following sections.

Of the 660 cases collected in the national sample, 42 were outside the cutoff date, reducing the total to 618 for this analysis. Originally, 322 data items were to be recorded for each project. Because one questionnaire was used in only one-third of the cases, the total number of available data

items for all projects was reduced to a maximum of 267. Clearly, this is a huge number of variables, a problem compounded by missing data. Through the development of conceptual groups of variables identified with specific sets of data items, the number of variables actually employed in the analysis was further reduced to 91.

Each component of the analysis has been carried through for several disaggregated subsamples in addition to the sample of all projects. These include (1) disaggregation of the total sample into limited dividend and nonprofit sponsored projects, and (2) disaggregation by regions, the original sample being drawn from federal regions III, VI, and IX. Later tables also distinguish between indicators of failure using the two measures defined in Section II.

Reading the Tables. Because of the multiplicity of variables and subsamples, a single, consistent format has been adopted for the presentation of results. Each table is constructed to reflect sample disaggregation in columns. Variables, according to their conceptual groups, appear in the rows. To compare a single variable across sponsor types, regions or failure measures, one simply looks across the row. To compare variables within a subsample, look down the columns. In order to reduce the complexity of tables, only results for Region IX have been included in the body of the text.

Summary Statistics on Sample Projects

In the following tables, two types of summary statistics are shown for the financial difficulty or failure indicators and the eight conceptual groups of potential explanatory variables. For variables that were nominal (i.e., the variables state whether a given condition, such as a recreation building, was or was not present), the tables give the percentages of projects in which the condition occurred. For interval measure variables (i.e., those that might take on a range of values, such as percent annual turnover), the tables record the mean value of the variable for projects in the subsample and its standard deviation as a measure of variation around the mean.

Financial Difficulty and Failure. The incidence of alternative measures of financial difficulty or failure can be seen directly from Table 1. Each percentage in the table refers to the total of the column subsample. In contrast with a HUD national estimate of 12% of insured projects in failure as

Table 1: Incidence of Financial Failure or Difficulty Variables in the Multifamily Project Sample, by Regiona and Sponsorship

Financial Failure or Difficulty Variables[a]	All Regions			Region IX
	All Projects	Limited Dividend	Non-Profit	All Projects
	Percent of Cases in Sample			
FAILURE 1 (Foreclosure or Assignment)	7.0	3.0	13.5	7.9
FAILURE 2 (Foreclosure, Assignment or Default)	22.5	14.4	34.9	16.2
DEFAULT	21.9	13.6	34.5	15.5
NEG FLOW (Negative Cash Flow)	50.2	46.7	53.9	53.3
WAVREP (Waiver of Replacement Reserve)	13.4	11.2	18.2	12.8
PRINMOD (Modification of Principal Payments)	10.9	7.8	15.7	11.5
Sample Size[b] (N)	618[c]	342	243	198

NOTES:

[a] For full definitions of variables, see Appendix I. All variables are binary.

[b] In the sample selection, projects with negative cash flow were drawn twice as often as others in order to provide adequate representation. All incidence figures reflect this to some degree and should be used for inter-group comparisons only. In the case of NEG FLOW, only the population values will be approximately .66 of those shown.

[c] Totals include coop units.

of April 30, 1973,* the total sample shows 22% were or had been in failure at about the same date. The divergence is partly accounted for by the fact that the sample identifies as failing all projects that have defaulted or been assigned at any previous time.

As expected, nonprofit sponsored projects are consistently higher in their percentage of failures than limited dividends. It is worth noting, however, that the proportionate difference on financial difficulty variables is much less than in failure, and for negative cash flow the two groups are almost identical. (Recall that the negative cash flow percentage is inflated in relation to its true population value.) This observation is consistent with the case study finding that non-failing projects are not necessarily financially stable, and the clear incentive for limited dividend sponsors to protect tax shelters by supporting shaky projects from other funds. Region IX appears to be marginally higher in foreclosures but lower in defaults than the total sample.

The incidence of measures to offset financial problems by waiving payments to replacement reserves or principal is in every instance strikingly lower than default and failure. Apparently, the use of these responses is either denied or infeasible for many cases. Limited dividend sponsors have been able to use them proportionately much more often, however. With 14% of all their projects in default, limited dividend sponsors obtained reserve waivers for 11% of all projects; nonprofit sponsors, having 35% of projects in default, obtained waivers for only 18% of all projects in the sample. Whatever the differences in deeper causes of failure might be, nonprofit sponsors clearly were less able to obtain these particular remedies.

Locational Environment. The sample data allows us to match a substantial number of data items with the types of conceptual variables suggested in Section II above. Most of the locational characteristics** of the sample

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*Department of Housing and Urban Development, Multifamily Failures Study, 1973, p. 2, citing the HUD Research and Statistics Quarterly Report and the Housing Monthly Report.

**Discrete nominal variables that can take on three or more states have been broken down into dichotomous categories for the regression analyses. Thus, there are two regional variables, corresponding to whether a project is or is not in Region III or Region VI. Location in Region IX, the third possibility, is not treated as a variable, since it follows by elimination once the other two are known. One category is left out of each such dichotomized set of variables throughout the study.

projects are straightforward and evident in Table 2.

Variables in the upper part of the table refer to broad location characteristics. The regional distribution is somewhat weighted toward Region VI (40% of all projects), while Region III has 28% and Region IX, 32%. This imbalance is particularly noticeable for nonprofit projects, with Region VI accounting for half the total sample. As expected, within metropolitan areas, limited dividend projects are more likely to be suburban than non-profits, which are corresponding more frequently in central city core areas. About 60% of each group, though, is located in central city non-core areas. Urban renewal areas account for about 11% of all sample projects, with nonprofit sponsors almost twice as likely to be in such locations as limited dividends.

Neighborhood locational variables comprise the lower part of Table 2. On social amenities, physical environment and sense of safety in the neighborhood, a high proportion of projects received positive ratings in the surveys. Although nonprofit projects were generally somewhat lower in the proportion rated positively, the differences are not large in the light of the aggregate differences in intra-metropolitan area location.

Indicators of market conditions, on the other hand, tend to favor nonprofit sponsored projects over limited dividends. While about the same proportion of each (22%) were seen as facing insufficient market demand, significantly fewer nonprofit projects were judged to suffer from competing subsidized or conventional units. It is worth noting that in the aggregate 21% of all projects in the sample were described as located in areas of insufficient market demand while about 60% faced competition.

Comparison of projects in Region IX with all regions reveals no major differences. Even in variables such as physical environment, HUD staff in Region IX did not rate projects any more positively in the aggregate than they did in the Eastern and Southeastern regions. Presumably, the ratings are relative and might still be consistent with actual environmental differences between regions.

Social Variables. Ten data items have been selected corresponding to variables describing the social functioning of housing projects. They are both useful and limited in that they relate almost entirely to behavior or actions affecting costs and revenues directly. Indicators of the quality of community life, leadership and cohesiveness are unobtainable.

Vandalism is taken as an important indicator of the degree of concern for

Table 2: Incidence of Project Locational Environment Variables, by Region and Sponsorship

Locational Environment Variables[a]	All Regions			Region IX
	All Projects	Limited Dividend	Non-Profit	All Projects
	Percent of Cases			
REG III (Region III)	28.1	29.0	25.2	--
REG VI (Region VI)	39.8	35.2	51.2	--
CITYOTH (Non-core central city)	61.4	59.8	64.4	54.5
007 (Urban renewal area)	11.3	8.5	15.6	9.6
186 (Adequate social amenities)	88.7	87.5	89.7	90.6
187 (Good physical environment)	89.6	94.2	82.1	89.7
193 (Sense of safety)	83.7	86.9	78.5	85.5
214 (Insufficient market demand)	21.4	21.5	22.1	19.8
219 (Competing subsidized units)	61.9	65.1	54.8	63.0
221 (Competing conventional units)	55.8	63.9	42.2	65.4
223 (Conventional rents comparable)	59.7	64.3	52.6	50.9

NOTE:

[a]For full definitions of variables see Appendix I. All variables are binary.

the project's physical quality and control of behavior by residents. This variable, however, also reflects the neighborhood environment insofar as damage might be caused by non-residents. Table 3 includes three variables related to vandalism. The dichotomous VANDSEV and VANDSLT reflect HUD staff judgments about the degree of severity of vandalism in the project. In addition, the percentage of maintenance due to vandalism was also estimated. Overall, about 10% of projects exhibited severe vandalism. In 60% the problem is slight, and in the remainder, moderate. Almost twice as many nonprofit projects were seen as severely vandalized (13%) as limited dividends (7%), but the difference in the proportion of slightly vandalized projects was minor. About 7% of project maintenance expenditures (212) were estimated to be due to vandalism on average. This moderate figure should be interpreted carefully in the light of the large standard deviations for this variable, exceeding 11%. It seems probable that the variation is due partly to the vagaries of judgment and partly to the wide range of vandalism levels between projects. In this variable, too, the average for nonprofit projects substantially exceeds that for limited dividends, but the difference, 3%, is far smaller than the standard deviations of either group. Region IX again differs moderately from the total sample. Its proportion of severely vandalized projects is higher, as is the average maintenance expenditure, but the difference among means is small in relation to the variation in each group.

The remaining social variables fall into three groups. Crime and security in the projects are indexed by variables 192 and 194. Police protection was viewed as adequate in about 90% of projects, slightly lower in nonprofit cases. Crime, as measured by the number of serious crimes (felonies), showed a striking difference, with nonprofit projects averaging twice as many serious crimes in the past year. Again, Region IX differed little from the average.

Evictions and rent delinquencies provide an indication of the general state of relations between tenants and management, and to some extent, of antisocial behavior among tenants. The pattern of higher mean values for evictions for nonpayment of rent (EVICNOPY) and for antisocial behavior (EVICSOC) among nonprofit projects is again evident. On average, the latter projects evicted 5% of tenants annually for nonpayment. Standard deviations

Table 3: Summary Statistics on Project Social Variables, by Region and Sponsorship

Project Social Variables		All Regions			Region IX
		All Projects	Limited Dividend	Non-Profit	All Projects
		Percent of Cases			
VANDSEV (Severe vandalism)		9.6	7.5	13.1	11.1
VANDSLT (Slight vandalism)		60.5	59.0	62.9	56.1
192 (Police protection adequate)		87.4	90.4	84.9	90.6
	(1) mean (2) std. dev.	Means and Standard Deviations			
EVICNOPY (Evictions for non-payment/ 100 units)	(1)	3.9	3.4	5.0	3.9
	(2)	7.7	8.5	6.7	6.0
EVICSOC (Evictions for anti-social behavior/ 100 units)	(1)	1.0	0.8	1.4	0.3
	(2)	2.2	2.1	2.5	1.5
VACANCY 2 (Estimated vacancy rate)	(1)	7.5	6.7	9.4	6.4
	(2)	10.6	7.5	13.9	8.8
194 (Number of serious crimes)	(1)	1.1	0.8	1.7	0.9
	(2)	3.0	1.9	4.1	3.3
208 (Percent turnover)	(1)	23.2	25.6	24.2	22.4
	(2)	21.2	21.6	21.1	21.4
209 (Percent rent delinquencies)	(1)	4.8	4.3	5.6	4.4
	(2)	6.6	5.9	6.1	7.0
212 (Percent maintenance due to vandalism)	(1)	6.9	5.8	8.7	5.9
	(2)	12.0	11.3	13.2	13.1

NOTE:

[a]For full definitions of variables see Appendix I.

for all groups are very large. Rent delinquency (209) shows much less variation, just over one percentage point difference.

Finally, we may be able to judge some of the attractiveness of projects to tenants by looking at vacancies and turnover. In the absence of a direct vacancy measure, VACANCY 2 estimates vacancy rates from actual and potential rents. By this measure, vacancy levels were moderate on average, slightly higher for nonprofit projects and lower in Region IX. Turnover rates show virtually no differences among groups, averaging 25% annually. Though apparently high, in the light of projects' population composition, the figure may not be excessive.

Physical Characteristics. The ten variables related to projects' physical characteristics in Table 4 primarily describe broad design decisions. Little usable data or detailed design quality is available in the survey.

Project scale is reflected in the UNIT variables that indicate whether a project is in a particular scale category, and variable 013 that measures the number of units directly. The former are chiefly intended to reveal nonlinearities in relationships with failure. The latter provides a direct summary scale measure. On average, the projects are small, about 125 units, varying substantially as shown by the standard deviation, but not systematically between our categories of disaggregation. Region IX does tend to have smaller projects.

After scale, it is logical to consider density. Gross density is remarkably constant at about 28 units per acre with Region IX slightly higher. The standard deviation is almost double this figure in every category, incicating a very wide range of densities among projects. If density does indeed relate to failure, its effect should be detectable. Parking spaces per unit provide a measure both of expected auto density and amenity. They also vary little among project categories. An implicit measure of interior spaciousness (unadjusted for family size), residential floor area per unit, similarly shows much variation but little systematic difference among classes. Nonprofit projects on average have apartments smaller than those in limited dividend projects by about 3%.

Some evidence on the physical character of projects is provided by variables indicating whether projects are high rise, newly constructed (vs. rehabilitated), contain recreation buildings and provide air conditioning

Table 4: Summary Statistics on Project Physical Variables, by Region and Sponsorship

Project Physical Variables[a]		All Regions			Region IX
		All Projects	Limited Dividend	Non-Profit	All Projects
		Percent of Cases			
UNIT 1 (1-50 units)		20.0	20.6	18.5	30.5
UNIT 2 (51-100 units)		29.9	24.4	35.0	26.4
UNIT 3 (101-150 units)		19.0	21.5	16.0	21.3
UNIT 4 (151-200 units)		15.4	14.4	18.5	9.6
UNIT 5[b] (201-300 units)		13.0	16.2	9.1	8.6
009 (Low rise project)		73.6	72.1	73.9	74.2
010 (New construction)		93.6	94.4	92.1	93.4
011 (Recreation building)		27.8	21.0	33.1	38.3
018 (Air conditioning)		54.9	61.7	43.2	43.4
	(1) mean (2) std. dev.	Means and Standard Deviations			
SPACUNIT (Residential floor area/unit)	(1) (2)	862.4 409.8	854.4 358.2	824.9 380.9	858.0 386.2
UNITACRE (units/acre; density)	(1) (2)	27.7 45.2	27.8 48.4	28.7 42.9	32.5 29.4
PARKUNIT (Parking spaces/unit)	(1) (2)	1.4 1.0	1.5 1.2	1.3 0.4	1.4 1.6
013 (Number of units; scale)	(1) (2)	123.5 82.3	127.9 84.0	122.6 81.6	106.9 86.6
213 (Percent of maintenance due to construction defects)	(1) (2)	6.0 11.3	3.4 8.1	10.0 14.3	2.6 7.6

NOTES:

[a]For full definitions of variables see Appendix I.

