Determinants of the Rental Housing Landlord's Renovation Decision

by

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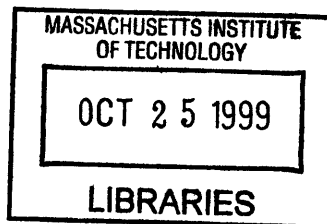
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ABSTRACT

Determinants of the rental housing landlord's decision to renovate are investigated using the Property Owners and Managers Survey conducted by the U.S. Census Bureau in 1995. Relationships are examined between the probability of renovation and the financial, managerial, structural, ownership and tenant characteristics provided by the survey. Four renovation types are examined, kitchen replacement, bathroom renovation, plumbing upgrade and heating system upgrade. Multivariate analysis is used to estimate the relative effects of above characteristics on the likelihood of renovation.

Several relationships are found to be important. Recently purchased properties were more likely to be renovated than others. Employment of a property manager decreased likelihood of renovation. Profitable properties appear less likely to be renovated than others. Probability of renovation is affected by, but does not increase directly with, size or age. Further research incorporating both these characteristics and property and neighborhood conditions is recommended.

Thesis Supervisor: Henry O. Pollakowski
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To my fellow Team POMS members, John Bell and Nadine Fogarty, without whose help and support I could not have completed this project.

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Chapter 1: Introduction

More than one third of the housing in the United States is renter-occupied.[1] The condition of the rental housing stock affects both the enjoyment and the health and safety of a large portion of the U.S. population. Despite this, much remains unknown of the factors that trigger improvement activities. A few, important studies have established and tested the core theory. Most analyzed a small community and focused on physical characteristics of the property and neighborhood. A recent survey conducted by the Census Bureau, the Property Owners and Managers Survey (POMS), now allows the effects of additional characteristics to be studied. The financial, ownership, managerial and tenant information it provides can be used to test for the significance of other factors on the decision to renovate. Understanding their role will further the understanding of what drives housing improvement.

The renovation decision for the rental housing owner is controlled by profit maximization. In theory, the owner continuously forecasts revenues and calculates net present values for the range of investment options available. Should a capital improvement increase the value of the property beyond its current value plus conversion cost, it is undertaken. Critical to this determination is the forecast of rental revenues and improvement costs. The owner determines the optimal condition for the property based on the additional rents that will be received for the change in housing service provided. When the property's condition is different enough from the optimal to make improvement expenses worthwhile, the project is undertaken. A critical determinant of the likelihood to renovate, then, is the property's condition. To the extent that neighborhood characteristics vary the additional rents received for an improvement, they, too, are important. Previous empirical work has demonstrated these relationships.

Other, untested factors may play a role in the owner's likelihood to renovate. The owner must recognize the opportunity and be able to capitalize on it. Ownership and management characteristics may affect these abilities. Economic conditions at the property may spur repositioning, while property market conditions may affect funding. Competition for tenants may also drive renovation efforts.

The Property Owners and Managers Survey (POMS) conducted by the U.S. Census Bureau in 1995 allows us to investigate these other potential determinants. The POMS contains

responses to questions about financial, structural and managerial characteristics by property owners or managers of 5754 multifamily properties. The properties spanned the ranges of possible sizes, ages and locations. Among the information provided was whether several different types of capital improvements were made, including kitchen replacement, bathroom renovation and heating, cooling and plumbing system upgrade.

The determinants of renovation likelihood were investigated using this data set in two ways. First, simple, bivariate relationships were investigated to see if something as simple as size or age drove renovation decisions. With no clear pattern emerging, multivariate equations were estimated to test a series of hypotheses regarding potentially influencing variables. Equations for both discretionary and systems types of improvements were investigated. Several of the theorized determinants had a statistically significant effect on likelihood of renovation. In particular, certain financial, ownership and management characteristics had consistently significant relationships to the probability of renovation. Overall, though, limitations in the POMS data left the estimated equations with a low level of explanatory power over the likelihood to renovate.

While POMS provides much needed insight into the supply side of housing, certain limitations hamper the study of determinants of renovation. The value of the improvements made to the properties is unknown. A large property replacing one kitchen and a small property replacing twenty would both merely report that, yes, kitchens had been replaced. The location of properties is only narrowed to one of four regions of the country, and within them, to urban, suburban or rural of setting. Some questions, particularly those financial in nature, had high rates of non-response, leaving a small useable sample. Most importantly, though, little information was collected regarding the characteristics of the structure and neighborhood. While the ownership, managerial and financial effects could be investigated, their relation to the structure and neighborhood characteristics needs further study.

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[1] 1995 American Housing Survey.

Chapter 2: Literature Review and General Theory

Due to limitations on data availability, less work has been done studying the supply of housing services than the demand. Ingram and Oron (8) laid out the theory of housing service supply in their work. Some empirical work has been done in cities where data has been available. Mayer (10) set forth theory on rental property rehabilitation and then empirically tested his hypotheses. Another empirical study of the property owner's decision on repair and improvements expenditures was prepared by Helbers and McDowell (7). While the theory was similar in both studies, the data used and specific hypotheses formed differed. The remodeling decision in owner-occupied housing shares some theory with that of rental housing and is worth comparison . Helbers and McDowell's study included owner-occupied residences, while Ziegerts's (15) study concentrated on the homeowner's decision. A paper by the Joint Center for Housing Studies of Harvard University (9) compared remodeling expenditures by homeowners with those of rental owners, outlining some trends in rental remodeling expenditures in the process.

The underlying theory behind the property owner's decision to remodel is his desire to maximize profits. Given the property's location and type, an optimal property condition exists where the difference between revenues and costs is maximized. To maximize his profits, the rental housing owner must shift his property to the optimal condition. He must recognize this condition and the path to achieve it, and he must be able to undertake the required improvement project.

Ingram and Oron (8) detailed the components of the property owner's housing service production decisions. They stated that housing services are a function of the quality of the structure services, neighborhood quality and accessibility. The housing producer has no control over neighborhood quality or accessibility, but can affect the structure services. The structure services are a function of the land, capital and operating inputs. Ingram and Oron divided capital into structure capital and quality capital. A minimum structure capital is required for any given structure type. Beyond that, quality capital determines the quality of that type provided. Structure capital is assumed to be durable, an example being the building foundation, while quality capital depreciates. Maintenance expenditures affect quality capital and can offset this depreciation.

At the beginning of every period, then, the housing producer faces three decisions – the current period operating decision, the current period maintenance decision, and the structure type decision. Operating inputs are assumed to affect the structure quality in the current period only, while maintenance inputs do not affect the structure quality until the next period. The current period operating decision, then, is based only on the calculation of operating inputs that will maximize the current period's cash flow.

The current period maintenance decision is more complicated. Since current period maintenance investments affect future periods, the owner's goal is to maximize the property's net present value of future revenues minus expenses, including those for operating and maintenance inputs. To simplify this calculation, they assume that property owners have knowledge of the relation between rents and quality for the next five time periods. After that, the owner considers the relationship between the two unchanging. With this assumption, the owner can calculate the optimal quality level to achieve by period five. If the property is not at that level, the optimal path to get it there can be charted. Restraints affect this path, though. Quality capital cannot be easily reduced. It must reduce through depreciation. To increase quality capital may take investment exceeding cash flow from the property. If so, the cost of capital changes if funds must be borrowed.

The third decision, the structure type decision, is a simple comparison between the previously calculated maximum value of the property and the value of the property if converted to another structure type. It is assumed that the new structure will be produced at the optimal quality level for the new type. If the value of the property as a different structure type is higher, after including conversion costs, the owner should undertake the conversion.

While the study at hand is not of maintenance expenditures, Ingram and Oron's theories still apply. While maintenance is a more continuous input, capital improvements occur infrequently and are larger in cost. The capital improvement decision is still one of maximizing profits, though. Despite the infrequency of the work, the decision must be made at the beginning of every period whether to undertake the capital improvement project based on the current forecast of future revenues and expenses.

Mayer (10) looked more specifically at the rental housing owner's rehabilitation decision. Building on general theory, he formulated a series of hypotheses on various determinants of the

likelihood to remodel. He then empirically tested his theories using data from the City of Berkeley. Again, his model was based on the theory that an optimal, profit maximizing level of capital stock exists. The property owner's likelihood to remodel is a function of the difference between this optimal and the current capital stock level of the property. Revenue is a function of housing services provided and neighborhood characteristics. Housing services provided are a function of maintenance and capital. The optimal capital level, then, depends on neighborhood characteristics, the price of maintenance inputs and the price of capital inputs. The likelihood to remodel depends on these factors and the current condition of the property.

Structure condition is obviously important because it is the difference between it and the optimal condition that affects the likelihood to remodel. Mayer tested additional hypotheses about the affect of the condition of different types of structure components on the likelihood to remodel other components. He divided components into core systems, such as plumbing and electrical service, and appearance-oriented components, such as the exterior condition and roofing. He theorized that a tenant would not pay additional rent for improved cosmetics if the basic systems were inadequate. The appearance items being in poor condition would not affect the additional rent the tenant would pay for an improvement in basic components, though. Two hypotheses result. The first is that, ceteris paribus, appearance items in poor condition increases the likelihood of remodeling. The second is that, ceteris paribus, inadequate basic services will decrease the likelihood of remodeling. The basic components, themselves, may be more likely to be repaired, but the cosmetic items are less likely, and this effect dominates.