[b]Projects larger than 300 units form the residual category.

in units. Variation in the first two are minimal. Predominantly low rise (75%) in character, almost all projects are newly constructed. A substantially higher proportion, 33%, of nonprofit projects included recreation buildings as opposed to 21% among limited dividends. Conversely, while 61% of the latter provided air conditioning, only 43% of the former did so. These figures may be affected by the regional distributions of projects in the sample. The only substantial difference in these variables between Region IX and the aggregate occurs in the prevalence of recreation buildings which were included in a surprising 38% of projects.

Our conceptual physical variable discussed in Section II was the quality and speed of construction itself. Our only indicator on this score, 213, is an estimate of the percent of maintenance costs attributable to construction defects. Allowing for variability in estimation, there does appear to be a very significant difference between nonprofit, 10%, and limited dividend projects, 3%, on this variable. It suggests a number of hypotheses that will be discussed in Section V below when we examine relationships with failure. Region IX is also very low in contrast to all projects, with less than 3% of maintenance attributed on average to construction deficiencies.

Tenant Characteristics. Although they are conceptually among the most important for project failure, the tenant related variables are the least satisfactory part of the sample. We have been able to define only five variables, and lack explicit information on family size, age composition, household structure and headship, family and household income, and occupation, employment status and social class. Table 5 contains data items that will be used.

Lacking age structure information, we can distinguish only between projects for the elderly (008) and others, presumably family oriented. Less than 10% of projects in the sample are identified as elderly (11% in Region IX), with nonprofit groups sponsoring them twice as frequently as limited dividends. Whether this reflects the problems of nonprofit sponsors with family projects or lower profitability cannot be determined a priori.

Ethnicity estimates (NONWHITE and SPANISH) are available. They are used below as proxies for income and perhaps cultural variables, although it is not necessarily true that they do in fact correlate well with other characteristics among occupants of subsidized housing. As might be expected, the mean

Table 5: Summary Statistics on Project Tenant Variables, by Region and Sponsorship

Project Tenant Variables[a]		All Regions			Region IX
		All Projects	Limited Dividend	Non-Profit	All Projects
		Percent of Cases			
008 (Elderly Project)		6.9	4.4	9.2	11.3
189 (Tenant Council)		19.0	12.7	25.5	22.6
190 (Rent Strikes)		3.7	4.6	2.7	5.9
SPANISH (More than 50% Spanish American)		5.3	2.9	9.4	5.6
	(1) mean (2) std. dev.	Means and Standard Deviations			
NONWHITE (Percent in project)	(1)	49.9	40.3	65.9	40.0
	(2)	39.0	37.0	37.4	34.7

NOTES:

[a]For full definitions of variables see Appendix I.

proportion of nonwhite tenants is substantially higher (66%) in nonprofit projects than in limited dividends (40%). Variation in all groups is substantial, with standard deviations of 35%. In Region IX the nonwhite sample percentage is lower than among all projects. Even the proportion of Spanish American tenants is very little higher, a result no doubt of the inclusion of Region VI with Texas in the sample.

The remaining two variables (189, 190) might also have been included among those describing project social characteristics. Here, we view them as indicators of the degree of tenant involvement and militancy. On average, about 20% of projects have tenant councils. For those with nonprofit sponsors the figure is higher, 26%; for limited dividend projects, lower, only 13%. Perhaps surprisingly, however, we find a reversal of this pattern in rent strikes. While strikes had occurred under 3% of the nonprofits, almost 5% of limited dividend projects experienced them. These figures are not trivial and may reflect differences in management styles that do not show up in other statistics. Region IX exhibited an even higher level of rent strikes, on average almost 6%. We have no interpretation for this figure.

Ownership and Financial Characteristics. Numerous data items corresponding to ownership and financial characteristics of projects are available in the sample. Eighteen have been selected or constructed for use in this analysis. They fall into two broad categories, those describing the nature and capabilities of sponsors, and those dealing with projects' financial structure and performance.

In the sample as a whole, Table 6 shows that about 40% of projects had nonprofit sponsors, 55% were limited dividends and the remaining 5% were coops. Little aggregate data descriptive of the sponsors themselves is available. Experience, as measured by the fact that a sponsor had had prior HUD projects (179) is less common than might have been expected. Less than half of all projects were sponsored by groups with this type of experience. The difference between nonprofit and limited dividend sponsors on this variable is substantial, 33% to 58%, but even among the latter it is not that high.

One variable (177) does suggest in a limited way the degree to which sponsors have a direct stake and interest in their projects. In about 53%

Table 6: Summary Statistics on Project Ownership and Financial Variables, by Region and Sponsorship

Project Ownership and Financial Variables[a]		All Regions			Region IX
		All Projects	Limited Dividend	Non-Profit	All Projects
		Percent of Cases			
NONPROF (Non-Profit Sponsor)		39.4	--	100.0	29.1
COOP (Cooperative Sponsor)		5.0	--	--	8.7
022 (Project had consultant)		25.2	4.9	51.1	24.2
177 (Sponsor owns management entity)		52.6	72.0	25.7	60.3
179 (Experienced sponsor)		47.3	58.1	33.0	49.1
182 (Project manager employed by sponsor)		42.7	54.5	36.5	48.6
	(1) mean (2) st. dev.	Means and Standard Deviation			
COSTUNIT (Replacement cost/unit, $,000)	(1)	16.02	16.32	15.40	16.82
	(2)	3.19	3.21	3.04	3.36
LAND (Land cost % of total replacement cost)	(1)	8.2	9.1	6.6	12.3
	(2)	8.5	9.3	6.9	11.7
ADMIN (% of expenses administrative)	(1)	19.6	20.5	19.3	20.9
	(2)	9.6	10.5	8.3	9.8
MAINT (% of expenses for maintenance)	(1)	14.9	14.2	15.1	16.2
	(2)	10.4	9.7	10.0	11.2
TAX (% of expenses for real estate taxes)	(1)	26.9	28.7	22.4	34.7
	(2)	14.5	16.0	10.1	16.0
OPERAT (% of expenses for operating costs)	(1)	34.7	34.9	35.4	30.8
	(2)	13.0	13.3	12.7	14.0
RENTSQFT (Rent/residential square foot, $)	(1)	1.91	1.85	2.02	1.92
	(2)	0.59	0.50	0.62	0.62
FIRSTINC (% first rent increase)	(1)	12.2	13.7	10.4	16.9
	(2)	82.5	83.0	84.4	104.6
REPLAC(Replacement reserve % of COSTUNIT)	(1)	64.6	58.1	67.1	69.3
	(2)	118.9	73.2	162.4	71.6
ACCREIV (Account receivable % of rent)	(1)	2.1	1.8	2.4	2.4
	(2)	4.3	5.1	3.1	6.4
DEFIUNIT (Revenue less expense/unit, $)	(1)	578.6	531.3	627.0	596.4
	(2)	401.5	425.6	382.7	374.1
225 (Months to 75% occupancy)	(1)	5.7	5.6	6.0	3.9
	(2)	5.6	6.2	4.6	7.6

NOTES:

[a]For full definition of variables, see Appendix I.

of projects, the sponsor owned the management entity, this proportion being much higher for limited dividend sponsors with 77%, contrasted to 26% for nonprofits. The tight relationship that ownership implies may signify more effective involvement in a project's fate. It is also consistent, however, with efforts to increase returns by manipulating management finance. In Region IX, the sponsor owns the management entity in 60% of cases, compared to 53% in the total sample. The difference is precisely accounted for by the fact that Region IX has a higher proportion of limited dividend cases.

The financial variables in the lower section of Table 6 cover project costs, the distribution of expenses, rents and rent increases, revenue sufficiency and effectiveness in rent-up. Mean total cost per unit in the sample, as measured by replacement cost, was about $16,000, unadjusted for apartment size mix. The standard deviation about this figure was quite small, though still larger than the differences between means of subsamples. Nonprofit units were on average about $900 cheaper than those in limited dividends, a difference perhaps attributable to larger numbers of small elderly units among the former. Costs in Region IX tended to be somewhat higher than the average.

A second cost variable shows the percentage of total cost attributable to land. With substantial variation, limited dividend projects had a higher mean share for land, 9%, than nonprofits with 7%. In Region IX the share is higher still, on average, more than 12%. Given the effect of land costs on mortgage carrying charges, these variations seem worth pursuing.

The percentages of expenses other than debt service and return on investment going to administration, maintenance, local real estate taxes and operating costs show very large variations among projects, but little consistent difference between categories. Overall, about 20% of expenses go for administrative costs, 15% for maintenance and 35% for operations. Taxes account for 27% of expenses, with limited dividend projects tending to spend a larger share, 29% than nonprofits, 22%. Despite claims that the latter do not take advantage of all the tax advantages that they might enjoy, they do seem to spend a lesser share, on average, for taxes. Region IX shows little difference from the total sample on these variables, except in its considerably higher proportion going to local taxes.

Rents and rent increases exhibit opposite tendencies. Controlled by

program constraints, rent per square foot is relatively uniform across projects at $1.90. Nonprofit projects tended to have higher rent per square foot than limited dividends, possibly due to apartment size mix. First rent increases indicate the degree to which sponsors were able or willing to use this means to maintain financial stability. The mean first increase was 12%, limited dividends being higher with 14%, and nonprofits lower with 10%. The degree of variation in percentage first increases is extremely large, suggesting that this variable should be approached with caution.

Some measure of the financial leeway of a project is given by the DEFIUNIT variable, measuring the average net revenue per unit after expenses other than debt service and return on investment. Perhaps the most striking feature of this variable is the substantially higher average figure for nonprofit projects, $627, as against $531 for limited dividends. Even though the variation among projects is large, size of the difference is surprising and difficult to interpret.

Finally, variable 225 records the number of months needed to achieve 75% occupancy in a project from the beginning of rental. The average was about six months, slightly higher for nonprofit projects and much lower in Region IX.

Project Management Variables. Since management is commonly seen as critical to the success of projects, it is important to have operational variables that describe its character and performance. Unfortunately, we have no variable that can suggest the kinds of differences between conventional and community oriented management styles discussed in the case studies. However, several variables do provide ratings of management quality, and characteristics of management itself.

In the sample survey, HUD staff were asked to rate the quality of management in each project. The results appear in Table 7. Three quarters of the projects in almost every category were evaluated as having medium quality management. Less than 20% were rated good, and the remaining 10% or so, poor. Between limited dividend and non-profit sponsored projects, there is very little difference on these variables, the former having a marginally larger proportion rated medium or good. How accurate or consistent a rating procedure was used is not known.

Table 7: Summary Statistics on Project Management Variables, by Region and Sponsorship

Project Management Variables[a]	All Regions			Region IX
	All Projects	Limited Dividend	Non-Profit	All Projects
	Percent of Cases			
QUALHI (Quality of management high)	16.6	17.7	16.1	18.8
QUALMED (Quality of management medium)	74.8	76.8	71.7	69.9
MANGEXP (Manages more than one project)	60.3	71.5	42.2	67.3
021 (Supplemental management fund)	4.0	2.4	4.4	5.6
142 (Professional manager)	75.6	80.1	67.3	79.2
175 (Single management since occupancy)	79.1	85.5	71.7	76.4
183 (Resident manager)	69.6	72.1	65.2	84.4
188 (Formal tenant screening)	83.9	81.2	86.2	89.7

NOTES:

[a]For full definitions of variables, see Appendix I.

Less subjective are the variables describing management characteristics. Management was carried on by professionals in 76% of all projects. This proportion was as high as 80% for limited dividends, but only 67% for nonprofits. A similar difference is visible in the degree to which managers have experience. Among limited dividend projects, some 72% of management entities look after more than one project. For nonprofits, this is true only in 42% of the cases. If experience and professionalism do matter, then the difference could affect the relative incidence of failure.

The pattern of a lower proportion of nonprofit projects having management characteristics that might normally be seen as positive extends to some indicators of the style of management itself. Resident managers are found in about 70% of all projects. They are slightly fewer for nonprofits, and substantially more common in Region IX. Management continuity (175) may be an important indicator both of involvement of management with a project and of successful operation. It shows a considerable difference according to form of sponsorship, but little by region. A formal tenant screening procedure, on the other hand, appears to be more frequent in nonprofit projects.

The management variables should allow us to investigate some important hypotheses about the influence of management on financial failure, notably those concerning professionalism, resident managers and continuity. Although, as in other conceptual groups, they are not all that we might desire, most of them do show variation and have fairly clear operational meanings.

HUD Program and Processing Characteristics. Since much of the information in the survey was gathered from HUD files, the variables in this category are quite numerous. They describe the program category, measures of accuracy in cost and revenue estimation, and various aspects of the processing of projects.

The distribution of program categories appears in Table 8. Not shown is the residual category, 221d3BMIR. Rent supplement projects were more frequent among nonprofit sponsors, as might be expected, while BMIR and 236 projects dominated in limited dividends. This difference in mix was reflected also in the percentage of units eligible for rent supplements (RENTSUP2). However, the latter variable is a source of financial stability inasmuch as the deeper subsidy offsets the probable lower income of nonprofit project tenants.

Table 8: Summary Statistics on HUD Programs and Processing Variables, by Region and Sponsorship

HUD Program and Processing Variables		All Regions			Region IX
		All Projects	Limited Dividend	Non-Profit	All Projects
		Percent of Cases			
PROGRS (Program 221d 3RS)		22.0	13.2	37.0	13.1
PROG236 (Program 236)		47.2	53.2	41.2	55.1
INSPGOOD (Last annual inspection good)		68.7	78.0	53.7	75.0
INSPFAIR (last annual inspection fair)		20.8	13.5	32.1	16.3
MISS141 (Information of replacement reserve missing)		33.3	30.2	37.0	30.8
228 (HUD technical assistance adequate)		87.8	87.5	87.9	81.0
	(1) mean (2) st. dev.	Means and Standard Deviations			
PREVEST (Actual less estimated as % of est. revenue)	(1) (2)	-9.2 207.9	-18.8 29.7	4.8 323.1	16.8 303.9
PCOSTEST (Actual less estimated costs as % of est. cost)	(1) (2)	4.7 96.7	0.8 67.0	-1.1 57.0	4.7 65.4
PTAXEST (Actual less estimated taxes as % of est. taxes)	(1) (2)	-11.7 155.6	1.2 206.1	-29.3 41.8	-23.8 65.3
PPROFEST (Actual net revenue less estimated net revenue as % of est. net revenue)	(1) (2)	-40.0 110.3	-40.6 66.8	-39.2 154.1	-30.8 63.8
PROCTIME (Processing time, months)	(1) (2)	19.7 7.9	19.7 7.2	19.1 8.0	19.2 7.1
RENTSUP2 (Percent rent supplement units)	(1) (2)	18.7 31.8	13.7 27.2	26.8 36.4	19.0 32.5

NOTES:

[a]For full definition of variables, see Appendix I.

Accuracy in estimation of costs has been a continuing concern of HUD staff. The figures given in Table 8 do not reflect recent changes in regulations on cost estimation designed to avoid earlier problems. Nevertheless, they are important both to demonstrate the quality of estimates in aggregate and their relationship to project failure. Each variable has been constructed as a measure of the percentage by which the original estimate was in error when compared to the actual figures in the first year of operation.

Of the four estimation variables, the first three deal with cost or revenue components, and the fourth provides a net measure of overall estimation. Revenue estimates (PREVEST) illustrate very well the aggregate characteristics of these variables. While mean percentage errors were quite small, being less than 20%, the standard deviations are large, indicating very large differences among projects with positive errors balancing the negative. Contrary to expectations, the mean errors are not negative for all categories. Although the difference is probably not statistically significant, nonprofit projects on average tended to have less error in their estimates than limited dividends. However, a very striking difference occurs in the sign of the standard deviations on this variable. Limited dividend projects show much less variation in estimation accuracy than nonprofits. The patterns here are puzzling and suggest that we use these variables carefully.

Cost estimates (PCOSTEST) on average were even closer than those for revenue, and their standard deviations, though large, were also smaller. Again positive and negative errors are cancelling each other out in the calculations of the mean.

Tax estimates (PTAXEST) do show some interesting patterns. Even though we saw in Table 6 that nonprofit projects paid a lower proportion of expenses in taxes than did limited dividends, nevertheless, the former underestimated taxes on average by about 30% compared to a mean 1% over-estimate for the latter. The pattern of standard deviations in this instance is the reverse of that for revenue estimates.

These mean values for revenues and costs individually show positive and negative errors to be substantial and mutually cancelling. But for analyzing financial viability, we need to put the two together in a net revenue estimate. This variable (PPROFEST) shows a pattern of underestimation by about 40% on average. Although the standard deviations are still large, the

consistency of this variable suggests that it may be significant for failure.

The remaining variables are related to HUD processing and operations. The results of the latest physical inspection should be looked at in conjunction with the physical condition variables. Few projects are rated poor, though nonprofit projects tend to come off worst. Variable 228 evaluates the adequacy of HUD technical assistance as being quite uniformly high. Time in processing, another potentially important influence on failure, was also very similar among categories. Processing from receipt of the application for mortgage insurance to permission to occupy took about 19 months on average, with a considerable variation among projects. Finally, a limited proxy for HUD's effectiveness in keeping information on the project up-to-date in its files, we have asked whether information on the replacement reserve balance, an important source of supplementary short-term funds, was available. In more than 30% of the cases, it was not.

Time. The final conceptual cluster of variables deals with time. Because the sample contains projects that were built at different times, it is important that their age variation be taken into account in any attempt to explain failure. This has been done with an intervalized age variable. The dichotomous categories should indicate whether non-linear age effects are present. We have not separately included a time-dependent inflation variable. The distribution of projects in Table 9 shows most to be four years old or less in 1973, evidence of the great program volume in 1969-72. If inflation were working against older projects, its effect should be picked up by the age variable. Differences in age structure among categories are quite minor, although both nonprofit sponsors and Region IX show somewhat larger proportions in the residual category (shown) of six years or more.

Conclusions

Descriptive tables are both suggestive and frustrating. They provide an overview of the data and variables according to a variety of disaggregations. And they do give rise to suggestive hypotheses. Nevertheless, they are always partial, providing at most a two- or three-dimensional perspective on the complex relationships with which we are concerned. Furthermore, relationships that seem strong when we look at summary statistics may be much weaker when the variation among individual projects is taken into account. For these reasons, other ways of looking at relationships are employed in the next two sections.

Table 9: Distribution of Project Ages in Sample, by Region and Sponsorship

Project Age Variables	All Regions			Region IX
	All Projects	Limited Dividend	Non-Profit	All Projects
	Percent of Cases			
AGE 1 (Age of project from initial occupancy, 1 year or less	3.5	3.0	4.0	5.0
AGE 2 (2 years)	37.8	40.8	35.2	41.2
AGE 3 (3 years)	23.7	25.3	23.6	21.8
AGE 4 (4 years)	17.6	16.6	19.6	13.4
AGE 5 (5 years)	8.9	9.8	7.5	5.9
AGE 6 (6 years or greater)	8.5	4.5	11.1	12.7
TOTAL	100.0	100.0	100.0	100.0

IV. CORRELATES OF FAILURE

Having selected a number of explanatory variables on theoretical grounds and identified the best operational equivalent that the sample provides, we now wish to find out how far those variables are empirically associated with financial failure. To begin with, only the simple pairwise relationships between measures of failure and each variable discussed previously are considered. To measure the degree of association, we will use the simple coefficient of correlation, r, that provides a quantitative estimate of the extent to which any two sample variables tend to vary systematically together. The correlation coefficient is a widely used conventional measure of association. However, because many of the variables in the project sample are dichotomous, some statistical properties of this measure are not necessarily realized. Nonetheless, we have deliberately chosen to use it for reasons that are discussed further in Section V.

The aim of this section is to present the pairwise correlations, to identify variables that strongly correlate with failure, and to interpret them in the light of theoretical expectations. Since the correlations measure only the degree to which statistical association occurs between two sets of numbers, it is entirely up to the interpreter of the data to decide whether they have meaning. Among the tests that might be used for this purpose, theory is foremost. Do we have reason to hypothesize that any two variables will in fact be associated? If so, then the observed degree of association may be interpreted in the light of our expectation. We are not looking simply for high degrees of association. As was pointed out in the Phase One Progress Report, correlations between two variables may be spurious and due only, for example, to the fact that each is independently correlated with some third factor. Nothing in the numbers themselves can tell us about the existence of such spurious correlations or about causation between variables.

The coefficients do provide two kinds of information. First, the size of the coefficient ranging from -1 to +1 indicates the strength of association. Coefficients close to zero imply little association; those close to -1 or +1 suggest a strong association. Perfectly correlated variables, in the sense that once the level of one is known, the other could be exactly predicted, would have coefficients of exactly one, either plus or minus. A

second kind of information is given by the sign of the correlation coefficient. A positive correlation indicates that the association between the variables is direct; that is, as one increases so does the other. A negative correlation indicates an inverse relationship; as one increases, the other decreases.

Thus, in applying theory or prior knowledge to the interpretation of correlation coefficients, there are two kinds of questions to be asked: (1) Is the degree of association strong or weak in the light of expectations? (2) Is the direction of the relationship, i.e., its sign, in conformity with our hypotheses? It is often hard to say much about the expected strength of relationship, other than to assert that it should or should not exist. Statistically, the square of the correlation coefficient (r^2) measures the proportion of variation in one variable that can be explained or predicted by variation in the other. For dichotomous variables, however, the construction of the coefficient will tend to give lower values than would be the case for interval measure variables. Small coefficients should therefore not be rejected out of hand. For the direction of relationship, there is usually a reasonable basis for hypothetical expectation and a sign test is commonly employed. In addition to looking at the size of the coefficient and its sign, we will also look for consistency or systematic variations across subsamples as indicators of a variable's behavior and significance.

Once again, this section is organized around a set of tables, using the conceptual framework described earlier. The first table deals with correlations among measures of financial difficulty and failure. Subsequent tables show correlations between the variables according to conceptual grouping and two measures of failure, for the whole sample and subsamples.

Correlation Among Measures of Financial Difficulty and Failure

In Section II, it was suggested that two measures of financial failure would be employed, FAILURE 1,* which indicates that the mortgage on a project has been foreclosed or assigned, and FAILURE 2, for projects that have been in foreclosure, assignment or default. Rather than using this overlapping definition, we might have employed default status as a second variable. However, Table 10 indicates that to have done so would make little difference. The correlations between DEFAULT and FAILURE 2 are everywhere greater than

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*In the tables and subsequent text, we will use F1 and F2 as abbreviations for failure variables.

Table 10: Simple Coefficients of Correlation (r) Between Alternative Failure Measures and Financial Difficulty Variables, by Region and Sponsorship

Financial Difficulty Variables[a]	All Regions						Region IX	
	All Projects		Limited Dividend		Non-Profit		All Projects	
	F1[b]	F2	F1	F2	F1	F2	F1	F2
DEFAULT	.48	.98	.35	.98	.53	.99	.65	.98
NEG FLOW	.14	.19	.03	.14	.22	.26	.04	.04
YRSNEG	.12	.16	.09	.14	.19	.23	.04	.07
WAVREP	.22	.35	.12	.30	.25	.39	.20	.28
PRINMOD	.24	.40	.16	.37	.26	.39	.22	.31

NOTES:

[a]For full definitions of variables see Appendix I or Table 1 above.

[b]F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment or default.

.98. To all intents and purposes, then, these are the same variable.

The correlations between F1 and DEFAULT are essentially equivalent to those between F1 and F2. Although large for dichotomous variables, ranging from .35 to .53, they are small enough to confirm the separate treatment of the two failure measures. Some variation among subsamples is visible, the correlation being higher for Region IX and nonprofit projects and lower for limited dividends.

The remaining variables in Table 10 all indicate financial difficulty. Several characteristics are visible in this table that will be found again elsewhere. We would expect financial difficulty and failure to be positively correlated, and indeed all coefficients are greater than zero. Everywhere, correlations with F2 are higher than with F1. However, the coefficients are not strikingly large, and in some instances the variables are essentially uncorrelated with failure. This appears to be the case, for example, for negative cash flow (NEGFLOW) in Region IX. Apparently, while failure projects experience cash flow problems, so do others. On the whole, the difficulty measures that indicate response (WAVREP, PRINMOD) are more highly correlated with failure than is negative cash flow.

Variations among subsamples also show patterns that appear later. Correlations for nonprofit projects are everywhere higher than those for limited dividends. On the other hand, with the exception of default, Region IX exhibits lower correlations than do all regions combined.

Overall, these coefficients should warn us that high correlation coefficients are unlikely in this data. If among such closely related variables none explains more than 16% of the variation in incidence of failure (i.e., no r is greater than .40), we should not expect that more remote individual variables will do much better.

Correlates of Failure

The rest of the tables in this section present correlations between F1 and F2 and potential explanatory variables by conceptual groups.

Locational Environment. The first five locational variables in Table 11 cover regional and metropolitan location. While we have no *a priori* hypotheses about regional location, we would expect non-core locations to correlate negatively with failure while urban renewal areas correlate positively. In fact, none of the variables correlates with failure very much.

Table 11 : Simple Coefficients of Correlation (r) Between Alternative Failure Measures and Project Location Variables, by Region and Sponsorship

Project Locational Environmental Variables[a]	All Regions						Region IX	
	All Projects		Limited Dividend		Non-Profit		All Projects	
	F1[b]	F2	F1	F2	F1	F2	F1	F2
REG III	-.04	.08	-.03	.18	-.03	-.01	--	--
REG VI	.01	.02	-.06	-.06	-.02	.02	--	--
SUBURB	.02	-.01	-.03	-.02	.12	.09	.05	.06
CITYOTH	-.06	-.03	-.02	-.01	-.13	-.10	-.09	-.17
007 (Urban renewal area)	.05	.11	-.05	.09	.07	.10	.11	.20
186 (Adequate social amenities)	-.08	-.05	.01	-.01	-.17	-.10	.03	-.03
187 (good physical environment)	-.21	-.18	-.22	-.14	-.15	-.13	-.20	-.24
193 (Sense of safety)	-.18	-.17	-.14	-.16	-.19	-.16	-.44	-.41
214 (Insufficient market demand)	.11	.08	.04	.08	.17	.11	.18	.25
219 (Competing subsidized units)	.00	-.06	.06	.02	.00	-.10	-.01	-.09
221 (Competing conventional units)	-.08	-.11	-.02	-.01	-.05	-.07	-.17	-.27
223 (Conventional rents comparable)	-.07	-.06	-.05	-.02	-.06	-.07	-.07	-.18

NOTES:

[a] For full definitions of variables see Appendix I or Table 2 above.

[b] F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment or default.

While the signs do largely conform to expectations, with the exception of suburban locations for nonprofit projects, virtually all the coefficients are too small to matter. On the basis of an admittedly arbitrary lower limit of .10, only the urban renewal variable would appear to be interesting, and that variable shows little consistency or pattern across subsamples. On the whole, this set of variables cannot be expected to explain failure very much.

Variables describing the physical and social environment of the project (186, 187, 193) do somewhat better. Since all are expressed positively (e.g., good physical environment), we would expect them to correlate negatively with failure, and they do in almost every instance. This consistency is reinforced by somewhat larger coefficients, especially for physical environment and safety. Differences between failure measures are small for these variables, with no particular pattern. The same holds for sponsor type. Region IX, however, does show a strong correlation on the safety variable.

Economic market condition variables (214, 219, 221, 223) show very little correlation with failure. While insufficient market demand does seem related to failure for nonprofit projects and in Region IX, the remaining variables have correlations close to zero and in the case of competing conventional units, the signs are negative. The consistency of signs for variables 221 and 223 suggest that the negative effect of competition is outweighed by the benefits in finding and keeping stable tenants that come from locations in neighborhoods where conventional units exist. Contrary to expectations, the existence of competing subsidized units shows virtually no relationship to failure.

Overall, the locational variables exhibit substantial consistency and mixed levels of association with failure. Neighborhood physical and safety factors do appear correlated. Broader locational indicators and market conditions, as measured by the sample data, are only modestly correlated with failure. Among the latter, the coefficients do suggest opposing tendencies, but we should not expect them to be more than marginal. The definition of failure makes little difference here, nor does sponsorship, but Region IX does tend to show higher correlations.

Project Social Characteristics. Correlations between failure and variables describing the social functioning of projects appear in Table 12.