Neighborhood characteristics are significant if the change in the neighborhood characteristic differs the amount of additional rent the tenant is willing to pay for a capital improvement. Just the fact that different neighborhood characteristics result in different rents is not in itself significant. There must be a change in additional rent for an improvement as a neighborhood characteristic changes. To establish these relationships, Mayer relied on results from hedonic rent regression equations for the properties in his dataset. He formed a series of hypotheses regarding the effect of such neighborhood conditions as crime, traffic, public improvement conditions, adjacent building conditions and adjacent land uses. These will be discussed in more detail in the Specific Hypotheses section.

The costs of capital and maintenance inputs were treated by Mayer as constant across his dataset and, thus not included in his model. Given that his data was from one small city over a short time period, this assumption was reasonable.

Mayer also tested other hypotheses that he found to affect the likelihood to remodel. These included the presence of an owner at the site, the recent sale of the property and the zoning of the parcel.

Helbers and McDowell (7) empirically tested a simpler model based on panel data from two cities. Instead of the likelihood to rehabilitate, though, they modeled the determinants of expenditures on maintenance and repair. They used building, financial and occupancy characteristics to specify their model, also based on a profit maximizing theory. Building characteristics included size of building needing maintenance, deterioration rate and construction technology. Financial characteristics consisted of the price of housing services and the target housing quality. Occupancy characteristics consisted of the presence of an owner occupant and elderly ownership. Unlike Mayer, they did not include measures of neighborhood or property condition. Like Mayer, they did not include relative price of repairs and relative price of service because it could be considered uniform across the samples.

Helbers and McDowell also modeled homeowner repairs in their study. Homeowners differ from nonresident rental property owners in that they both produce and consume the housing services. While they still seek to maximize their profits from the property, their profit is affected by the utility they derive as occupant. As explained in Helbers and McDowell, since there is no clear market for their utility, the pricing the owner makes in determining repairs can vary. Additionally, the frictional costs associated with moving are higher for an owner-occupant than a tenant. This will result in different repair and improvement behavior. While a renter may move to adjust to a change in permanent income, an owner may be less likely to move and more likely to improve the property.

Ziegert (15) studied the homeowner decision exclusively. He empirically tested a series of hypotheses in a two step process. First he investigated factors critical in the decision to make improvements. Next he tested determinants of the value of the improvement. While he only looked at new additions to housing, not renovations, the comparison is still worthwhile. In his estimation of the probability of an addition he included variables to test for the importance of

both investment and consumption demands of housing services. His results showed that homeowner wealth and his deficit from housing level need had the greatest effects on probability. The investment terms had no significance. This was attributed more to an inability to accurately measure the variables than their actual insignificance, though. In any event, homeowner consumption was shown an important factor in the improvement decision, unlike the profit motivated rental housing owner. As will be discussed in the next section, this is, in part, why properties with fewer than five units are excluded from this study.

A recent publication by the Joint Center for Housing Studies of Harvard University, *Improving America's Housing* (9), devoted a section to rental remodeling influences. It showed through tabulations of the POMS data that institutions and individual owners of more than nine units spend a higher percentage of their rental income on maintenance and repair than individuals owning fewer units. It is hypothesized that either the larger owners view maintenance as important to a long term investment strategy, or the individual small owners have not accounted for the value of their own efforts in do-it-yourself type projects. Tabulations were also made of spending composition. The proportion spent on systems improvements, about 60%, was found significantly higher than homeowner spending on these components. The difference in behavior among owner types and the difference between systems and discretionary improvements are both issues that will be explored in this paper. The Joint Center's paper also outlined the change in spending with market conditions over the past 15 years. The theory that remodeling expenditures follow the market cycle is not inconsistent with the theory that the remodeling decision is made at any given period based on a profit-maximizing path. Current and projected market conditions are the basis for determining the profitability of the improvement options.

To maximize his profits, the rental housing owner must shift his property to the optimal condition. He must recognize this condition and be able to undertake the required improvement project. The Mayer and Helbers and McDowell studies set forth variables significant in determining the remodeling effort as a function of the opportunity presented. This work hopes to add to those variables that are indicative of the presence of a profit maximizing opportunity. The likelihood to remodel also depends on the owner's ability to recognize and capitalize on this opportunity, though. The change in a factor such as management type that influences the ability to recognize the opportunity, ceteris paribus, changes the likelihood that the opportunity is seized. Similarly, the change in a factor indicative of the owner's ability to undertake the opportunity will affect its likelihood.

Chapter 3: The Property Owners and Managers Survey

3.1 Overview

The Property Owners and Managers Survey (POMS) was conducted in 1995 by the U.S. Census Bureau and sponsored by the Department of Housing and Urban Development. The POMS is the first national survey of its kind, providing valuable new information about rental housing in the United States. The purpose of the survey was to gain a better understanding of the supply side of the rental housing market by interviewing property owners and managers. The survey asked owners and managers of privately held rental housing questions about structural, financial, ownership and management characteristics of their properties. Owners were also polled about their attitudes about ownership, plans for their properties, and views on governmental regulations.[2]

The universe was approximately 29,300,000 privately owned rental housing units in the U.S. The initial sample was approximately 16,300 housing units, taken from properties included in the 1993 American Housing Survey.[3] A unit (and the property containing the unit) was included in the survey if it was a privately-owned rental unit at the time of the 1993 housing survey, and was still a rental in 1995. A unit was considered a rental unit if it was currently rented, occupied rent-free by a person other than the owner, or vacant but available for rent. Publicly owned properties (public and military housing, or housing owned by another federal agency) were not included in the survey.[4] Information was collected between November 1995 and June 1996. Separate surveys were given to owners of single- and multi-unit properties. The resulting multi-unit data set contained 5754 observations.

The data permits analysis at either the property or unit level. Information about the location of each property is very limited. Properties are identified as in one of the four census regions (Northeast, Midwest, South and West), inside or outside the metropolitan area, and inside or outside the central city. States, metropolitan areas, and cities are not specified.

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[2] Savage, Howard, "What We Have Learned About Properties, Owners and Tenants From the 1995 Property Owners and Managers Survey," U.S. Census Bureau, census website:
http://www.census.gov:80/hhes/www/housing/poms/staterep4html.
[3] Property Owners and Managers Survey Technical Documentation, U.S. Department of the Commerce, Washington D.C.: February, 1997.
[4] Properties used primarily for vacation homes were also excluded. Note that properties built or converted to rental between 1993 and 1995 were not included in the sample.

Table 3.1: Census Regions

Northeast	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
Midwest	Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin
South	Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia
West	Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming

Source: Technical Documentation for Property Owners and Managers Survey, 1995-1996, U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census

The POMS collected information about the following aspects of rental housing:

- *Ownership*: characteristics of owners, ownership structure, attitudes toward the property, and reasons for owning.

- *Property and unit characteristics*: including age of structure, amenities, and recent capital improvements. Also, estimations of current value, value relative to other properties, and recent changes in property value.

- *Financial characteristics*: including method of and reasons for acquiring the property, mortgage information. The data includes detailed operating income and expense information, including rents from both residential and commercial space, and itemized expenses from the previous year.

- *Management policies*: including procedures for handling maintenance, tenant screening and turnover.

- *Governmental benefits and regulations*: includes property benefits received, such as tax credits and abatements, and participation in the federal Section 8 rental housing subsidy program.
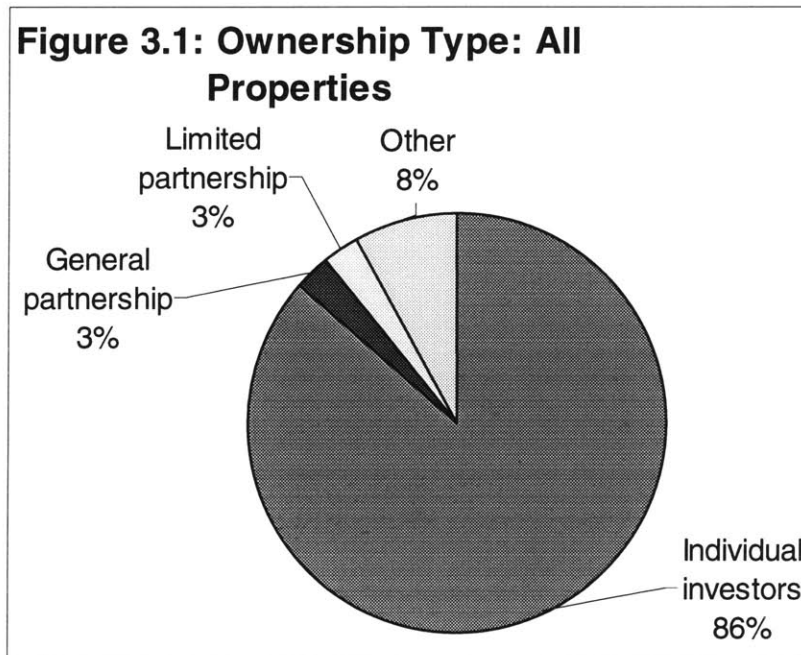
3.2 Descriptive Statistics

The following summary, unless otherwise specified, presents property-level information based on the entire data set of 5754 observations, and considers only properties with greater than one unit. This summary relies heavily on the U.S. Census report, "What We have Learned About

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Properties, Owners and Tenants From the 1995 Property Owners and Management Survey," by Howard Savage.[5]

Owner Characteristics

Most properties were owned by individual or partnership owners, half of whom owned only one property. However, the breakdown of ownership types varied considerably between small and large properties. Small properties were most likely to be owned by an individual, at 90 percent. In contrast, only 32 percent of the owners of properties with over 50 units were owned by individuals. (Figures 3.1 and 3.2) These properties also are more likely to be owned by partnerships (38%), corporations (11%), or non-profits (6%). As of 1995, Real Estate Investment Trusts (REITs) owned a negligible percentage (1%) of residential properties in the United States, but because their properties tend to be larger, this represents an estimated 417,612 units (2%).[6]

Figure 3.1: Ownership Type: All Properties

Limited partnership 3%
Other 8%
General partnership 3%
Individual investors 86%

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[5] Savage, 1.
[6] U.S. Census Bureau website, multi-family unit tables.