Table 12 : Simple Coefficients of Correlation (r) Between Alternative Failure Measures and Project Social Characteristics, by Region and Sponsorship

Project Social Variables[a]	All Regions						Region IX	
	All Projects		Limited Dividend		Non-Profit		All Projects	
	F1[b]	F2	F1	F2	F1	F2	F1	F2
VANDSEV	.21	.23	.16	.16	.22	.27	.44	.42
VANDSLT	-.02	.04	-.03	.05	-.04	.00	-.18	-.21
EVICNOPY	.07	.14	.01	.05	.11	.27	.20	.12
EVICSOC	.14	.07	.17	-.01	.07	.09	.44	.37
VACANCY 2	.31	.35	.13	.29	.35	.35	.55	.47
192 (Adequate police protection)	-.17	-.18	-.13	-.11	.20	-.24	-.27	-.29
194 (Number of serious crimes)	.18	.24	.20	.24	.13	.22	.30	.36
208 (Percent turnover)	.14	.12	.08	.09	.18	.16	.22	.13
209 (Percent rent delinquencies)	.17	.27	.16	.21	.21	.29	.35	.24
212 (Percent maintenance due to vandalism)	.20	.27	.11	.28	.22	.21	.47	.28

NOTES:

[a] For full definitions of variables see Appendix I or Table 3 above.

[b] F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment or default.

Vandalism (VANDSEV, VANDSLT, 212) shows a substantial correlation with failure. As expected, severe vandalism and vandalism related maintenance are both quite strongly positively correlated, most coefficients being above .20. Slight vandalism has negative but generally low correlations. Little consistent difference in these variables occurs with failure status. but nonprofit projects and Region IX both show generally higher correlations than their counterpart categories.

Crime and security within projects (192, 194) are also quite strongly correlated with failure with consistent and opposite direction of relationship. The positive correlation of failure in nonprofit projects with police protection is inexplicable. Sponsorship does not make much difference to these correlations. But in most instances, F2 correlates more strongly, and coefficients for Region IX are again everywhere higher than for the whole sample.

Tenant-landlord relations and behavior, reflected in evictions for nonpayment or antisocial behavior (EVICNOPY, EVICSOC) and delinquencies (209), show a more varied pattern. While the direction of relationship is positive, the size of coefficients jumps about from category to category in no clear way. Among the variables in this group, rent delinquency shows the strongest relationship with failure, especially for F2. Correlations for nonprofit projects tend to be higher than those for limited dividends, and the same is true for Region IX in relation to the whole sample.

Finally, project stability, as evidenced by vacancies and turnover (VACANCY 2, 208) has among the highest correlations with failure of any variables in the study, especially for nonprofit projects and Region IX. The direction of relationship is consistent with expectations in every case. Except in Region IX, the coefficients tend to be higher for F2 than F1.

Social variables correlate strongly with failure in the sample. Although not absolutely large, the coefficients of correlation behave consistently and are high for dichotomous variables. We can anticipate that this group of variables does reflect some important factors at work.

Project Physical Characteristics. Although there are many hypotheses about the relation of physical design to project performance, the correlations between these variables and failure are disappointing. Of the 112 coefficients reported in Table 13, only 19 exceed .10 and only 4 are greater than .20.

Table 14 : Simple Coefficients of Correlation (r) Between Alternative Failure Measures and Project Physical Characteristics, by Region and Sponsorship

Project Physical Variables[a]	All Regions						Region IX	
	All Projects		Limited Dividend		Non-Profit		All Projects	
	F1[b]	F2	F1	F2	F1	F2	F1	F2
SPACUNIT	.01	.00	.10	.06	.01	.00	.10	.06
UNITACRE	-.01	-.01	.00	-.04	-.03	.01	-.04	-.05
PARKUNIT	-.03	-.04	-.04	-.07	.00	.06	-.04	-.05
UNIT 1	-.02	-.07	.00	-.02	-.03	-.10	-.11	-.11
UNIT 2	.01	.04	-.02	.03	-.01	-.01	.05	.09
UNIT 3	.05	-.04	.01	-.05	.13	-.01	.14	-.02
UNIT 4	.01	.05	.08	.03	-.06	.04	-.02	.06
UNIT 5	-.03	.00	.03	.02	.01	.02	-.02	.01
009 (Low Rise project)	.01	-.07	.03	-.13	.01	-.02	.04	.09
010 (New construction)	-.09	-.04	-.04	-.02	-.11	-.04	.07	-.07
011 (Recreation building)	-.08	.00	-.04	-.08	-.14	.00	-.10	-.02
013 (Air-conditioning)	-.01	.07	-.01	.00	-.01	.15	.02	.08
018 (No. of units)	.00	-.01	-.04	-.01	.10	.08	.03	-.07
213 (Percent of maintenance due to construction defects)	.19	.19	-.02	-.01	.21	.20	.22	.27

NOTES:

[a]For full definitions of variables see Appendix I or Table 4 above.

[b]F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment or default

Project scale (UNIT, 018) and density (UNITACRE, PARKUNIT, SPACUNIT) are all very weakly related to failure. No significant conclusions can be drawn, although there does seem to be a very weak negative association of failure with small projects of 50 units or less.

Physical characteristics (009, 010, 013) are similarly uncorrelated with failure. Some tendency towards a negative association between failure, new construction and recreation buildings is perceptible, but again all the coefficients are very small.

The only interesting exception in this group of variables is 213, the percent of maintenance attributable to defects in construction. For the total sample, and the nonprofit and Region IX subsamples, this variable shows a correlation of about .20 with both definitions of failure. In contrast, the correlation for limited dividend projects was very small and negative. This finding seems to support the earlier comments about the significance of the difference in mean values for this variable between sponsor types. It also suggests that quality of construction may mean more than design for financial viability.

Physical and design variables do not appear to correlate well with financial failure. Whatever their significance for success of housing or other dimensions of performance, in the gross form measurable in the sample, they do not seem to make much difference. No do region, sponsor type or definition of failure. Construction defects, on the other hand, with their direct impact on costs, do appear to be related to failure.

Tenant Characteristics. Because we have so few variables describing tenants, and because those that we have may be proxies for other things, correlations with failure need to be interpreted carefully. Although the coefficients are small, the correlations between elderly tenants (008) and failure are consistently negative, matching expectations. Ethnicity is more complex. While the percentage of nonwhite tenants correlates positively and quite strongly with failure, we do not know how much of this correlation might be due to other characteristics of projects in which nonwhite tenants are concentrated or other economic and social characteristics of the tenants themselves. Certainly, the correlation does not hold up for the percentage of Spanish-American tenants. The latter shows no correlation overall, and reverses itself from positive in Region IX to negative for nonprofit projects.

Table 14: Simple Coefficients of Correlation (r) Between Alternative Failure Measures and Project Tenant Variables, by Region and Sponsorship

Tenant Variables[a]	All Regions						Region IX	
	All Projects		Limited Dividend		Non-Profit		All Projects	
	F1[b]	F2	F1	F2	F1	F2	F1	F2
NONWHITE (%)	.14	.20	.10	.14	.08	.13	.25	.24
SPANISH (%)	.00	.05	-.03	.10	-.04	-.04	.12	.10
008 (Elderly project)	-.02	-.05	-.04	-.04	-.04	-.11	-.11	-.10
189 (Tenant council)	.06	.18	.06	.14	.03	.14	.21	.19
190 (Rent strikes)	.09	.07	.05	.08	.18	.11	.12	.04

NOTES:

[a] For full definitions of variables see Appendix I or Table 5 above.

[b] F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment or default.

The variables associated with tenant involvement (189) and militancy (190) are in every case correlated positively with failure. Whether they might be a cause or a response remains indeterminate. The size of the coefficients is surprisingly variable and shows little consistency. The higher incidence of rent strikes in limited dividend projects, noted in Section III, is not reflected in the correlation coefficients.

Overall, the tenant variables that we have do correlate with failure, but their interpretation remains cloudy. Little consistency in differences between sponsor types or failure definitions can be seen in this data. Correlations with failure are again higher in Region IX.

Ownership and Financial Variables. In this category are those variables that describe the nature and capabilities of sponsors and those reflecting financial structure and performance of projects. Sponsor type itself is a major category of disaggregation in this study. The reason is evident in Table 15. Nonprofit sponsorship is indeed positively correlated with failure, though rather less so than a number of other variables that we have considered, many of which themselves may be correlated with sponsor type. The two sponsor characteristics that impinge on management (177, 179) both exhibit moderately negative correlations with failure. Especially for limited dividends, experience and sponsor-management identity are negatively associated with failure. For nonprofit sponsors, however, the correlation of experience with failure is inexplicably near zero or positive.

Few of the financial variables in Table 15 show high correlations with failure, even by the standards applicable to dichotomous variables. Cost per unit and percentage of cost attributable to land are both negatively associated with failure for the most part. The percentage of expenses going to local taxes is similarly negatively correlated. These rather surprising correlations should give us pause.*

Rents and rent increases also show quite mixed correlations, with sharp variations between sponsor types. The percentage first increase is positively correlated with failure, especially for nonprofits, suggesting that whatever the significance of that response to financial difficulty, it is too little or too late for failing projects.

The single financial variable that correlates consistently with failure

*The very high correlation of REPLAC with failure for limited dividend projects is almost certainly a chance result.

Table 15 : Simple Coefficients of Correlation (r) Between Alternative Failure Measures and Project Ownership and Financial Variables, by Region and Sponsorship

Ownership and Financial Variables[a]	All Regions						Region IX	
	All Projects		Limited Dividend		Non-Profit		All Projects	
	F1[b]	F2	F1	F2	F1	F2	F1	F2
NONPROF	.21	.24	--	--	--	--	.21	.31
COOP	-.06	-.04	--	--	--	--	-.09	-.09
COSTUNIT	-.05	-.02	-.02	-.05	.00	.08	-.12	-.11
LAND	-.01	-.08	.00	-.04	.05	-.05	-.09	-.06
ADMIN	-.05	-.12	.02	-.14	-.12	-.13	.05	-.01
MAINT	.04	.00	.16	.06	-.03	-.04	.03	-.01
TAX	-.08	-.10	-.06	-.04	.05	-.02	-.18	-.06
OPERAT	-.04	.02	-.11	-.04	-.03	.05	-.13	-.10
RENTSQFT	-.03	.03	-.09	.03	-.09	-.09	.10	.04
FIRSTINCR	.08	.07	-.02	.06	.16	.10	-.03	-.04
REPLAC	.10	.02	.80	.24	.00	-.08	.04	.05
ACCREIV	.08	.06	.06	.03	.11	.06	.11	.04
DEFIUNIT	-.16	-.18	-.11	-.13	-.31	-.30	-.28	-.24
022 (Consultant)	.09	.11	-.04	-.08	.01	.04	.05	.09
177 (Sponsor owns management)	-.18	-.21	-.11	-.22	-.15	-.07	-.12	-.20
179 (Experienced sponsor)	-.09	-.10	-.17	-.21	.02	.10	-.04	-.17
225 (Time to 75% occupancy)	.04	.10	-.04	.03	.11	.21	-.07	-.03

NOTES:

[a] For full definitions of variables see Appendix I or Table 6 above.

[b] F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment or default.

is the average net revenue per unit after expenses (DEFIUNIT). Since the variable is defined as revenue minus cost per unit, we would hypothesize that it is negatively correlated with failure. In Table 15, the signs are negative for all cases and the sizes of the coefficients large in comparison to those for other variables. Correlations are especially high for nonprofit projects, about -.30, an interesting characteristic when we recall that the average value for this variable was substantially higher for nonprofit projects than for limited dividends.

Only one other variable displays any notable features in relation to failure. It is the time taken to achieve 75% occupancy. While most correlations on this variable are quite small, those for nonprofit projects stand out as being substantially stronger.

Sponsorship and financial characteristics present a mixed picture. Variables associated with nonprofit status, experience and identity of ownership do correlate with failure. Most financial variables do not correlate highly and the directions of correlation are surprising. The only financial variable seeming to be associated with failure in a consistent and logical way is a constructed measure of surplus net revenue. No strong differences between definitions of failure are visible, but correlations for Region IX are generally stronger than for the total sample.

Project Management Variables. Some of the highest correlations in the sample occur among the management variables, providing further support for the belief that they are significantly related to failure. The HUD staff rating of management (QUALHI, QUALMED) generally correlate predictably, although the strength of relationship, even for high ratings, is not great. (See Table 16)

Among the less subjective variables, experience and continuity show up strongly. Experience, as indicated by management of more than one project (MANGEXP), is consistently negatively correlated with failure. The degree of association varies, however, from quite high for limited dividends and Region IX to very weak, though still negative, for nonprofit projects. In contrast, continuity of management since occupancy (175) shows a relatively stronger negative correlation with failure for nonprofit projects than for limited dividends. Whether this variable is simply a reflection of good management and stable project condition, or whether it is a contributing factor to stability, we cannot say. But it is clearly correlated with financial

Table 16 : Simple Coefficients of Correlation (r) Between Alternative Failure Measures and Project Management Variables, by Region and Sponsorship

Project Management Variables[a]	All Regions						Region IX	
	All Projects		Limited Dividend		Non-Profit		All Projects	
	F1[b]	F2	F1	F2	F1	F2	F1	F2
QUALHI	-.10	-.14	-.08	-.14	-.13	-.14	-.08	-.13
QUALMED	-.04	.00	-.03	.08	-.03	-.05	-.09	.05
MANGEXP	-.15	-.16	-.21	-.18	-.02	-.03	-.19	-.30
021 (Supplemental fund)	.04	.07	.11	.08	.02	.09	-.06	.14
042 (Professional management)	-.04	-.03	-.09	-.06	.04	.06	-.15	-.07
175 (Single management since occupancy)	-.29	-.31	-.18	-.27	-.35	-.34	-.22	-.30
182 (Sponsor employs manager)	-.17	-.08	-.09	-.01	-.20	-.12	-.12	-.03
183 (Resident manager)	-.04	-.03	-.02	-.11	-.03	.10	.00	-.02
188 (Formal tenant screening)	-.06	.07	-.02	-.09	-.11	-.09	-.15	-.15

NOTES:

[a] For full definitions of variables see Appendix I or Table 7 above.

[b] F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment or default.

success, suggesting that its converse, frequent management turnover, may be a good indicator of impending financial problems.

The remaining management variables convey a mixed picture. Professional management (042), as such, correlates weakly and inversely with failure. But for nonprofit projects, the relationship seems to go the opposite way if anything. At the risk of reading too much into small coefficients, this may be some confirmation of differences in management style discussed in the case studies. In contrast, management by a direct employee of the sponsor (182) appears to be inversely correlated with failure more strongly for nonprofit projects, although it is everywhere negative. Together with identity of ownership, this finding seems to confirm the importance of involvement and contact among the parties responsible for a project.

Neither a resident manager nor a formal tenant screening procedure correlates strongly with failure, although in most instances the direction of relationship is predictably negative. The higher values of the latter variable for Region IX have no obvious interpretation, but do suggest that it is less of a formality in that region.

Management quality, experience, continuity and involvement with sponsors all correlate negatively with financial failure. They tend to confirm the importance of management, but also clearly show that at best it is only a partial factor. Furthermore, variations among the coefficients do suggest differences of style for appropriate management among sponsors. Alternative measures of failure show no consistent patterns of variation, nor is Region IX very different from the full sample on these variables.