Figure 3.2: Ownership Type: Large Properties (50 or More Units)

Other 31%

Individual investors 31%

Limited partnership 25%

General partnership 13%
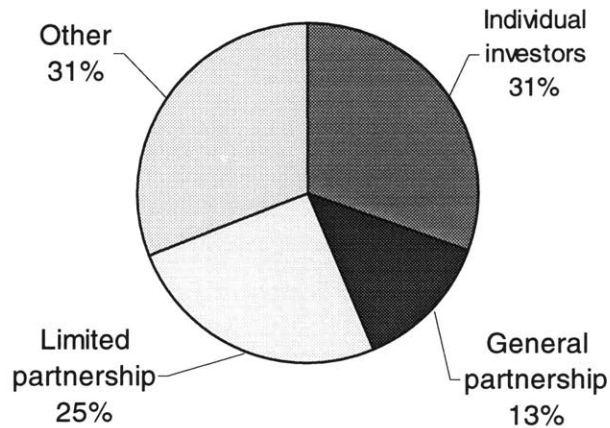
About one fourth of multifamily properties were owner-occupied. This percentage decreased significantly at larger properties. Twenty-nine percent of small properties (less than 5 units) had owners living on the premises, while this was only true for 3% of properties with 50 or more units. Owners of large properties seemed more pleased with their properties, generally. Eighty-seven percent of owners of properties with 50 or more units reported that they would buy their property again. Meanwhile, only about two-thirds of small and medium-sized properties would buy their property again.

The primary reason investors acquired rental property was to receive income from rents, 33 percent. The second most common reason for acquisition was for use as a residence. Smaller properties were more likely to be bought for this purpose: a third of all properties under 5 units were purchased for use as a residence. Only 10% of all owners purchased their property for long-term capital gain. However, 22% of properties over 50 units were acquired for this purpose.

Half of multifamily property owners were between 45 and 64 years old, 85 percent were white (94 percent for large properties), 8 percent were African American, 6 percent were Hispanic and 4 percent were Asian or Pacific Islander.

Property Characteristics

Although only 2% of all properties have 50 or more units, forty-six percent of all units were in properties with more than 50 units in 1995. (Figure 3.3)

Figure 3.3: Size of Properties
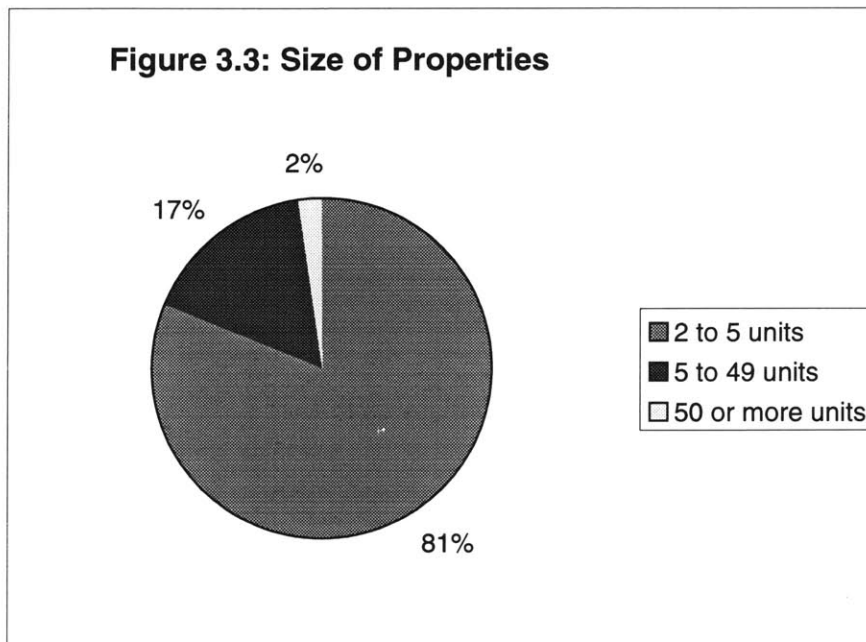
Those units are more likely to be in a newer building. Properties with 50 or more units were built predominantly in the 1960's or later. (Table 3.2)

Table 3.2 - Property Location and Age

Region	All Properties #	%	Properties with >4 units #	%	Properties with >49 units #	%
Northeast	921,597	33%	139,545	27%	11,907	20%
Midwest	682,289	25%	113,306	22%	10,093	17%
South	562,232	20%	104,398	20%	19,356	32%
West	588,748	21%	161,591	31%	18,220	31%
	2,754,866	100%	518,840	100%	59,577	100%
Decade Built						
Pre-1920	533,557	21%	66,822	14%	1,065	2%
1920	294,313	12%	45,979	10%	2,491	4%
1930	255,175	10%	28,975	6%	1,012	2%
1940	262,778	10%	32,730	7%	1,567	3%
1950	259,099	10%	42,111	9%	2,361	4%
1960	299,998	12%	83,827	18%	11,464	20%
1970	332,774	13%	88,322	19%	20,267	35%
1980	256,204	10%	73,252	15%	15,735	27%
1990	53,288	2%	12,743	3%	2,158	4%
	2,547,187	100%	474,760	100%	58,121	100%

Note: Fewer units represented due to age non-responses.

While 53% of all properties were built prior to 1960, only 15% of properties with 50 or more units were built before then.

The larger properties are also more likely to be located in the south or the west. While the northeast and midwest hold 58% of all properties, they only hold 37% of those properties with 50 or more units.

The distribution of properties among census regions was relatively uniform, with the largest number of properties in the south. Just over half of all properties were located in central cities, and only 10 percent were outside of metropolitan areas. The northeast was the most urban, with 56 percent of properties located in central cities. Of the four regions, the midwest is the least urban, with less than half of all properties located in central cities and 16 percent located in rural areas.

The most common capital improvements during the years 1990 to 1995 were bathroom renovations, kitchen facility replacements, and heating system upgrades.[7] Only 12 percent of properties included handicap-accessible units.

According to owners, 38 percent of properties housed mostly low-income people, and 39 percent were occupied by mostly middle-income people. Only 3 percent of multifamily properties have mostly high-income renters, and these renters are more likely to be in properties with more units. According to a report by the U.S. Department of Housing and Urban Development based on the POMS data, roughly half of multifamily units qualify as affordable according to HUD standards.[8]
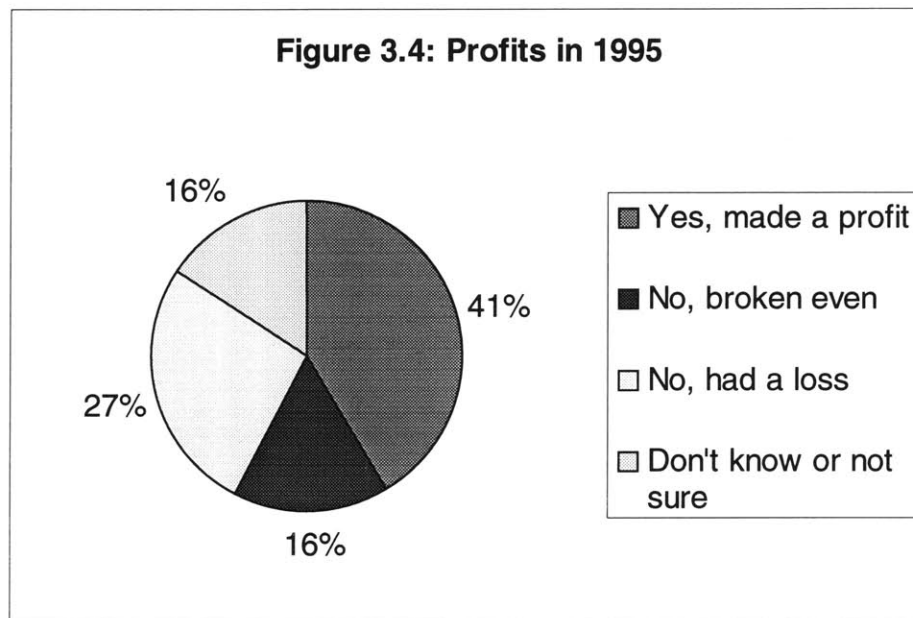
Financial Characteristics

Fifty-eight percent of multifamily properties made a profit or broke even, and 27 percent had a loss. Sixteen percent of those surveyed didn't know if the property was profitable during the

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[7] "Property Taxes and Parking Restrictions Were Leading Complaints of Multifamily Property Owners, Census Bureau Says," Press release, U.S. Department of Commerce, Census Bureau, December 2, 1998
[8] "The Providers of Affordable Housing." U.S. Housing Market Conditions, 4th Quarter 1996, U.S. Department of Housing and Urban Development, Office of Policy Development and Research, February 1997. Affordable rental units are identified as those that a family with 50 percent of the HUD-adjusted median income could afford witrhout spending more than 30 percent of their income on rent.

previous year.[9] Only 3 percent of properties over 50 units reported losses, but a high 37 percent reported that they didn't know whether the property was profitable. Researchers from the National Multihousing Council point out that this may be because the interviews were done in early 1996, before the previous year's profitability was determined.[10]   (Figure 3.4)

Figure 3.4: Profits in 1995

- Yes, made a profit
- No, broken even
- No, had a loss
- Don't know or not sure

16%
41%
27%
16%

Operating income and expenses vary widely among properties. Average rent receipts per unit were $5,152.[11] Based on property level data, yearly median operating expenses per unit were $2,300. Large properties had higher median operating expenses as $3,300. Three-quarters of units are in mortgaged properties. Average mortgage expenses were $1,139 per unit, or 22 percent of rent receipts.