HUD Program and Processing Variables. With some exceptions, the correlations in this group vary more erratically than any other that we have looked at. There are large variations among coefficients in Table 17, both between subsamples and between failure measures. However, the variations are not particularly consistent.

The program variables are highly correlated with project age, which probably explains the negative correlation of 236 projects with failure. Rent supplement 221d(3) status, on the other hand, correlate positively, with the exception of nonprofit sponsors where the direction is reversed. In the latter, the existence of rent supplements may help provide an extra measure of financial stability.

Table 17: Simple Coefficients of Correlation (r) Between Alternative Failure Measures and HUD Program and Processing Variables, by Region and Sponsorship

HUD Program and Processing Variables[a]	All Regions						Region IX	
	All Projects		Limited Dividend		Non-Profit		All Projects	
	F1[b]	F2	F1	F2	F1	F2	F1	F2
PROGRS	.01	.04	.03	.04	-.10	-.09	.11	.12
PROG236	-.06	-.14	-.05	-.21	-.06	-.05	-.09	-.09
INSPGOOD	-.25	-.29	-.27	-.30	-.18	-.20	-.25	-.16
INSPFAIR	.10	.20	.02	.22	.08	.10	.01	.06
PREVEST	.16	.08	.00	-.07	.17	.09	.25	.19
PCOSTEST	.05	.06	.00	.05	.20	.18	.11	.10
PTAXEST	-.02	-.04	-.02	-.05	.05	.10	-.12	-.12
PPROFEST	-.11	-.14	.00	-.15	-.19	-.17	-.28	-.20
PROCTIME	.00	.12	-.05	.20	.06	.12	.04	.03
MISS141	.06	.06	.04	.01	.05	.06	-.03	-.05
RENTSUP 2	.03	.02	.00	-.05	-.02	-.02	.10	.08
228 (HUD assistance adequate)	-.04	.03	.01	.10	-.09	-.07	-.01	.01

NOTES:

[a] For full definitions of variables see Appendix I or Table 8 above.

[b] F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment or default.

HUD inspection results (INSPGOOD, INSPFAIR) also correlate quite well with financial failure. As expected, a rating of good is strongly and inversely correlated in all instances. This physical condition measure may be after the fact, but its value as an indicator is visible.

The cost and revenue estimation accuracy variables behave in ways quite consistent with the observation about them in Section III. Revenue (PREVEST), cost (PCOSTEST) and tax (PTAXEST) accuracy correlate poorly overall with failure. Because of the way in which the variables are constructed, we would expect PREVEST to correlate negatively and the others to correlate positively with failure. In fact, only the cost variable correlates in the expected direction, indicating that other factors are at work. The other variables have mostly small and varied coefficients except in Region IX, but the results are still problematical. As was the case with the descriptive statistics, the net revenue error variable (PPROFEST) appears to be much more consistent. With the exception of F1 in limited dividend projects, its sign is negative and the coefficients are quite high. This may be a useful variable for predicting failure.

The HUD processing variables show no striking features. Processing time does correlate mildly with failure, but the coefficients vary considerably. The remainder appear not to be significant.

The HUD related variables on the whole are poorly correlated with failure except for those describing physical inspection and net revenue estimation accuracy. Once again, no strong patterns of difference between failure definitions are visible. Region IX does tend to have higher correlation in general than all projects combined.

Project Age. The correlations of project age with failure in Table 18 are much as we would expect. The cumulative effect of age on the likelihood that a project will have failed is clearly visible in the negative coefficients in early years and positive ones later. But few coefficients are greater than .10, and they vary erratically within and between subsamples and failure definitions. In Region IX, correlations of failure with older projects are stronger than for the total sample, a phenomenon for which we have no interpretation.

Table 18: Simple Coefficients of Correlation (r) Between Alternative Measures of Failure and Project Age, by Region and Sponsorship

Project Age Variables[a]	All Regions						Region IX	
	All Projects		Limited Dividend		Non-Profit		All Projects	
	F1[b]	F2	F1	F2	F1	F2	F1	F2
AGE 1	-.05	-.05	-.02	.00	-.08	-.10	-.06	.12
AGE 2	-.09	-.10	-.04	-.14	-.11	-.06	-.15	-.14
AGE 3	-.05	-.08	-.07	-.12	-.05	-.05	-.06	-.16
AGE 4	.05	.07	.03	.10	.05	.02	.19	.12
AGE 5	.06	.09	.17	.11	.05	.14	.22	.10

NOTES:

[a] Age by one year intervals.

[b] F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment or default.

Conclusion

Simple correlations of variables with failure presented in this section throw further light on the influences at work in housing projects. They suggest strongly that no single factors dominate and that any aggregate explanation of failure must attempt to weave together many small effects. To the extent that this can be done with existing data, it requires a way of estimating simultaneously the impact of several variables. Correlation alone cannot do this. Nevertheless, the coefficients do suggest variables for consideration in the more complex models that are the subject of the concluding section of the report.

V. MULTIVARIATE MODELS OF FAILURE

Many variables are statistically associated with financial failure to a modest degree. By itself, that proves nothing. To make the statistical observations meaningful, it is first of all necessary to have a theoretical framework of causal explanation that the observed results will tend to support or deny. Secondly, we must be reasonably sure that the statistical relationships are not spurious, not caused by some variable that is related to both the apparent cause and effect. Neither of these requirements is ever completely satisfied. Theories always have gaps, and someone can always think of another possibly significant variable that has not been taken into account. We have begun to develop parts of a conceptual explanation for failure. Now it is necessary to consider empirically the problem of the multiplicity of factors at work.

The purpose of everything that has gone before was to prepare for the examination of failure as a function of many variables simultaneously. As the Phase One Progress Report demonstrated, too many variables with much variation can make it difficult to distinguish their individual effects on failure. On the other hand, variables taken one, two or even three at a time in cross-tabulations cannot reveal all the interdependencies at work, and simple pairwise correlations may turn out to be spurious. With problematic data, large numbers of observations and many variables on each observation, it is necessary to be highly selective while having good reasons for choosing the variables that we employ. The results of our efforts to do this are presented in this section.

Modelling Financial Failure: Methods and Models

Two aspects of multivariate analysis of failure need to be discussed before the results are presented. They are the choice of analytical method and the selection of variables to be considered simultaneously. We consider them in this section.

Analytic Methods. The method employed for multivariate analysis in this study is multiple regression. This is a conventional technique for estimating the degree to which variation in a number of independent variables

can explain variation in some dependent variable of interest. The relationship is a linear function, though non-linearities may be accounted for by transformations of the variables (for example, logarithmic) or by breaking continuous variables into intervals and treating each interval as a dichotomous variable in its own right. The objective of the statistical method is to calculate estimates of the parameters of the function from the available data.

The chief problems in the use of multiple regression analysis are usually not technical. They are substantive, having to do with the question of whether the correct variables have been included in the explanatory model (specification) and whether the form of the model and the available information will allow us to estimate the relationships we seek (identification). A common statistical difficulty, in addition, is multicollinearity, high correlations between explanatory variables themselves that lead to inaccurate estimates of parameters in the model.

Under normal circumstances, the statistical assumptions of multiple regression require that the dependent variable to be explained be at least measured on an interval or ratio scale. In other words, the variable should take on quantitative values over some range that do not simply express an ordinal relationship and that the size of differences between values has an intrinsic meaning. For explanatory variables, this need not be the case and they can be expressed as dichotomous categories, taking a value of one when a particular state occurs and zero when it does not.

It is immediately evident that the data in the housing project sample does not meet this requirement. The dependent variable, housing failure, is either present or absent, although it may be defined in several different ways. While we could conceptualize a variable measuring the degree of financial failure, the data does not permit its operational definition. A number of statistical techniques analogous to multiple regression have been developed for this kind of problem. They treat the problem as one of estimating the contribution of each explanatory variable to the probability that the state expressed by the dichotomous dependent variable will occur. Methods such as discriminant analysis, probit and conditional logit could be employed.

Nevertheless, we chose to use multiple regression instead. This was a conscious decision based on a number of considerations that are worth discussing both to explain this choice and because they are typical of many

situations that occur in real policy analysis. A primary concern was data. Other methods present severe problems in dealing with missing data. Especially where there are many variables involved, program data sets characteristically have many gaps. The housing project sample was no exception. The methods used to deal with them were discussed in the Phase One Progress Report.

Beyond the difficulty of employing other methods, it is still necessary that regression analysis be usable for this type of problem. Despite its drawbacks, the estimates of parameters would not be biased. In instances where both logit and regression have been used, results have been quite similar. However, the parameters themselves would not be so constrained that if used for predicting probabilities they could not generate values outside the zero-one range. Thus, strictly speaking, we are not estimating probabilities but approximations to them. Perhaps the overriding factor in the decision is our experience of regression as a robust technique that provides reasonably good answers even when many of the basic assumptions are not met. We want to use the results not for highly precise forecasting, but rather as a means of judging the relative importance of different explanatory variables. For this purpose, regression should prove more than adequate.

A final consideration is overall feasibility. Within the cost and data limitations of this analysis, the real choice was between regression analysis and multiple cross-tabulations of data. The other approaches were simply infeasible. Once again, this criterion leads us to the use of regression. There is no way in which one can economically examine the ramifications of such a large number of variables by looking at tables.

Models of Failure. A failure model, in the sense employed in this section, is a linear equation with parameters that measure the effect of each one of a set of independent variables on a dependent variable. When values for the variables are inserted into the equation, the result is an estimated value for the dependent variable. For example, if we believe there are three such explanatory variables, X_1, X_2, X_3,

this amounts to:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + u$$

where

b_0, b_1, b_2, b_3 are estimated parameters,

X_1, X_2, X_3 are independent variables,

Y is the dependent variable, failure,

and u is an error term expressing effects not explained by the variables, X_i.

Mathematically, this is simple and straightforward. Statistically, the values for parameters are estimated by ordinary least squares multiple regression. The substantive problem remains what variables should be included. Answers to this question can only be given on the basis of understanding of the behavior of the phenomenon under consideration. That is, from theory, experience and insight. While technical considerations exist, they are secondary to the issue of the meaning of the variables selected and their relationship to each other as well as to the variable being explained.

Six sets of variables have been used in the regression analyses presented below. They correspond to different ways of conceptualizing the problem of failure while also reflecting compromises with reality. We will describe each set briefly; their detailed composition is discussed later in conjunction with the results.

Most of the Phase One analysis used the full set of all 91 variables selected for the quantitative analysis. The resulting equations were very large and cumbersome. Parameters were often not statistically significant, the high degree of correlation between variables making them highly suspect. As a result, this phase has concentrated on disaggregation, not only by region and sponsor type, but also by sets of explanatory variables.

The first of these, called the reduced set, took 27 variables of the original 91. These were selected for their probable utility in predicting failure irrespective of the actual status of the project, whether close to failure or not. Thus, the set includes variables indicating financial difficulty (WAVREP, PRINMOD) as well as those from the conceptual groups of

explanatory variables discussed earlier. Also included were variables that rated quality, irrespective of whether such data might routinely be available.

Since a significant part of the problem of dealing with failure rests in the initial conditions under which projects are designed and built, the next two sets of variables are designed to reflect stages of project development. The first stage of development set includes only variables that could be gathered before a project is occupied. It should reflect, then, only the influences of those factors at work early or to bring about or predispose a project to failure.

The second stage of development set adds to the first a few variables corresponding to factors at work during the initial period of occupancy, a time generally regarded as critical by HUD staff. In the event, the results of these two sets are so close that only those for Stage 2 are presented in the report.

During the initial survey study by HUD staff, a number of factors were identified as being important for failure. the HUD set comprises those variables. The intent here is to test the validity of the conclusions when interactions between variables are taken into account more fully than is possible with cross-tabulation.

Finally, it is always an objective of analysis to attempt to develop models with the simplest configurations. The selected set of variables attempts to identify a very few variables corresponding to areas of conceptual importance and use them as the basis for explaining failure. The emphasis here is on selecting a minimum number of conceptually important factors in order to see how well a relatively simple, though still multiple, explanation can do.

All these models are represented by single equations. Although we have experimented with causal analysis and multiple equation models, either the problem is too complex or the data insufficient to allow their effective use. For this reason, the report does not attempt to present a formalized causal structure for understanding failure. The furthest that we have been able to go is to look at failure from a number of different points of view and compare and interpret the results.

Regression Models of Financial Failure

During the study, an extremely large number of regressions have been run. They correspond to the complex variety of disaggregations by definition of failure, sponsorship, region and explanatory variable sets described previously. The results will be presented in a compact form analogous to the preceding sets of tables.

Regression models may be interpreted according to several criteria. The most common and straightforward criterion of the effectiveness of a model is the square of the coefficient of multiple correlation, R^2. This statistic is analogous to r^2 for pairwise correlations and expresses the fraction of variance in the dependent variable that can be accounted for by all the independent variables in the equation simultaneously. Because those variables are normally intercorrelated to some degree, R^2 will be less than the sum of the squared simple correlation coefficients, but greater than any one of them. Unlike the simple r^2, the coefficient of multiple correlation is always positive, ranging from 0 to 1, since it incorporates both positive and negative influences. A high degree of explanatory power is expressed by R^2 close to 1. It is a useful summary indicator of the extent to which the specified independent variables can explain the variable of interest.

Table 19 presents an overview of the regression results using R^2 as the criterion for interpretation. The purpose of this table is to provide an overview of all the models at once, allowing us to compare many complex relationships across failure definitions, sponsor types and regions. The results include the three regions individually as well as all regions combined. Otherwise, the column headings are as before. The rows correspond to the sets of explanatory variables. Because of the dichotomous dependent failure variable, the coefficients might appear low but should not necessarily be rejected for that reason alone.

The regressions in Table 19 were almost all calculated with the stepwise method that allows us to examine the effects of variables as they enter the equation. This technique was used to reduce the effects of entering too many highly intercorrelated variables at once and allows us to exclude variables with little explanatory power. However, it was only applied to prespecified variable sets. Where results could not be calculated, usually due to interdependency among independent variables, the table has no entries.

Table 19 : Coefficients of Multiple Correlation (R^2) Between Alternative Measures of Failure and Sets of Independent Variables, by Region and Sponsorship

Independent Variable Sets for Regression[c]	All Regions						Region IX		Region VI		Region III	
	All Projects		Limited Dividend		Non-Profit		All Projects					
	F1[a]	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Stage of Development 1	.18[b]	.17	.13	.22	.28	.24	.41	.44	.24	.22	.36	.35
(2) Stage of Development 2	.19	.19	.13	.23	.31	.24	.38	.44	.25	.24	.41	.38
(3) Reduced Set	.23	.37	.13	.36	.33	.41	.73	.50	.38	.38	.41	.52
(4) HUD Set	.24	.33	.28	.32	.33	.40	.53	.42	.38	.35	.52	.58
(5) Selected Set	.23	.29	.14	.26	.38	.31	.49	.42	--	--	--	--
(6) All Variables	.31	.40	--	--	--	--	--	--	--	--	--	--

NOTES:

[a] F1 = foreclosure or mortgage assignment; F2 = foreclosure, assignment or default.