Management Policies

About 21 percent of owners reported that they were seeking new tenants at the time of the survey. Approximately one-quarter of properties with less than 5 units rejected tenants in the

[9] "Property Taxes and Parking Restrictions Were Leading Complaints of Multifamily Property Owners, Census Bureau Says," Press release, U.S. Department of Commerce, Census Bureau, December 2, 1998
[10] "Highlights from HUD's New Survey of Property Owners and Managers," Research Notes, National Multihousing Council, February 1997.
[11] Emrath, Paul, "Property Owners and Managers Survey," Housing Economics, July 1997: (6 –9), p. 7.

last two years, and 85 percent of properties with 50 or more units. The main reasons tenants were rejected for apartments were poor credit, insufficient income, and unfavorable references.

Fifty-five percent of the owners of multifamily properties were attempting to reduce tenant turnover by redecorating or making other improvements. Twenty-seven percent of properties offered rent concessions to retain residents. Larger properties were more likely to offer increased services as a means to retain tenants. Owners at less than 1 percent of properties were trying to increase tenant turnover.

The median amount of gross rental income spent on maintenance was 14%. Smaller properties spent a smaller percent of income on maintenance.[12]

Governmental Benefits and Regulations

Overall, 7 percent of properties have Section 8 tenants, with larger properties more likely to participate in the Section 8 program. Four percent of properties participated in other Federal, state, or local housing programs. Owners of larger properties were much more likely to know about the Section 8 program, at 88 percent. Nearly half of small multifamily property owners did not know about the program.

When asked what governmental regulations made it more difficult to operate the property, property taxes were consistently ranked highest, regardless of size of property. Parking was also listed as a major complaint.

3.3 Response Limitations

Important considerations in analyzing the data are the rate and pattern of non-response to the survey questions. Few categories were completed by all respondents and many fundamental questions had high rates of non-response. Financial information, in particular, was frequently not reported. Per Census tabulations by unit, 40% of represented units did not have complete operating cost data.[13] The category most responded to, advertising cost, had a 38% non-response rate. Six of the twenty operating cost categories had over 50% non-response rates. When tabulated by property size, the larger the property, the less likely the owner was to respond to operating cost questions. (Figure 3.5) Tabulation of the survey responses revealed

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[12] Savage, 2.
[13] "Property Owners and Managers Survey: Source and Accuracy Statement," op. cit.

only 32% of individual owners responded to all sixteen operating cost categories used in calculating net operating income in this paper. This was slightly better than the response rate of properties owned by limited partners (29%) and much better than the response rate of real estate corporations (18%), the next largest owner types. This is consistent with the tendency for limited partnerships and real estate corporations to own larger properties.

Figure 3.5: Non-response by Building Size
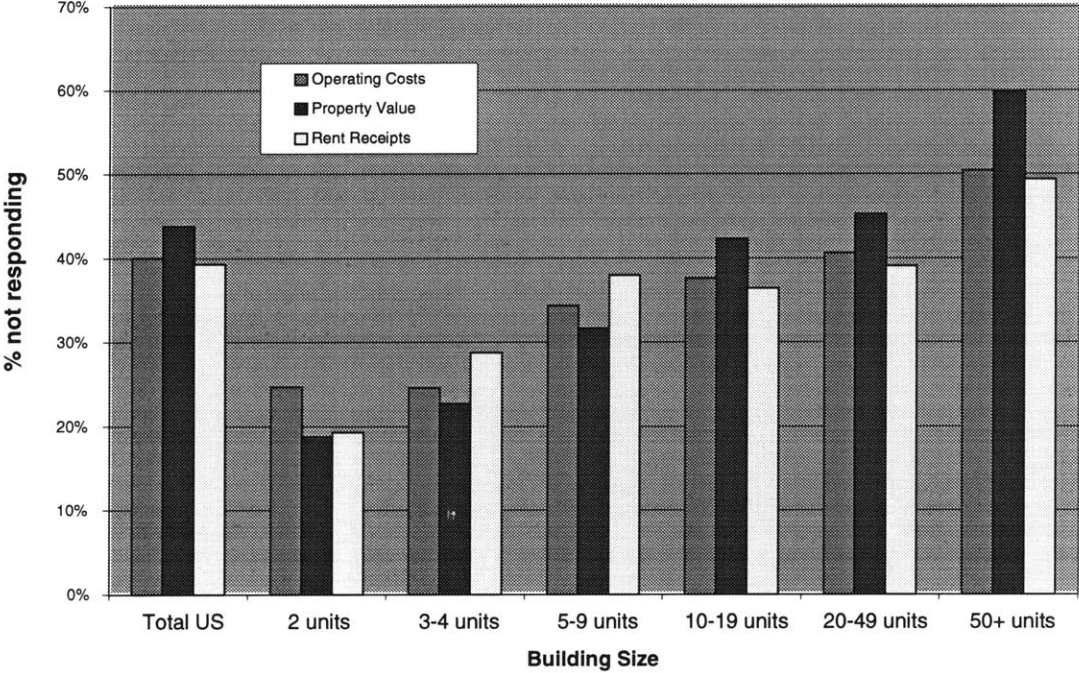
Chapter 4: POMS and Capital Improvements

To begin to understand the determinants of renovation, basic characteristics are investigated in search of obvious relationships. The building's size, age, location, ownership, profitability and tenant composition are all potentially significant variables in the probability of its renovation and shall be explored in this chapter with bivariate correlations.

To begin, we look at the effect of property size on its likelihood to be renovated. The series of capital improvement questions in POMS ask if any improvements were made to the property, not the subject unit. This means that the question would be responded to in the affirmative if any unit in the property had had a kitchen replaced, for example, in the last five years. Obviously, then, the more units in a property, the greater the likelihood work had been done. Unfortunately, the relationship is not direct. Several units in a property may be remodeled at once, for example. Also, other capital improvement items, such as the plumbing and air tempering systems, may serve the whole property resulting in a likelihood of replacement less directly related to the number of units in the property. Table 4.1 shows that, in fact, no clear relationship exists for either an appearance-related item, a kitchen, or a basic system, heat. For both the largest and smallest properties, the rate of remodel is somewhat lower, but the expected increase with size is not evident.

Table 4.1 - Effect of Building Size on Renovation

Bldg Size	N	%	Kitchen replacements #	Kitchen replacements %	Heating system upgrades #	Heating system upgrades %
5-9 units	543	13%	51	9.4%	32	5.9%
10-19 units	422	10%	37	8.8%	23	5.5%
20-49 units	617	15%	80	13.0%	43	7.0%
50-99 units	536	13%	62	11.6%	42	7.8%
100-149 units	458	11%	65	14.2%	45	9.8%
150-199 units	357	8%	42	11.8%	35	9.8%
200-299 units	561	13%	71	12.7%	52	9.3%
300+ units	721	17%	66	9.2%	44	6.1%
	4215		474	11.2%	316	7.5%

As mentioned, the individual property owner owns a greater percentage of smaller properties, while corporations and partnerships own a greater percentage of larger properties. To see if differing behavior of these types of owners could have some relation to renovation probability,

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we separate them out in Table 4.2. Again, no clear pattern is evident between likelihood to remodel and building size for each type of owner. The smallest and largest properties typically have lower rates, but high and low spikes exist throughout the data. A low number of observations in some categories contributes to this.

When looking at a summary of remodeling rates for most owner types, little variation exists except of that of real estate corporations and limited partnerships. See Table 4.3. Whereas other entities renovated kitchens approximately 10% of the time, these two major owners renovated slightly more than 12% of the time.

A possible explanation for this might be that their specialization in real estate gives them the ability to recognize the profit maximizing opportunity. A REIT may have similar knowledge but may have funding problems due to the cash payout requirements of their structure. General partnerships and joint ventures may have control issues. The individual owner is the third most likely to remodel. Their ability to recognize and fund the opportunity probably varies more widely. Many other explanations are possible, though, and the differences are not overly significant.

Table 4.2 - Ownership and Size Interactions

UNITS OWNED BY INDIVIDUALS

Bldg Size	N	Kitchen replacements #	%	Heating system upgrades #	%
5-9 units	379	39	10.3%	20	5.3%
10-19 units	251	27	10.8%	14	5.6%
20-49 units	289	53	18.3%	24	8.3%
50-99 units	174	24	13.8%	14	8.0%
100-149 units	90	12	13.3%	12	13.3%
150-199 units	77	9	11.7%	9	11.7%
200-299 units	102	11	10.8%	11	10.8%
300+ units	91	8	8.8%	6	6.6%
	1453	183	12.6%	110	7.6%

UNITS OWNED BY PARTNERSHIPS

Bldg Size	N	Kitchen replacements #	%	Heating system upgrades #	%
5-9 units	43	4	9.3%	6	14.0%
10-19 units	42	3	7.1%	4	9.5%
20-49 units	144	13	9.0%	9	6.3%
50-99 units	156	20	12.8%	15	9.6%
100-149 units	160	25	15.6%	12	7.5%
150-199 units	109	13	11.9%	9	8.3%
200-299 units	180	26	14.4%	18	10.0%
300+ units	230	21	9.1%	15	6.5%
	1064	125	11.7%	88	8.3%

UNITS OWNED BY CORPORATIONS

Bldg Size	N	Kitchen replacements #	%	Heating system upgrades #	%
5-9 units	25	1	4.0%	2	8.0%
10-19 units	41	3	7.3%	1	2.4%
20-49 units	56	7	12.5%	4	7.1%
50-99 units	63	9	14.3%	3	4.8%
100-149 units	73	13	17.8%	9	12.3%
150-199 units	55	5	9.1%	5	9.1%
200-299 units	78	18	23.1%	8	10.3%
300+ units	121	9	7.4%	10	8.3%
	512	65	12.7%	42	8.2%

Table 4.3 - Renovation by Owner Type

Owner type	N	Kitchen replacements #	Kitchen replacements %
individual	2766	289	10.4%
trustee for estate	88	5	5.7%
limited partnership	728	91	12.5%
general partnership	398	39	9.8%
joint venture	111	11	9.9%
REIT	121	11	9.1%
RE corporation	346	46	13.3%
other corporation	191	18	9.4%
nonprofit or church	165	16	9.7%
	4914	526	10.7%

Another obvious influence to investigate is age. Table 4.4 shows the possible existence of differing bivariate relationships for the remodel of appearance and systems items.

Table 4.4 - Renovation by Structure Age

Year Built	N	Kitchen replacements #	Kitchen replacements %	Heating system upgrades #	Heating system upgrades %
<1919	527	52	9.9%	41	7.8%
1920-1929	366	36	9.8%	36	9.8%
1930-1939	268	27	10.1%	14	5.2%
1940-1949	298	32	10.7%	19	6.4%
1950-1959	376	48	12.8%	33	8.8%
1960-1969	902	127	14.1%	99	11.0%
1970-1979	1374	184	13.4%	123	9.0%
1980-1984	491	39	7.9%	17	3.5%
1985-1989	675	30	4.4%	22	3.3%
	5277	575	10.9%	404	7.7%

The rate of kitchen remodeling increases with age to a high point in structures approximately 20 to 30 years old. The rate diminishes slightly in structures older than that. Rate of heating system upgrade has distinct high points in structures 30 and 70 years old. As Mayer showed, the inadequacy of basic systems decreases the likelihood of remodeling on the whole. Basic systems are replaced when they must be for functional reasons. The pattern of heating system upgrade suggests a lifespan of a heating system of approximately 30 to 40 years. Kitchen remodeling occurs more frequently as styles and their appeal change.

Location may also be related to renovation. The POMS data specifies only whether the property is in the Northeast, Midwest, South or West, whether it is in a metropolitan area, and, if so, whether it is in the center city.

Table 4.5 - Renovations by Location

| Location | N | Kitchen replacements | | Location | N | Kitchen replacements | |
		#	%			#	%
Northeast	1348	145	10.8%	Northeast center city	750	90	12.0%
				Northeast suburb	506	49	9.7%
				Northeast rural	92	6	6.5%
Midwest	1287	130	10.1%	Midwest center city	621	64	10.3%
				Midwest suburb	457	55	12.0%
				Midwest rural	209	11	5.3%
South	1770	189	10.7%	South center city	959	106	11.1%
				South suburb	622	64	10.3%
				South rural	189	19	10.1%
West	1349	128	9.5%	West center city	684	66	9.6%
				West suburb	566	51	9.0%
				West rural	99	11	11.1%
	5754	592	10.3%		5754	592	10.3%

Looking at the rate of remodel of kitchens by just region of country – northeast, midwest, south and west - shows that the rate of kitchen remodel is fairly uniform. The rate in the west is slightly below the rest of the group, as one might expect given the newer housing stock there. The northeast and south have the highest rate. When each region is divided into center city, suburb and rural areas, differences are still slight, but a pattern is evident. In the northeast and midwest, the remodeling rates are much higher in the metropolitan areas than the rural areas. In the south and west, the remodeling rates are more uniform across the divisions. It is important to note that the rural data contains much fewer observations, though. One possible explanation for the different rates is in the definition of metropolitan area. Western and southern metropolitan areas extend to areas that are essentially rural. The difference in age between housing in and out of the metropolitan area is probably lower in the south and west as well.

Since the larger buildings are located more frequently in the west and smaller buildings in the northeast, we again check if the remodel rate's variation with size is more clearly related if we

separate out the regions. See Table 4.6. Again, no clear relationship is evident and the small sample size for some categories gives more deviation than probably exists.

Table 4.6 - Renovation by Size and Location

NORTHEAST, METROPOLITAN AREA

Bldg Size	Northeast M.A.		Kitchen replacements		Heating system upgrades	
	N	%	#	%	#	%
2-4 units	492	39%	44	8.9%	40	8.1%
5-9 units	143	11%	16	11.2%	13	9.1%
10-19 units	80	6%	12	15.0%	7	8.8%
20-49 units	126	10%	18	14.3%	7	5.6%
50-99 units	105	8%	14	13.3%	8	7.6%
100-149 units	78	6%	8	10.3%	7	9.0%
150-199 units	48	4%	7	14.6%	11	22.9%
200-299 units	76	6%	8	10.5%	14	18.4%
300+ units	108	9%	12	11.1%	14	13.0%
	1256	100%	139	11.1%	121	9.6%

WEST, METROPOLITAN AREA

Bldg Size	West M.A.		Kitchen replacements		Heating system upgrades	
	N	%	#	%	#	%
2-4 units	239	19%	21	8.8%	8	3.3%
5-9 units	120	10%	8	6.7%	3	2.5%
10-19 units	113	9%	7	6.2%	2	1.8%
20-49 units	186	15%	27	14.5%	11	5.9%
50-99 units	153	12%	14	9.2%	13	8.5%
100-149 units	104	8%	10	9.6%	6	5.8%
150-199 units	90	7%	12	13.3%	4	4.4%
200-299 units	117	9%	13	11.1%	6	5.1%
300+ units	128	10%	5	3.9%	2	1.6%
	1250	100%	117	9.4%	55	4.4%

Since the renovation decision is one of profit maximization, financial characteristics should have some relation to its likelihood. A most basic financial characteristic is profitability. Table 4.7 shows the respondent's rate of remodel given the profitability reported. For both an appearance-oriented item and a basic system, the rates are higher if the owner does not think the property was profitable the previous year. One possible explanation is that the work was done to increase profitability.

Table 4.7 - Renovation by Profitability

Profitability		Kitchen replacements		Heating system upgrades	
		#	%	#	%
yes	1798	199	11%	110	6%
no, broke even	265	41	15%	27	10%
no, had a loss	576	77	13%	64	11%
don't know or not sure	1252	139	11%	98	8%
not reported	324	18	6%	17	5%
	4215	474	11%	316	7%

Another is that the property was not profitable because of the construction costs incurred and rent lost by renovating. This cannot be a clear determinant of the likelihood to remodel, then.

Tenant income characteristics provide a glimpse into the property's market position, and its structure and neighborhood quality. A breakdown of renovation rates by tenant income shows a slight increase in renovations in properties with low income tenants, whether exclusively low income or a mix. See Table 4.8. Mayer's study showed that renovation was more likely in neighborhoods with higher crime rates and in buildings in poor condition visually. This would be one explanation of the higher remodel rates, if these factors are what is making the property affordable. The mixed income properties that included high income tenants also had high renovation rates, though, indicating that other factors must be at work. In any event the differences in rate are slight.

Table 4.8 - Renovation by Incidence of Crime

Vandalism	N	Kitchen replacements	
		#	%
never	2469	227	9.2%
rarely	1796	199	11.1%
sometimes	906	122	13.5%
frequently	189	21	11.1%
	5360	569	10.6%

Examination of physical, geographic, management, financial and tenant characteristics reveals some weak bivariate correlations to the renovation rate of rental housing, but no clear determinants. In the next chapter, more significant relationships will be sought through multivariate analysis.

Chapter 5: Multivariate Analysis

5.1 Description of the Model

In this chapter, multivariate analysis is performed to better understand the determinants of the decision to renovate. Since no information was collected in the POMS on expenditures for capital improvements, we are limited to exploring only whether capital improvements were made, not amount spent. Given the exploratory nature of this study and the limitations of the data set, this is a reasonable starting point.