[b] R^2 computed by stepwise regression for all except the Selected Set and All Variables.

[c] For definitions of variable sets, see text and Tables 20-23.

Starting with all 91 variables simultaneously (row (6)), the lower left-hand corner of Table 19 shows R^2 values of .31 and .40 for F1 and F2 respectively. These results are included for comparative purposes only, having been discussed in the previous report. They revealed few significant variables and clearly suffered from too much information. Nevertheless, they do provide an upper limit to the size of R^2 for the entire sample as a single unit. While higher than the simple coefficients seen in Section IV, they are not remarkable. They do not answer the question of whether the low values are due to the absence of appropriate variables, poor data, or the fact that the sample included subsamples of projects that really do behave differently from each other.

The reduced variable set (row (3)) allows us to avoid the problems of collinearity by employing fewer variables (27) and stopping arbitrarily when 15 had entered the equation. Thus, the results are actually based on the best 15 variables out of the 27 for each disaggregation. We will examine the implications of this below. The values of R^2 for the whole sample in columns (1) and (2) of the Reduced Set row show clearly how redundant the 91 variables are. For F1, 15 variables give an R^2 of .23, compared to .31 for all; for F2, the equivalent values are .37 as against .40. Clearly, the additional variables do not add very much by this criterion.

Values of R^2 for the reduced set across disaggregated subsamples show interesting variations. Correlations are substantially higher for nonprofit projects than for limited dividends on F1. For the broader failure definition, F2, however, the difference is much smaller. It is noticeable that the correlations for limited dividends are also smaller than for the sample as a whole, especially for F1 (columns (3) and (4)). While default may be somewhat predictable, the ultimate degree of financial failure is not.

Regional disaggregations show striking differences in the reduced variable set. The values of R^2 are substantial, ranging from the consistent .38 in Region VI to a high of .52 in Region III and a surprising .73 for F1 in Region IX. Everywhere, they are higher than the equivalent values for the total sample, which suggests that there are real interregional differences in behavior.

Overall, the regressions on the reduced set confirm the value of using fewer variables and disaggregating the sample. Correlations are mostly

higher for the subsamples than the total sample with far fewer variables. Even for the entire sample, we lose little explanatory power by throwing out most variables.

Equations for the reduced set, together with those for the remaining sets in Table 19 are examined in detail subsequently. Therefore, only an outline interpretation will be given here. The first striking characteristic of the development stage sets 1 and 2 in Table 19, rows (1) and (2), is the similarity between equivalent coefficients between the rows. Rarely do they differ by more than .03. Because of this, only the equations for stage 2 will be presented in a detailed table below. As expected from the additional variables, R^2 values are higher for stage 2, but the difference is slight.*

The predictive capacity of this set of variables is very limited over the total sample. Values of R^2 less than .20 are not encouraging. For subsamples, the picture is more varied. While limited dividend projects do poorly, especially for F1, nonprofits have rather higher correlations with failure. The regional breakdowns also make a difference, with Regions III and IX having R^2 values about .40. These results are sufficiently encouraging for further examination of the regression equations themselves. However, it is clear that with the available variables, predicting failure before construction is very difficult, as indeed it should be if the procedures for project assessment are effective.

The 34 variables identified as significant by HUD staff as the basis of their original analysis of cross tabulations of data in the sample are included in the HUD variable set (row (4)). As might be expected, these variables generate higher values of R^2 than those for the early development stages. Across the total sample, values of .24 and .33 are found for F1 and F2 respectively. These rise somewhat for the nonprofit subsample, and are over .50 for Regions III and IX. As for other variable sets, R^2 values for Region VI are consistently lower. Since there is much overlap between the HUD and reduced variable sets, the apparent similarity of results should not be surprising. It seems likely that most significant variables were identified

*The lower value for F1 in Region IX is due to a computational necessity to stop with only twelve rather than 15 steps.

from the tables, but the degree of interregional difference was not appreciated.

Finally, in row (5), the results of multiple regressions of failure on only 9 variables show that it is indeed possible to achieve quite a high degree of explanation with very few variables. Compared with the results for all variables, or, for more subsamples, the reduced set, it is clear that a very large part of what we are able to explain is taken care of by a small number of factors. The levels of R^2, as high as .49 for Region IX, emphasize once again the importance of careful theoretical specification before data is collected.

What can we conclude from the summary measures of all the analyses in Table 19? First, that combining many variables with small simple correlations with failure does not allow us to generate very high levels of multiple correlation. The factors are not additive, but rather tend to run in parallel. Finding out what is causally important in this kind of situation is very difficult. Second, the level of multiple correlation is nevertheless high enough to suggest that some factors can be identified. Third, disaggregation by sponsor type or region does make a considerable difference. We have reason to suspect that different factors are at work or the same factors have differing results in different regions. Further examination of the regression equations themselves in the next section should throw more light on these conclusions.

Regression Equation for Financial Failure

The final sequence of tables in this report contain the numerical results of the regression analyses for each set of variables across the disaggregated samples. Because the tables are complex, their makeup needs to be described carefully. The columns in each table correspond to the disaggregations of the sample used throughout; the total sample, all limited dividend projects, all nonprofit projects and all projects in Region IX. Results for the other regions are not given here in order to allow ease of comparison while keeping the size of tables manageable. Each disaggregated sample is further analyzed for the two failure definitions, F1 and F2. Thus, the columns represent the dependent variables and the various populations for which they have been examined.

The rows in each table list the independent or explanatory variables

in a particular set. The variables themselves are organized by conceptual groupings so that the reader can see which variables in each group have been included in each set simply by referring back to the appropriate Table 1 through 9. The numbers in the body of each table are the regression coefficients, the b_j in the regression equation for that subsample and failure definition. They are listed vertically, rather than in their conventional horizontal form, as on page 60. In this way, we are able to summarize the values of the parameters for eight regressions in each table. The regression coefficients are estimates of the strength and direction of the effect of a unit quantity of the corresponding independent variables upon the dependent variable, over the sample or subsample. Where the independent variable can take on only values of zero or one, the regression coefficient approximates the contribution of that variable to the probability of failure. Where no value for the coefficient appears in the table, that variable was insufficiently significant to be among the first 15 selected for inclusion in the regression equation. In almost every instance in this data, that means that the net contribution to R^2 from adding that variable would be less than .01.

The regression equations provide a number of ways in which we can interpret the meaning and significance of the contribution of the variables to failure. (1) The value of R^2, discussed above, provides a summary indicator of the overall degree to which that set of variables can account for variation in the failure variable. (2) The values of the individual regression coefficients, b_j, provide a direct measure of the per unit effect of each on failure that may be considered in the light of theory and experience. (3) Since the range in each variable may be large or small (for example, hundreds of square feet, or dollars), a standardized measure of relative impact in relation to variation in the independent variable is given by the beta coefficient, β_j, not shown in the table. Roughly speaking, this measures the relative effect of each variable when all have been standardized to become comparable. (4) The sign of each regression coefficient may be compared with our theoretical expectation, since it shows immediately whether the variable tends to increase or decrease the likelihood of failure. (5) Each regression coefficient may be compared to its standard error (not shown) to determine the level of significance at which it may be judged different from zero, i.e., that the variable does have some effect and that the

observed value is not simply random. In the tables, coefficients that are not significant at the 90% confidence level are indicated with an asterisk. Finally, by comparing coefficients across subsamples, we may be able to observe (6) whether they are consistent in sign and similar in size, and (7) whether they are consistently selected by the stepwise regression technique, or whether they appear only rarely. All of these will be employed in the following section.

Reduced Variable Set. The purpose of this set of variables in regression was to attempt to reveal patterns of relationships that were masked by the large numbers of variables in the full sample. Thus, some representative variables from every conceptual group are included. However, to reduce the overlap with the HUD set, not all the most obvious variables, for example among physical characteristics, were chosen. The set also includes the three measures of financial difficulty. It is eclectic rather than strongly determined by theoretical or empirical considerations.

Multiple correlation coefficients have been discussed earlier. For the reduced set, they varied from a low value of .13 for F1 in limited dividend to a high of .73 for F1 in Region IX (See Table 19).

The regression coefficients in Table 20 provide a mixed picture. They can be scanned down the columns for level, sign, and significance, across rows for consistency and frequency, and in conceptual groups for some sense of group frequency. We will begin by looking at the more frequent and consistent variables.

Among the financial difficulty variables, both PRINMOD and WAVREP occur frequently, are mostly significant, and are related to failure in the direction we would expect. The coefficients vary a good deal, with little obvious pattern other than a generally stronger effect on F2 than F1, which is to be expected given their character as responses to financial problems. These variables also have high beta coefficients (not shown) and usually enter the equations early, which reinforces their significance. The negative cash flow variable does not appear to be influential in relation to failure, a peculiar finding but clearly consistent with the earlier simple correlations.

The locational environment variables are quite spotty. None occurs very frequently, although they do tend to appear more often in the limited dividend equations. Their signs are mostly in conformity with what we expect, with

Table 20: Stepwise Regression Coefficients (b_j) for the Reduced Set of Independent Variables Upon Alternative Definitions of Failure, by Region and Sponsorship.

Independent Variables	Expected sign	All Regions						Region IX	
		All Projects		Limited Dividend		Non-Profit		All Projects	
		F1[a]	F2	F1	F2	F1	F2	F1	F2
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I FINANCIAL DIFFICULTY									
WAVREP	+	.056[b]	.172		.095*	.101	.255	.075	
PRINMOD	+	.044*	.231	.077	.241		.229	.181	.240
NEGFLOW	+			-.0075*			.166		-.054
II LOCATIONAL ENVIRONMENT									
REG III		-.044		-.042	.108	-.058*		--[c]	--
REG VI			.053	-.015*			.160	--	--
SUBURB	-	.029*			-.063			-.104	
CITYOTH				-.010*				-.135	-.079
187 (Good physical environment)	-	-.067		-.146	-.157			.523	
III SOCIAL CHARACTERISTICS									
VACANCY 2	+	.0048	.0077	.0018*	.0098	.0054	.0054	.022	.107
212 (% of maintenance due to vandalism)	+	.0013*	.0041		.0045	.0034*	.0045	.018	.0024*
IV PHYSICAL CHARACTERISTICS									
009 (Low rise project)	-		-.052*			.044*			.119
018 (Air conditioning)	-					.026*		.125	-.096
V TENANTS									
NONWHITE	+	.00029*		.00021*	-.0010				
189 (Tenant council)	+		.124	.042*	.104		.143	-.133	
190 (Rent strikes)	+	.077*				.259		.192	.171

(Continued on next page)

Table 20 (Continued)

Independent Variables	Expected sign	All Regions						Region IX	
		All Projects		Limited Dividend		Non-Profit		All Projects	
		F1[a]	F2	F1	F2	F1	F2	F1	F2
VI FINANCIAL AND OWNERSHIP									
NONPROF	+	.061	.106	--[c]	--	--	--		.143
COOP	-			--	--	--	--	.236	
REPLAC		.00017				-.00011*	-.00023*	-.0010	.00053
DEFIUNIT	-	-.000059	-.00014	-.000029	-.00015	-.00014			-.00023
VII MANAGEMENT									
QUALHI	-	-.026*	-.071	-.018*		-.066*	-.128		
175 (Single management since occupancy)	-	-.099	-.127	-.066	-.127	-.107	-.146	.048	-.108
VIII HUD PROCESSING									
PROGRS					.082*	-.047*			.187
PROG 236			-.066	-.018*	-.082	-.109	.072		
PCOSTEST	+	.00017	.00020*			.0012	.0015	.00072	.00039*
PROCTIME	+		.0045	-.0022	.0075		.0061		
MISS 141			.032*	.022*			.0075*		
228 (HUD assistance adequate)	-				.106	-.068*	-.071*	.212	.114
X									
CONSTANT		.141	.167	.285	.165	.308	-.00084	-.769	.054

*Parameter not significant at the 90% confidence level.

NOTES:

[a]F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment, or default.

[b]All parameters are rounded to three decimal places or to two significant digits for those less than .010.

[c]Not applicable.

Region IX providing one oddity. Good physical environment (187) appears especially important for limited dividend projects. It also enters a number of other F1 equations with high beta coefficients.

Variables related to social characteristics, namely vacancy (VACANCY 2) and percent of maintenance (212) due to vandalism appear frequently and consistently, though they are not always statistically significant. Their effect is to increase failure and their size is generally consistent, except for Region IX where they are an order of magnitude larger. Their high beta coefficients also tend to confirm the importance of these variables for financial failure.

The physical characteristics variables in this set are evidently not particularly significant either statistically or otherwise. However, only a small portion of possible variables are included here. The others are dealt with in later tables.

Among the tenant variables, it is notable that the proportion of nonwhite tenants (NONWHITE) turns out to be insignificant when other characteristics are taken into effect. This still leaves us with serious deficiencies, but suggests that ethnicity is not a useful indicator in this context. Rent strikes and tenant councils each have significant values in different parts of the subsamples. Although the values are fairly consistent, there is not much that can be said about them. Their relatively low beta coefficients also reduce their impact.

The ownership and financial variables give two useful findings. Although the nonprofit sponsorship coefficients are significant and positive, their size is not large, corresponding at most to a 14% increment in the probability of failure. Net revenue (DEFIUNIT) conforms to our earlier expectations as an important variable. It is consistently negative in sign, and, for the most part, similar in magnitude. The beta coefficients are relatively high and the variable enters early.

The two management variables offer an interesting contrast. Management quality (QUALHI) performs poorly in the equation despite its high simple correlation with failure. Continuity (175), on the other hand, is perhaps the most consistent variable in the entire set. With one exception, all the coefficients have the expected sign and show a pattern of stronger effect in relation to F2. This variable is also notably stronger for nonprofit projects than for limited dividends. Its beta coefficients are high.

The HUD program and processing variables offer little information with the exception of the accuracy of cost estimation (PCOSTEST). Despite its low correlations, and although not always significant, this variable does appear everywhere except for limited dividend projects. The larger size of regression coefficients for nonprofit projects are worth noting, especially since the beta coefficients also indicate that the variable is important.