The lack of any quantification of value of the improvement immediately raises the question of whether all the reported improvements were actually substantial. The POMS includes questions about both repairs and maintenance and capital improvements. For both, questions were asked about whether work was done in the last five years for a number of similar categories. For example:

Repair and maintenance section:

10.   In the last five years, was any of the following work done to the rental unit identified in Item A?

c.   Some or all kitchen appliances replaced.

Capital improvement section:

19.   In the last five years have any of the following capital improvements or upgrades been made or started at this property? Capital improvements are additions to the property that increase the value or upgrade the facilities.

d.   Replacement of kitchen facilities.

In addition, the amount spent on repairs and maintenance was quantified in two ways. In the operating cost section, an item was included for repairs and maintenance expenditures. The question prior to this asked for the percentage of rental income spent on maintenance. Both questions clearly stated that expenditures for capital improvements were to be excluded.

Given that similar questions were posed but with a clear difference in magnitude of scope and given that the difference was reinforced whenever maintenance expenditures were requested, it is assumed that the respondents only indicated true, substantial capital improvements in that section. Minor repairs are assumed to have been properly indicated in the maintenance and repair section.

A linear equation was estimated using an ordinary least squares regression.

$$I = a + SUM(\beta i^* Xi)$$

Where I = 1 if subject improvement was made in 1995, 0 if not.

    a = constant

    βi = Coefficients estimated in the regression.

    Xi = Variables hypothesized to affect the likelihood of the improvements being made.

Only improvements made in 1995 are being used since several variables give conditions existing at the property in 1995 or the year previous. These conditions could have been very different prior to any remodeling done before 1995. Equations are fit for four different improvement types. The replacement of kitchens and bathrooms is viewed as a more discretionary improvement, while the upgrade of the plumbing and heating systems is less so. Fitting an equation for all four should draw out both general and type-specific determinants.

The observations used were limited to those of properties with greater than four units. Properties smaller than these are frequently owner-occupied and sometimes treated differently by lending institutions. As discussed, homeowner renovation decision behavior is different than rental owner behavior. In properties this small, the owner-occupied behavior may dominate and skew the results. Of the 5754 observations in POMS, 4215 represent properties larger than four units in size.

Rural properties were also excluded from the empirical analysis. The crosstabulations presented in the previous chapter showed that, in some regions, renovation behavior differed between metropolitan and rural areas. The rural areas also contained far fewer observations.

Given their potentially confounding effects and small numbers, their loss was viewed as acceptable. This narrowed the dataset to 3884 observations.

As mentioned earlier, the rate of non-response to some questions in the survey was very high. While the capital improvement questions were responded to very frequently, the equation estimated includes variables with higher non-response rates. Of the 3884 multifamily, metropolitan observations, only 1534 observations had complete information in all of the categories of interest. Tables 5.1 and 5.2 list the descriptive statistics for all reported values of each item and those of the dataset used in the regression analysis, respectively. Comparison of the two shows some differences. All of the tested capital improvements tested occurred more frequently in regression sample. More of the properties were profitable, a higher percentage of real estate corporate owners is represented, and fewer properties employ managers. The tested sample has an older mix of smaller buildings. More properties with low and moderate to low income tenants are included. Slightly more midwestern and western properties are included in the reduced set at the expense of southern properties. The tested set contains a much higher percentage of rent controlled units. Overall, though, the differences are small and acceptable for the level of analysis undertaken. Given the reduced sample size, dividing the sample further was resisted, though. Regional effects were handled with both region dummy variables and select interaction terms.

The following are a series of hypotheses regarding the effect of various conditions on the likelihood of renovation. Characteristics of the financial condition, owner, management, tenant, structure and neighborhood are tested. Hypotheses of previous researchers are tested alongside new hypotheses.

5.2 Specific Hypotheses

Financial characteristics
Profitability
The property's profitability over the previous year may have some relation to whether a profit maximizing opportunity was pursued. The most likely candidate for improvement is the property that is not profitable. The owner of the profitable property may not be actively pursuing ways to further increase profitability. While the owner of the unprofitable property may be reluctant to

Table 5.1 - Descriptive Statistics for All Respondents [a]

	N	Min.	Max.	Mean	Std. Dev.
Dependent Variable					
Kitchen replacement	3731	0	1	0.118	0.322
Bathroom replacement	3728	0	1	0.091	0.288
Plumbing replacement	3743	0	1	0.070	0.256
Heating system replacement	3748	0	1	0.077	0.266
Financial Characteristics					
Property profitable last year	3591	0	1	0.462	0.499
Property more profitable than similar properties	3639	0	1	0.141	0.348
10%-19% of tenants delinquent	3154	0	1	0.155	0.362
20% or more of tenants delinquent	3154	0	1	0.117	0.322
*Omitted - Less than 10% of tenants delinquent					
Value increased	3669	0	1	0.278	0.448
Ownership Characteristics					
Owner purchased within past 2 years	2886	0	1	0.138	0.345
Owner intends to hold property for 5 or more years	2771	0	1	0.867	0.340
Individual owner	3223	0	1	0.406	0.491
Individual owner in the midwest	3223	0	1	0.084	0.277
Individual owner in the south	3223	0	1	0.114	0.318
Individual owner in the west	3223	0	1	0.127	0.333
Real estate corporation	3223	0	1	0.098	0.297
*Omitted - Limited partner or other owner					
Management Characteristics					
Owner employs manager	3746	0	1	0.829	0.377
Competes for tenants with subsidized properties	3521	0	1	0.232	0.422
Competes for tenants with public housing	3521	0	1	0.167	0.373
*Omitted - Competes with private, nonsubsidized only					
10%-19% of rental income spent on maintenance	2621	0	1	0.286	0.452
20% or more of rental income spent on maintenance	2621	0	1	0.171	0.377
*Omitted - Less than 10% spent on maintenance					
Physical Characteristics					
Built prior to 1940	3722	0	1	0.125	0.331
Built 1940-1959	3722	0	1	0.096	0.295
Built 1960-1979	3722	0	1	0.484	0.500
*Omitted - Built 1980 or after					
20-49 units	3884	0	1	0.134	0.340
50-99 units	3884	0	1	0.125	0.331
100-199 units	3884	0	1	0.197	0.398
200-299 units	3884	0	1	0.143	0.350
300+ units	3884	0	1	0.184	0.387
*Omitted - 5-19 units					
Neighborhood Characteristics					
Vandalism	3615	0	1	0.662	0.473
Theft	3594	0	1	0.644	0.479
Tenant Characteristics					
Tenant income low or low to moderate	3668	0	1	0.451	0.498
Tenant income high or moderate to high	3668	0	1	0.157	0.364
Tenant income diverse	3668	0	1	0.067	0.250
*Omitted - Tenant income moderate					
Lower tenant turnover desired	3622	0	1	0.797	0.402
Location					
North suburban	3884	0	1	0.078	0.268
Midwest urban	3884	0	1	0.108	0.311
Midwest suburban	3884	0	1	0.091	0.288
South urban	3884	0	1	0.209	0.407
South suburban	3884	0	1	0.135	0.341
West urban	3884	0	1	0.141	0.348
West suburban	3884	0	1	0.119	0.324
*Omitted - North urban					
Rent control	3841	0	1	0.111	0.314
Rent control in the North	3841	0	1	0.067	0.249

[a] among properties with more than 4 units and in metropolitan areas

Table 5.2 - Descriptive Statistics - Multivariate Analysis Sample Set

	N	Min.	Max.	Mean	Std. Dev.
Dependent Variables					
Kitchen replacement	1534	0	1	0.137	0.344
Bathroom replacement	1534	0	1	0.104	0.305
Plumbing replacement	1534	0	1	0.091	0.287
Heating system replacement	1534	0	1	0.083	0.277
Financial Characteristics					
Property profitable last year	1534	0	1	0.548	0.498
Property more profitable than similar properties	1534	0	1	0.149	0.356
10%-19% of tenants delinquent	1534	0	1	0.159	0.366
20% or more of tenants delinquent	1534	0	1	0.127	0.333
*Omitted - Less than 10% of tenants delinquent					
Value increased	1534	0	1	0.284	0.451
Ownership Characteristics					
Owner purchased within past 2 years	1534	0	1	0.114	0.318
Owner intends to hold property for 5 or more years	1534	0	1	0.841	0.366
Individual owner	1534	0	1	0.396	0.489
Individual owner in the midwest	1534	0	1	0.090	0.286
Individual owner in the south	1534	0	1	0.085	0.280
Individual owner in the west	1534	0	1	0.127	0.333
Real estate corporation	1534	0	1	0.070	0.255
*Omitted - Limited partner or other owner					
Management Characteristics					
Owner employs manager	1534	0	1	0.763	0.425
Competes for tenants with subsidized properties	1534	0	1	0.253	0.435
Competes for tenants with public housing	1534	0	1	0.199	0.400
*Omitted - Competes with private, nonsubsidized only					
10%-19% of rental income spent on maintenance	1534	0	1	0.308	0.462
20% or more of rental income spent on maintenance	1534	0	1	0.166	0.372
*Omitted - Less than 10% spent on maintenance					
Physical Characteristics					
Built prior to 1940	1534	0	1	0.178	0.383
Built 1940-1959	1534	0	1	0.110	0.313
Built 1960-1979	1534	0	1	0.460	0.499
*Omitted - Built 1980 or after					
20-49 units	1534	0	1	0.161	0.368
50-99 units	1534	0	1	0.118	0.323
100-199 units	1534	0	1	0.185	0.389
200-299 units	1534	0	1	0.126	0.332
300+ units	1534	0	1	0.151	0.358
*Omitted - 5-19 units					
Neighborhood Characteristics					
Vandalism	1534	0	1	0.668	0.471
Theft	1534	0	1	0.636	0.481
Tenant Characteristics					
Tenant income low or low to moderate	1534	0	1	0.520	0.500
Tenant income high or moderate to high	1534	0	1	0.126	0.332
Tenant income diverse	1534	0	1	0.055	0.229
*Omitted - Tenant income moderate					
Lower tenant turnover desired	1534	0	1	0.780	0.415
Location					
North suburban	1534	0	1	0.076	0.266
Midwest urban	1534	0	1	0.124	0.330
Midwest suburban	1534	0	1	0.093	0.291
South urban	1534	0	1	0.179	0.383
South suburban	1534	0	1	0.106	0.308
West urban	1534	0	1	0.152	0.359
West suburban	1534	0	1	0.113	0.316
*Omitted - North urban					
Rent control	1534	0	1	0.179	0.384
Rent control in the North	1534	0	1	0.098	0.297

invest more in it, or may have problems funding the project, he should still be more actively pursuing such options. A true interpretation is muddied by the possibility that the property was unprofitable because of the expenses involved in the capital improvement. A dummy variable is set equal to one if the respondent reported earning a profit the previous year. The omitted case is the owner not making a profit or unsure of his profitability.

Relative profitability

Two possible effects are possible. An owner who feels his property is not as profitable as comparable properties is more likely to remodel to improve its competitiveness. Alternatively, though, an owner who just committed capital to his building is probably convinced it is at its optimal condition and more profitable than its competitors. A dummy variable equal to one if the respondent thought the property more profitable than similar properties will help clarify the issue.

Change in property values

A change in property values in itself does not mean that a profit maximizing opportunity exists. It does provide the liquidity to fund any opportunities that do exist, though. Borrowing against the newfound value allows the owner to undertake any worthwhile projects. A dummy variable is set equal to one if the respondent thought area property values had risen in the past year.

Delinquency

Tenant delinquency in rent payments at low levels is an expected but unwelcome cost of ownership. At low levels, the cost of removing tenants is unjustified. Beyond a certain point, it becomes worthwhile to seek better tenants. Renovation is hypothesized to be one way this is done. Higher delinquency may spur property owners to reposition the property through improvement. When delinquency rates become too high, however, a cash flow problem arises. Two dummy variables are used to test for this effect. The first is set equal to one when delinquencies are between 10% and 19%, the other when they are 20% or greater.

Cash Flow and Cost of Capital

Besides the respondent's answer to the profitability question, profitability can be calculated from the financial information given. Measures of profitability were calculated from the rent receipts, operating costs, mortgage payments and value. These included net operating income to value ratios and net cash flow after debt service. The first mortgage interest rate was treated as a

cost of capital. In equations estimated using these variables, none of the coefficients was statistically significant. The respondent's answer to the profitability question was consistently more significant. As mentioned, the non-response rates for financial variables in particular were very high. Including these variables in the analysis lowered the usable sample size to 884 observations. Given their low significance, the variables were dropped from the analysis so that the sample size could be nearly doubled.

Tax credits

Properties receiving favorable tax treatment may be more likely to be improved. The additional capital can be used to fund a profit maximizing opportunity. The tax abatement or refund may also have been granted because improvements were to be made. The POMS data set contains information on the tax abatement or refunds resulting from being located in an economic development area, low income area or housing low income tenants. Unfortunately, positive responses made up a very small portion of the sample and results from equations estimated were poor. The variables were subsequently removed.

Owner characteristics

An owner's level of understanding of real estate and market conditions is integral to his ability to recognize the profit maximizing remodeling decision. Different ownership entities also have different abilities to capitalize on the opportunity. Several factors indicate this ability and depth of knowledge.

New owner

Through his search for investment property, the new owner should be quite familiar with the real estate market. The gain possible from an underimproved property should be readily apparent. In buying the property, he is making an active investment decision. Meanwhile, a long time owner may be more passive in tracking the market and managing his property. A recently purchased property is probably more likely to be remodeled, then. To test for this effect, a dummy variable is set equal to one if the property was purchased within the two years prior to the survey.

Holding period

An owner with a short expected holding period is less likely to assume the initial costs of a capital improvement. An owner planning to sell the property within a couple of years may not be able to do the work, rent the unit and achieve the stabilized rents required to maximize sale proceeds. The expected holding period needs to be longer to realize the gain the optimal property condition will yield. A dummy variable is set equal to one in the model if the respondent projected holding on to the property for five or more years.

Owner type

Different types of owners each have qualities that may serve to promote or restrict the maintenance of the property. Larger institutions or corporations, especially those in the real estate business, are more likely to have systems and constant monitoring procedures in place to ensure the best use is being made of their capital. When it is most profitable to remodel, the professional corporation will be more likely to do so. The individual owner, at the other extreme, may have less systematic a review and evaluation procedure and may miss such an opportunity. Alternatively, he may misjudge the situation and improve when not ideal. Dummy variables are used for the individual owner and the real estate corporation. The individual owner owns 40% of the properties in the sample and the real estate corporation 7%. The omitted case is all other owner types.

Management Characteristics

Competition for tenants

Profit can be maximized by raising returns or lowering risk. Income from government subsidies carries less risk than that purely from tenants. The condition of the property may affect its ability to compete for those tenants bringing government subsidies. The desirability of the government subsidy may lead to increased remodeling efforts in properties competing for subsidy holding tenants. Conversely, though, properties competing with public housing may be less likely to upgrade. The remodeling effort will not help win the tenant considering public housing. Also properties competing only with privately owned, unsubsidized properties may be less likely to remodel. Dummy variables are used for properties which compete with only private properties, whether subsidized or not, and for those that compete with public housing. The omitted case are properties that compete only with private, nonsubsidized properties.

Professional Management

A professional manager may have more market knowledge and reasonable expectations than an owner manager. With these, he may be more likely to recognize the profit maximizing opportunity renovation may provide. As such, the professionally managed property may be more likely to be renovated. Alternatively, though, without a vested interest in the property beyond management fee collection, the professional manager may not have the incentive to recommend a renovation program. Being one step removed from the property, the owner would be less likely to renovate, then. A dummy variable set equal to one if the owner employs a manager is used to test for this effect.

Maintenance

A moderate level of maintenance may prolong the life of a property's systems, while a high level of maintenance may indicate that the property is in poor condition. As such, moderate expenditures may decrease the likelihood of systems type improvements. Discretionary improvements are probably less affected by maintenance expenditures. Dummy variables were used for two different levels of maintenance expenditures to clarify this issue. The first is 10% to 19% of rental income and the second is 20% and up. The omitted case is less than 10%.

Structure characteristics

As discussed, the likelihood to remodel is heavily dependent on the structure condition and the difference between that and the optimal condition. Unfortunately, the POMS data contains very little insight into the property condition. Certain tenant characteristics may be related to structure quality, though. See Tenant Characteristics section.

Exterior Condition

Mayer (10) found that an inadequate exterior condition led to an overall higher likelihood to remodel. Of building condition variables, a unit change in exterior condition had the greatest affect on likelihood. As discussed earlier, Mayer theorized that inadequate appearance-oriented items would have a positive affect on likelihood. The POMS data contains no information on or proxy for exterior condition.

Kitchen and Bathroom Condition

The kitchen and bathrooms' current condition is critical to determining how far removed they are from the profit maximizing condition. Also, being somewhat cosmetic in nature, their inadaquacy will increase the likelihood to remodel, as postulated by Mayer. The POMS data contains no information on or proxy for their condition.

Plumbing Condition

Heating and Air conditioning Condition

As above, their condition is critical to determining the likelihood of their remodel, with the worse the condition the higher the likelihood. Since they are basic systems, though, their inadequacy will lower the likelihood of cosmetic repairs being undertaken, according to Mayer. The POMS data contains no information on or proxy for their condition.

Foundation Condition

Although there is no capital improvement category for the foundation, its condition will affect the likelihood of other repairs. As stated above, the worse its condition, the lower the likelihood of rehabilitation on the whole. This was another variable found by Mayer to have a larger affect on likelihood. The POMS data contains no information on or proxy for its condition.

Relative Building Condition

Mayer found that the likelihood to remodel was essentially unaffected by a differential in building condition between the subject property and its neighbors. The POMS data contains no information on or proxy for its condition.

Age

Helbers and McDowell (7) theorized that the age of the structure could represent a deterioration rate, since an older structure usually requires more work. An older structure could also just have more components reaching the end of their useful lives, although not deteriorating any more quickly. In either case, the older the structure, the more likely some rehabilitation will be done. Dummy variables are used to represent 20 year spans of time. The omitted case is properties built in 1980 or later.