To summarize, five important variables emerge from this set of regressions: vacancies, vandalism (as measured by maintenance), operating surplus or deficit, continuity of management and cost estimation. Since a number of other variables were not included, we will watch the performance of these variables in later regressions. Perhaps as important is the negative finding on ethnicity and the weak coefficients for nonprofit sponsorship. Finally, coefficients for F2 are generally larger absolutely than their F1 counterparts.

Looking down the columns, we might note that equations with low R^2 values, for example for limited dividend projects on F1, have many nonsignificant parameters. Evidently, there is nothing much in this data to explain them.

Development Stage Set. The regressions on this set of variables are especially interesting in that they allow us to compare a large number of variables in the environment, physical design, ownership and program categories. As we saw in Table 19, the levels of predictive power of this set of variables is quite small for the total sample, although better for the regional disaggregations. Nevertheless, it is important to try to identify variables that do have impacts on failure. The regression coefficients in Table 21 will be analyzed in the same way as for the previous set. Since some variables overlap between the two sets, we will also be able to see differences in coefficient values for identical independent variables, samples and failure definitions that result from differences in other independent variables.

Among the locational environment variables, three stand out as consistent and significant. As in the previous table, location in Region III shows a generally negative implication for failure compared to other regions. Relatively straightforward in interpretation are the variables for good physical environment (187) and neighborhood safety (193). Both are consistently negative, as we would expect, and have moderately large regression and

beta coefficients. Physical environment does not show up in the equation for nonprofit projects although it is an important factor for limited dividends. Safety, on the other hand, is a powerful neighborhood variable, especially for nonprofit projects and Region IX. In the latter case, the coefficients are very high. None of the other variables occurs frequently at a significant level.

The development stage set includes most of the measures of physical characteristics available in the sample. The results seem to confirm the findings from simple correlations. Most of the variables simply do not appear in the equation at all. Construction defects (213), however, are consistently positive in their impact on failure. The substantial betas indicate that this variable is strong within the equations where it occurs. Again, the variable does not enter for limited dividend projects. One other interesting variable that appears in some equations, especially for nonprofit projects, is the presence of a recreation building (011). The simple correlations on this variable were very small, but its appearance does tend to support the case study finding of the importance of recreational support for project stability. As a variable, it is limited by the observed variability in the actual use of such buildings in projects. Without adequate program support recreation facilities alone are not likely to be effective. The density, scale and amenity variables do not appear to be significant for failure.

The only tenant related variable in this set is that for elderly projects. Except in one instance, it does not enter the equations.

Among the financial and ownership variables, nonprofit sponsorship is still significant for the total sample, but for Region IX it no longer enters the equation. Evidently, the other variables make it redundant. Of the other variables, only sponsor-management identity (177) is both fairly frequent and consistent, though its betas are small. Experience (179) shows up with the expected sign only in the limited dividend subsample, but there the relatively high beta coefficients confirm its importance.

The HUD program and processing variables show predictably negative coefficients for projects in the 236 program. The effect, however, is probably associated with the age structure of the sample. Of the remaining variables, the net revenue estimate (PPROFEST) is the most frequent to appear. Although

Table 21: Stepwise Regression Coefficients (b_j) for the Development Stage Set of Independent Variables Upon Alternative Definitions of Failure, by Region and Sponsorship

Independent Variables	Expected sign	All Regions						Region IX	
		All Projects		Limited Dividend		Non-Profit		All Projects	
		F1[a]	F2	F1	F2	F1	F2	F1	F2
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
II LOCATIONAL ENVIRONMENT									
REG III		-.070[b]		-.038*	-.137	-.189	-.126	--[d]	--
REG VI				-.041				--	--
CITYOTH									
SUBURB	-	.037					.099*	.108[c]	.086
007 (Urban Renewal Area)	+			-.004					
186 (Adequate Social Amenities)	-			.034*	.070*	-.099*		.147	.245
187 (Good physical environment)	-	-.081	-.119	-.138	-.195			-.176	
193 (Sense of safety)	-	-.088	-.094	-.080	-.072*	-.125	-.222	-.384	-.216
214 (Insufficient market demand)	+	.044*	.062*		.091	.114			.212
219 (Competing subsidized units)	+			.025			-.146		
221 (Competing conventional units)	+				.043*				-.279
223 (Conventional rents comparable)	+	-.034	-.040*		-.037*	-.059*		-.047*	-.200

(Continued on next page)

Table 21 (Continued)

Independent Variables	Expected sign	All Regions						Region IX	
		All Projects		Limited Dividend		Non-Profit		All Projects	
		F1[a]	F2	F1	F2	F1	F2	F1	F2
IV PHYSICAL CHARACTERISTICS									
SPACUNIT	-			.000034*				.0017	
UNITACRE	+				-.00085				.0035
PARKUNIT				-.0067					
009 (Low rise project)	-			.025*		-.600*			.142
010 (New construction)	-								
011 (Recreation building)	-	-.062				-.114	-.084	-.059	
013 (Number of units)	+						.0011		.00053
018 (Air conditioning)	-				.038*				
213 (% Maintenance due to construction defects)	+	.0038	.0055			.0054	.0048		.0099
V TENANTS									
008 (Elderly project)	-								-.158
VI FINANCIAL AND OWNERSHIP									
NONPROF	+	.055	.123	--[d]	--	--	--		.042*
COOP	-		-.101	--	--	--	--	-.135	-.182
COSTUNIT	+						.000018	-.000016	
FIRSTINCR	+	.00025	.00029*			.00080	.00055		
LAND				-.0017				-.0033	
022 (Consultant)	-			-.040*	-.216				
177 (Sponsor owns management)	-	-.050	-.075	-.037	-.133	-.083			
179 (Experienced sponsor)	-			-.057	-.103		.108		
125 (Months to 75% occupancy)	+		.0061				.020		

(Continued on next page)

Table 21 (Continued)

Independent Variables	Expected sign	All Regions						Region IX	
		All Projects		Limited Dividend		Non-Profit		All Projects	
		F1[a]	F2	F1	F2	F1	F2	F1	F2
VIII HUD PROCESSING									
PROGRS		-.072*	-.129			-.188			
PROG236		-.057	-.157		-.142	-.189			-.215
PREVEST	+	.00018	.00018			.00016		.00012	
PCOSTEST	+					.00050*	.00065		
PTAXEST							.0014		-.00066
PPROFEST	-	-.00019	-.00031		.00021*	-.00030	-.00044	-.00088	
PROCTIME	+		.0049		.0069		.0051		
RENTSUP 2					-.00090*				
X									
CONSTANT		.236	.344	.261	.441	.587	-.051	.287	.166

*Parameter not significant at 90% confidence level.

[a]F1 = foreclosure or mortgage assignment; F2 = foreclosure, mortgage assignment or default.

[b]All parameters are rounded to three decimal places or to two significant digits for those less than .010.

[c]Stepwise regression concluded at 12th step.

[d]Not applicable.

consistent, its beta coefficients are relatively small. In this instance, the variable does not seem to be influential for limited dividend projects. Revenue estimation also appears strongly in the total sample equations, but the other estimation variables are not in evidence.

Few strong early stage variables have been identified. Those of interest include physical environmental quality, neighborhood safety, constuction quality, sponsor-management identity and accuracy in net revenue estimation. Those coefficients that have a direct probabilistic interpretation remain quite small. Only those for good physical environment exceed 10%.

HUD Variable Set. It is evident from the size of Table 22 that the number of variables included in this set is very large. As a result of stopping the stepwise process at 15 steps any variable is likely to appear in fewer equations. Even so, the financial difficulty variables again appear as frequently as in the earlier set. Their regression coefficients also remain at about the same level, although many new variables are present. To these indicators are added the principal variables identified by HUD staff as significant during the original study.

Values of R^2 for this set are quite high, ranging from .24 to .58 across subsamples and failure definitions (Table 19). Furthermore, very few of the variables that enter the regression equations fail to be statistically significant at the 90% level of confidence. However, the inclusion of the financial difficulty variables may tend to offset the apparent importance of some other variables.

This may be the case in the locational environment category, where only the good physical environment (187) and neighborhood safety (193) variables appear with sizable coefficients in as many as three equations. Safety has a positive coefficient for F2 in nonprofit projects, a peculiar result that may be related to collinearity of that variable with the quality of police protection (192) which has a very large negative coefficient further down column (6). The presence of competing subsidized units in the neighborhood (219) is significant for F2, but has a negative sign. This is consistent with the simple correlations, but the coefficients are very small in absolute size indicating only a marginal effect. The small beta coefficients support this conclusion.

The project social characteristics in this set include only vandalism ratings and an indicator of police protection in the project. Severe vandalism has a positive relationship with failure in every subsample except

Table 22: Stepwise Regression Coefficients (b_j) for the HUD Set of Independent Variables Upon Alternative Definitions of Failure, by Region and Sponsorship.

Independent Variables	Expected sign	All Regions						Region IX	
		All Projects		Limited Dividend		Non-Profit		All Projects	
		F1[a]	F2	F1	F2	F1	F2	F1	F2
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I FINANCIAL DIFFICULTY									
WAVREP	+	.103[b]	.230		.115	.176	.342	.106	
PRINMOD	+		.242	.090	.253	-.019*	.166		.273
NEGFLOW	+						.160	-.140	-.090
II LOCATIONAL ENVIRONMENT									
SUBURB	-	.046				.102			
CITYOTH									
007 (Urban renewal area)	+			-.056					
187 (Good physical environment)	-	-.114		-.184	-.238				
193 (Sense of safety)	-						.170	-.257	-.272
219 (Competing subsidized units)	+		-.053		-.058				-.070
221 (Competing conventional units)	+								-.106
III SOCIAL CHARACTERISTICS									
VANDSEV	+		.197			.062	.182	.108	.032*
VANDSLT	-		.056	-.029					-.109
192 (Police protection adequate)	-	-.078	-.097			-.115	-.299		-.179

(Continued on next page)

Table 22 (Continued)

Independent Variables	Expected sign	All Regions						Region IX	
		All Projects		Limited Dividend		Non-Profit		All Projects	
		F1[a]	F2	F1	F2	F1	F2	F1	F2
IV PHYSICAL CHARACTERISTICS									
UNITACRE	+				-.00056*				
PARKUNIT							.111		
UNIT 1									-.089
UNIT 2									
UNIT 3			-.070		-.068				
UNIT 4				.055					
UNIT 5									
009 (Low rise project)	-	.066		.047	-.066	.082			.120
010 (New construction)	-							.167	
011 (Recreation building)	-	-.055		-.035				-.083	-.093
018 (Air conditioning)	-		.063		.078				-.058*
V TENANTS									
NONWHITE									
008 (Elderly project)	-								
189 (Tenant council)	+		.118	.035*	.159		.130	.092	
190 (Rent strikes)	+	.120				.428	.307	.154	
VI FINANCIAL AND OWNERSHIP									
NONPROF	+	.069	.103	--[c]	--	--	--		.128
COOP	-			--	--	--	--		
REPLAC									
VII MANAGEMENT									
QUALHI	-		-.106		-.095	-.106	-.166		
142 (Professional management)	-							.100	
182 (Sponsor employs manager)	-	-.071		-.019*		-.116		-.077	
183 (Resident manager)	-						.125	.112	

Table 22 (Continued)

Independent Variables	Expected sign	All Regions						Region IX	
		All Projects		Limited Dividend		Non-Profit		All Projects	
		F1[a]	F2	F1	F2	F1	F2	F1	F2
VIII HUD PROCESSING									
PROGRS		-.056				-.093			
PROG 236				.027*	-.050*		.010		
INSPGOOD	-	-.182	-.129	-.233	.172			-.248	
INSPFAIR		-.120		-.211		.116	.176	-.116	
PREVEST	+	.00011				.00016			
PCOSTEST	+			-.00017*		.0011	.0013		
PPROFEST	-	-.00020	-.00030		.00056	-.00034	-.00040		
IX AGE									
AGE 12	-	-.046	-.078	-.043	-.148	-.124		-.165	-.164
AGE 3			-.103		-.170				-.102*
AGE 4									
AGE 5				.082				.230	
X									
CONSTANT		.357	.300	.396	.645	.198	-.855	.484	.804

*Parameter not significant at 90% confidence level.

NOTES:

[a]F1 = foreclosure or mortgage assignment; F2 = Foreclosure, mortgage assignment, or default.

[b]All parameters are rounded to three decimal places or to two significant digits for those less than .010.

[c]Not applicable.

limited dividend projects. Only for nonprofits is it significant for both failure categories. In contrast with the previous vandalism measure, its beta coefficients are quite small. Adequate police protection (192) is even more consistent and strongly related to failure except for limited dividend projects, though again its strength as indicated by the betas is low.

Coefficients of the physical characteristics in Table 22 are either small or infrequently entered into the equations. The existence of a recreation building (011) again appears in some equations with an effect counter to failure and small coefficients. For reasons not clear to us, the low rise project variable (009) enters a number of times with a positive sign, but its coefficients are also insubstantial. The remaining density and scale variables (in this case broken into intervalized dichotomous variables) have little or no impact.

It is interesting to compare the coefficients for tenant variables in this table with those in Table 20 where there are many fewer variables in the set. Ethnicity disappears completely from the equation as does the elderly project variable. On the other hand, tenant councils and rent strikes still have positive coefficients. In most cases, these coefficients are quite large. Whether these variables really reflect project social conditions or some predisposition of tenants toward militancy, they do appear quite powerful.

Nonprofit status is the only major variable in this set related to project ownership. The coefficients for this variable remain much as they are elsewhere, about .10, indicating that the contribution of nonprofit status as such to the probability of failure is only some 10%. In addition, the beta coefficients are relatively weak.

Among management related variables, a high quality rating is the most frequently entered variable, with negative coefficients of about .10. Neither professional management, nor resident managers enter very often, but an employment relationship between sponsor and manager (182) does occur in three equations.

The HUD program and processing variables also show some shift in this table. Because this variable set includes project age specifically, the program variables, especially 236, largely drop out. In contrast, the inspection quality rating has quite consistently negative, sizable coeffi-

cients. Its high beta coefficients confirm that this is a strong variable. On the revenue, cost and net revenue estimation variables, only the last (PPROFEST) is reasonably frequent and consistent in the equations, confirming the importance of the net estimate. The cost estimation variable is again significant for nonprofit projects.

Finally, in this set, an interval age variable has substantial negative coefficients for projects two years old or less. Of all the variables in this set, this one has significant coefficients in more equations than any other. This variable, however, perhaps should be viewed as standardizing the sample rather than having much significance in its own right.

Not many surprises occur among the variables in this set. Financial difficulty, physical environment, neighborhood safety and project security, tenant activity, physical condition, net revenue estimation and age are all related to failure. Most have quite small coefficients in the regression equations.

Selected Variable Set. As a final part of the regression analysis, we have selected a limited number of variables reflecting each conceptual group. Regression coefficients for this selected set appear in Table 23. Because all variables were required on the equations, these regressions are not stepwise. The results are instructive.

The nine variables together exhibited R^2 values in Table 19 ranging from .14 to .49 across the subsamples. The variables include a number of those discussed above, the selection being constrained by the necessity to include variables that are only slightly or moderately correlated with each other. As a result, most of the coefficients and variables are significant. The major exception is tenant ethnicity which clearly drops out. With so few variables and all forced into the equations, we can compare coefficients in some detail. The variations across subsamples are often considerable.

Good physical environment (187) represents the locational category. For the total sample, the coefficients are negative and less than .10. For limited dividend projects, the coefficients are twice as large, but for nonprofits they are not significantly different from zero. We cannot account for this difference. In any event, the beta coefficients remain quite small throughout.

For social characteristics, the constructed vacancy rate was selected.

Table 23: Regression Coefficients (b_j) for the Selected Variable Set Upon Alternative Measures of Failure, by Region and Sponsorship.

Selected Variable Set	Expected sign	All Regions						Region IX	
		All Projects		Limited Dividend		Non-Profit		All Projects	
		F1[a]	F2	F1	F2	F1	F2	F1	F2
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
II LOCATIONAL ENVIRONMENT									
187 (Good physical environment)	-	-.093	-.083	-.167	-.204	-.023*	.032*	.117	.083*
III SOCIAL CHARACTERISTICS									
VACANCY 2 (Est. vacancy rate)	+	.006	.011	.002	.010	.007	.009	.019	.023
IV PHYSICAL CHARACTERISTICS									
213 (% Maintenance due to construction defects)	+	.002	.002	-.0005*	-.0005*	.002	.003*	.009	.011
V TENANTS									
NONWHITE (% Nonwhite)	+	.0003*	.001	.0003*	.0005*	-.0002*	.0009*	.0007*	.001
VI FINANCIAL AND OWNERSHIP									
DEFIUNIT (Revenue less expense/unit)	-	-.0001	-.0002	-.0001	-.0001	-.0002	-.0003	-.0001	-.0001
177 (Sponsor owns management)	-	-.035	-.082	-.015*	-.087	-.085	-.014*	-.064	-.103
VII MANAGEMENT									
175 (Single management)	-	-.087	-.134	-.046	-.095	-.101	-.189	-.060	-.151
VII HUD PROCESSING									
PPROFEST (Net revenue estimate error)	-	-.0002	-.0003	.003	-.002*	-.0004	-.0005	-.00005*	.0005*

(Continued on next page)

Table 23 (Continued)

Selected Variable Set	Expected Sign	All Regions						Region IX	
		All Projects		Limited Dividend		Non-Profit		All Projects	
		F1[a]	F2	F1	F2	F1	F2	F1	F2
IX AGE									
AGE 12	—	-.158	-.270	.005*	-.440	-.420	-.322	.102	.044
AGE 3	—	-.132	-.254	.008*	-.428	-.336	-.241	.130	-.021*
AGE 4		-.081	-.133	.037*	-.300	-.210	-.144*	.149	.021*
AGE 5		-.066*	-.088	.102	-.260	-.277	-.026*	.235	-.008*
X CONSTANT		.831	.575	.235	.823	.583	.658	-.182	.095*

*Parameter not significant at 90% confidence level.

NOTES:

[a]F1 = foreclosure or mortgage assignment; F2 = foreclosure, assignment or default.

as the representative variable. It turns out to be perhaps the most powerful in the entire system, with very high beta coefficients reinforcing its consistent sign and regression coefficient size. The main problem is one of interpretation. Although we have chosen to see this variable as an index of social conditions and desirability of a project, it is also consistently viewable as an ex post indicator of failure, especially in cases where apartments have been vandalized. Nevertheless, it is clearly a major concommitant of financial failure and could be a useful indicator.

The lack of direct correlations with physical characteristics led to the choice of variable 213, percent of maintenance due to construction defects, in this category. Except for limited dividend projects, it behaves consistently. Only in Region IX, however, are the beta coefficients high enough for us to call it a relatively important variable. It might have been preferable to include the physical condition inspection variables also in this category, but its simple correlation with variable 213 was too high (-.37).

The single tenant variable (NONWHITE) confirms our earlier rejection of ethnicity as a proxy for other variables or influential in its own right. The absence of data about the families living in the projects remains the biggest gap in this study.

Sponsorship type is not explicitly included in these equations. Instead, we have used the revenue surplus measure (DEFIUNIT) and sponsor-management identity variables in the financial and sponsorship category. Both are consistent in sign and with two exceptions significant in size of regression coefficients. Its larger beta coefficients suggest that revenue surplus is the more powerful of these variables. However, each reflects a different aspect of this conceptual category.

Only one management variable is included, namely continuous single management over the lifetime of the project (175). After vacancy and revenue surplus, it is the strongest non-age variable in the set, as indicated by consistency and beta coefficients. Interpreting the regression coefficients as approximate marginal effects on probabilities of failure, we can see a range of marginal impact from 5% in limited dividend projects to 10-19% in nonprofit projects.

The HUD processing variable selected is net revenue estimation error (PPROFEST). It behaves consistently, though not significant for Region IX.

The beta values are generally low, making this one of the relatively less important variables in the set.

Age is the final variable category. The results in Table 23 have some anomalies that are hard to explain. Generally, the coefficients are negative and diminish as age increases. But for Region IX, they behave in odd ways that suggest some possible data problems. For the most part, we consider this variable as standardizing the unequal ages of projects in the sample, rather than directly interpreting project age as influencing the propensity to failure in its own right.

Altogether, these few variables do work quite well to account for variation in financial failure in the sample of projects. They illustrate the degree to which a relatively simple structure of variables can explain a fair amount. But neither small nor large sets of variables can account for failure with a high degree of certainty. Nor does any single variable appear to be dominant in bringing it about. The results, then, remain consistent with but amplifying our earlier findings from the case studies.

APPENDIX I

CONCEPTUAL AREAS AND FINAL VARIABLES

I. Financial Failure and Difficulty Variables

FAILURE1	foreclosure or mortgage assignment	Q150, Q151 Y/N
FAILURE2	foreclosure, mortgage assignment or default	Q149, Q150, Q151 Y/N
MORTFCY2	foreclosure or mortgage assignment in year 2 or less	Q150, Q151 Y/N
MORTFCY3	in year 3 or later	Q150, Q151 Y/N
DEFAULT	default	Q149 Y/N
DEFY1	first default in year 1 or less	Q149 Y/N
DEFY2	year 2	Q149 Y/N
DEFY3	year 3 or later	Q149 Y/N
NEGFLOW	negative cash flow	Q136 Y/N
NEGY1	first negative cash flow in year 1 or less	Q136 Y/N
NEGY2	year 2	Q136 Y/N
NEGY3	year 3	Q136 Y/N
NEGY4	year 4 or later	Q136 Y/N
YRSNEG	% years negative cash flow	Q137/AGE
WAVREP	waiver of replacement reserve	Q145 Y/N
PRINMOD	modification or waiver of principal payments	Q147 Y/N

II. Environmental Variables

Q186	adequate social amenities	Y/N
Q187	good physical environment	Y/N
Q193	people in neighborhood feel safe	Y/N
Q223	comparable rent	Y/N
Q214	insufficient market demand at occupancy	Y/N

NOTE: Y/N: 1 = YES; 0 = NO

Q219	other HUD units in area since initial occupancy	Y/N
Q221	other private sector units in area	Y/N
Q7	urban renewal	Y/N
CITYOTH	located in city other than core	Q140 Y/N
SUBURB	located in suburb	Q140 Y/N
REGIII	HUD region III	Q2 Y/N
REGVI	HUD region VI	Q2 Y/N
SMSA	located in SMSA	Q3 Y/N

III. Project Social Variables

Q197	false fire alarms	Y/N
VANDSEV	vandalism severe	Q199 Y/N
VANDSLT	vandalism slight	Q199 Y/N
Q212	% maintenance due to vandalism	
Q192	adequate police protection	Y/N
CRIME	one or more serious crimes in project	Q194 Y/N
Q195	fires requiring fire equipment	Y/N
Q208	% turnover	
Q209	% rent delinquencies	
EVICNOPY	evictions for nonpayment of rent per 100 units	100*Q210/Q13
EVICSOC	evictions for anti-social behavior per 100 units	100*Q211/Q13
VACANCY1	vacancy rate based on potential versus actual rent, adjusting for accounts receivable, %	$100*\frac{(Q120-Q118+Q144)}{Q120}$
VACANCY2	vacancy rate based on potential versus actual rent, not adjusting for accounts receivable, %	$100*\frac{(Q120-Q118)}{Q120}$

IV. Project Physical Variables

Q13	# units (scale	
Q232	size or # units a factor in project financial condition	Y/N

Q213	% maintenance due to construction defects	
SPACRESD	% space residential	100*Q15/Q14
SPACUNIT	residential floor area per unit	Q15/Q13
Q9	low rise (versus high rise)	Y/N
Q11	recreation buildings	Y/N
PARKUNIT	paring spaces per unit	Q17/Q13
Q18	air conditioning	Y/N
Q10	new (versus rehabilitated)	Y/N
UNITACRE	units per acre (density)	43560*Q13/Q12

V. Tenant Variables

Q8	elderly (versus family)	Y/N
Q189	tenant council	Y/N
Q190	rent strikes	Y/N
NONWHITE	% nonwhite	100-Q200
BLACK	more than or equal to 50% Black	Q201 Y/N
SPANISH	more than or equal to 50% Spanish	Q204 Y/N

VI. Financial and Ownership

NONPROF	sponsor nonprofit	Q6 Y/N
COOP	sponsor coop	Q6 Y/N
Q179	sponsor had other HUD projects in occupancy before sponsoring this project	Y/N
Q177	sponsor owns management entity	Y/N
Q182	project manager employee of sponsor	Y/N
COSTUNIT	estimated total replacement cost inflated per unit	Q25 infl/Q13
LAND	estimated land cost as % of estimated total replacement cost	100*Q24/Q25
ADMIN	% expenses administrative	100*Q122/Q134
MAINT	% expenses maintenance	100*Q129/Q134
TAX	% expenses real estate tax	100*Q130/Q134
OPERAT	% expenses operating	100*Q128/Q134

TAXESTC	current real estate tax - estimated real estate tax inflated	Q130,Q94 Y/N
PROFESTC	current revenue-cost - estimated revenue-cost inflated	Q119, Q134 Y/N Q83, Q98
CREVEST	current revenue-estimated revenue inflated as a % of estimated revenue inflated	$100*\frac{(Q119-Q83infl)}{Q83infl}$
CCOSTEST	current cost-estimated cost inflated as a % of estimated cost inflated	$100*\frac{(Q134 - Q98infl)}{Q98infl}$
CTAXEST	current real estate taxes-estimated real estate taxes as a % of estimated real estate taxes inflated	$100*\frac{(Q130-Q94infl)}{Q94infl}$
CPROFEST	current revenue-cost-(estimated revenue-estimated cost) inflated as a % of (estimated revenue-estimated cost) inflated	$100*\frac{(Q119-Q134-(Q83-Q98)infl}{(Q83-Q98)infl}$
REVESTO	same as REVESTC with initial year	
COSTESTO	same as COSTESTC with initial year	
TAXESTO	same as TAXESTC with initial year	
PROFESTO	same as PROFESTC with initial year	
PREVEST	same as CREVEST with initial year	
PCOSTEST	same as CCOSTEST with initial year	
PTAXEST	same as CTAXEST with initial year	
PPROFEST	same as CPROFEST with initial year	
Q230	accurate estimation of expenses facot in financial condition	Y/N
PROCTINE	permission for initial occupancy to application for insurance, building and HUD processing time, in months	Q32, Q80
INSPGOOD	last annual physical inspection good	Q139 Y/N
INSPFAIR	last annual physical inspection fair	Q139 Y/N
DIFF181	answers on HUD and management questionnaire agree on	Q181, Q261 Y/N
DIFF183	answers on HUD and management questionnaire agree on	Q183, Q263 Y/N
MISS141	information on replacement reserves balance missing	Q141 Y/N
RENTSUP	rent supplement units as % of units	Q78, Q79
Q228	HUD personnel provided adequate technical assistance	Y/N

RENTSQFT	apartment rent per residential square foot	Q120/Q15
RENTUNIT	apartment rent per unit per month	Q120/Q13*12
RENTINCR	rent increase	Q48 Y/N
FRSTINCR	% increase of first rent increase	100*(Q49-Q46)/Q46
TOTINCR1	increase in rent over life of project inflated as a % per year	$100*\frac{(Q120-Q46\ infl)}{Q46\ infl*AGE}$
TOTINCR2	same as TOTINCR, using Q102	
RENTUP	longer than 6 months to 75% occupancy	Q225 Y/N
Q225	# months to 75% occupancy	
REPLAC	replacement reserve as a %*100 of estimated replacement cost inflated	10000*Q141/Q25 infl
ACCREIV	accounts receivable as a % of total rent	100*Q144/Q119
DEFIUNIT	revenue-cost/unit	(Q119-Q134)/Q13
COMMERC	commercial rent as a % of total rent	$100*\frac{(Q119-Q118)}{Q119}$
Q22	consultant	Y/N

VII. Management Variables

Q142	professional manager	Y/N
MANGEXP	if manages more than one project	Q180 Y/N
Q183	manager in residence	Y/N
Q175	managed since initial occupancy	Y/N
QUALHI	quality of management high	Q233 Y/N
QUALMED	quality of management medium	Q233 Y/N
Q21	supplemental management fund	Y/N
Q188	formal screening procedure for tenants	Y/N

VIII. HUD variables

REVESTC	current revenue - estimated revenue inflated	Q119, Q83 Y/N
COSTESTC	current cost - estimated cost inflated	Q134, Q98 Y/N

NOTE: infl - inflated, 1.05**(AGE - 1)

	Q229	provision of adequate technical assistance a factor in financial condition	Y/N
	PROGRS	HUD program 221d3RS	Q5, code 35 Y/N
	PROG236	HUD program 236	Q5, code 44 Y/N
IX.	Age		
	AGE	age of project from initial occupancy to 5/73, in years	Q80
	APPAGE	age of project from initial application for insurance to 5/73, in years	Q32
	AGE1	age of project from initial occupancy is 1 year or less	Q80 Y/N
	AGE2	2 years	Y/N
	AGE3	3 years	Y/N
	AGE4	4 years	Y/N
	AGE5	5 years	Y/N
	AGE6	6 years or more	Y/N

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