Size

The profit maximizing condition should not be dependent on building size, but the effect of the phrasing of the questionnaire is tested with this series of variables. Dummy variables are used to investigate the effects of number of units in the property. The omitted case is 5 to 19 unit properties.

Neighborhood Characteristics

Mayer empirically demonstrated that certain neighborhood conditions affected the increase in rent if the building were improved. Below are several of his findings. Unfortunately, the POMS data does not contain information on many of the variables. Certain tenant characteristics may be related to neighborhood quality, though. See Tenant Characteristics section.

Street Condition

Mayer found that the better the condition of the curbs, gutters and sidewalks, the better the chance of remodel. The POMS data contains no information on or proxy for its condition.

Crime

Mayer found the presence of crime to increase the likelihood of rehabilitation significantly. The differential between "good" and "bad" buildings was higher, and bargain hunting was taking place. The POMS data does contain some questions about disruptive behavior at the property. Included in our equation are two terms, theft and vandalism. They are dummy variable set equal to one if the crime occurs rarely, sometimes or frequently. The omitted case is never.

Noise and Traffic

Mayer found that both noise and traffic in the neighborhood had a slightly negative affect on the likelihood of rehabilitation. The POMS data contains no information on or proxy for these conditions.

Adjacent Uses, Density and Condition of Surrounding Structures

The presence of nonresidential adjacent uses was found by Mayer to have an insignificant effect on the likelihood to remodel. Population density and surrounding structure condition also had little effect. The POMS data contains no information on or proxy for these conditions.

Tenant characteristics

Tenant composition in the property gives insight into the target market of the property and into the neighborhood or structure condition

Tenant income

A building with lower income tenants should either be in worse condition or in a worse neighborhood. In either case, the likelihood is increased that renovation will be done. The POMS dataset gives a variety of income levels. It is hypothesized that those properties with a higher percentage of lower income tenants will be more frequently renovated. Dummy variables are used for properties with low or low to moderate income tenants, high or moderate to high income tenants, or tenants diverse of income. The omitted case is moderate income tenants only.

Turnover

If an owner is trying to minimize turnover, he is probably going to consider improvements as incentive to tenants to stay. A dummy variable, equal to one if the owner wants to minimize turnover, is used to test this theory.

Location

The POMS data set specifies whether the property is located in the northeast, midwest, south or west. It also indicates whether the property is in a metropolitan area or not, and, if so, whether it is in the center city. To determine the profit maximizing condition, both revenues and costs are critical. Other empirical studies included few to no cost variables because cost was assumed constant across the small region of study. Being a cross-section of the entire country, the POMS properties' costs cannot be assumed constant. Unfortunately, the limited breakdown provided does not come close to allowing for a control of cost and introduces a potentially serious limitation into the analysis. Dummy variables are used for each urban and suburban region of the country, with the northeast urban area omitted.

Interaction terms are used for individual owners of properties in each of the regions to investigate behavior by region.

Additional control is attempted by including a variable identifying rent-controlled properties. The rent control dummy is entered into the equation both alone and interacted with the northeast region. This variable should capture some of the activity taking place in the large, northeast urban areas, most notably New York City.

5.3 Results

The estimated equation for the likelihood of a kitchen renovation has an adjusted R-squared value of 0.034. The bathroom, plumbing and heating renovations have adjusted R-squared values of 0.034, 0.039 and 0.024, respectively. See Tables 5.3 through 5.6. While the overall explanatory power of the equations is small, one must remember the details of the data and model used. The POMS data leaves large gaps in information and the information we do have is best represented as dichotomous dummy variables. An estimated equation with a dichotomous dependent variable and a list of dichotomous independent variables is typically low of explanatory power. The important results are the relationships of the variables to each other and to the likelihood to renovate. Many coefficients may be small and statistically insignificant, but some do provide valuable insight into the renovation decision.

5.3.1 Kitchen Renovation

Several of the financial characteristics were significant in the likelihood of kitchen renovation. As predicted, the owner of a profitable property is less likely to renovate than the owner of an unprofitable one is. An owner who thinks the property more profitable than similar properties, however, is more likely to renovate. While this seems contradictory, it could be the effect of unprofitable owners who did renovate believing that they are ahead of the curve although not profitable yet. This coefficient is also smaller and only significantly different from zero at the 0.20 level. Those properties with a moderate level of delinquency had a greater probability of kitchen renovation. Properties with higher delinquency levels had no significant difference in probability from the base case of low delinquency. An increase in area property values did increase the likelihood of renovation as predicted.

Ownership characteristics had mixed effects. While the amount of time a property has been owned seems to be irrelevant, the longer the time it is projected to be owned into the future, the

Table 5.3 - Kitchen Replacement Equation

	B	Std. Error	t
Dependent Variable			
Kitchen replacement			
Financial Characteristics			
Property profitable last year	-0.058	0.018	-3.146
Property more profitable than similar properties	0.033	0.025	1.280
10%-19% of tenants delinquent	0.067	0.025	2.730
20% or more of tenants delinquent	0.029	0.028	1.033
*Omitted - Less than 10% of tenants delinquent			
Value increased	0.037	0.020	1.817
Ownership Characteristics			
Owner purchased within past 2 years	0.030	0.028	1.071
Owner intends to hold property for 5 or more years	0.039	0.024	1.611
Individual owner	0.090	0.040	2.281
Individual owner in the midwest	-0.093	0.054	-1.739
Individual owner in the south	-0.102	0.052	-1.958
Individual owner in the west	0.001	0.051	0.012
Real estate corporation	0.043	0.035	1.215
*Omitted - Limited partner or other owner			
Management Characteristics			
Owner employs manager	-0.017	0.026	-0.672
Competes for tenants with subsidized properties	-0.003	0.022	-0.114
Competes for tenants with public housing	-0.018	0.024	-0.736
*Omitted - Competes with private, nonsubsidized only			
10%-19% of rental income spent on maintenance			
20% or more of rental income spent on maintenance			
*Omitted - Less than 10% spent on maintenance			
Physical Characteristics			
Built prior to 1940	0.116	0.035	3.331
Built 1940-1959	0.091	0.034	2.679
Built 1960-1979	0.095	0.023	4.164
*Omitted - Built 1980 or after			
20-49 units	0.078	0.029	2.666
50-99 units	0.009	0.035	0.264
100-199 units	0.077	0.033	2.349
200-299 units	0.097	0.037	2.636
300+ units	0.056	0.036	1.560
*Omitted - 5-19 units			
Neighborhood Characteristics			
Vandalism			
Theft			
Tenant Characteristics			
Tenant income low or low to moderate	0.014	0.022	0.618
Tenant income high or moderate to high	0.030	0.031	0.994
Tenant income diverse	-0.017	0.041	-0.409
*Omitted - Tenant income moderate			
Lower tenant turnover desired	0.027	0.022	1.224
Location			
North suburban	0.025	0.041	0.610
Midwest urban	-0.016	0.047	-0.336
Midwest suburban	-0.014	0.048	-0.290
South urban	0.018	0.043	0.411
South suburban	0.011	0.047	0.240
West urban	-0.051	0.045	-1.118
West suburban	-0.072	0.048	-1.486
*Omitted - North urban			
Rent control	0.005	0.034	0.157
Rent control in the North	-0.091	0.051	-1.800
Constant	-0.035	0.057	-0.615

Number of Observations	1534
Adjusted R-squared	0.034

Table 5.4 - Bathroom Renovation Equation

	B	Std. Error	t
Dependent Variable			
Bathroom renovation			
Financial Characteristics			
Property profitable last year	-0.043	0.016	-2.638
Property more profitable than similar properties	0.011	0.023	0.503
10%-19% of tenants delinquent	0.023	0.022	1.037
20% or more of tenants delinquent	0.011	0.025	0.440
*Omitted - Less than 10% of tenants delinquent			
Value increased	-0.006	0.018	-0.310
Ownership Characteristics			
Owner purchased within past 2 years	0.057	0.025	2.266
Owner intends to hold property for 5 or more years	0.011	0.021	0.526
Individual owner	0.047	0.035	1.326
Individual owner in the midwest	0.039	0.048	0.813
Individual owner in the south	-0.061	0.046	-1.326
Individual owner in the west	0.046	0.045	1.004
Real estate corporation	0.024	0.031	0.779
*Omitted - Limited partner or other owner			
Management Characteristics			
Owner employs manager	-0.038	0.023	-1.684
Competes for tenants with subsidized properties	-0.011	0.020	-0.581
Competes for tenants with public housing	-0.015	0.022	-0.712
*Omitted - Competes with private, nonsubsidized only			
10%-19% of rental income spent on maintenance			
20% or more of rental income spent on maintenance			
*Omitted - Less than 10% spent on maintenance			
Physical Characteristics			
Built prior to 1940	0.111	0.031	3.597
Built 1940-1959	0.085	0.030	2.840
Built 1960-1979	0.052	0.020	2.591
*Omitted - Built 1980 or after			
20-49 units	0.082	0.026	3.145
50-99 units	0.069	0.031	2.240
100-199 units	0.056	0.029	1.920
200-299 units	0.092	0.032	2.836
300+ units	0.072	0.032	2.258
*Omitted - 5-19 units			
Neighborhood Characteristics			
Vandalism			
Theft			
Tenant Characteristics			
Tenant income low or low to moderate	0.049	0.019	2.522
Tenant income high or moderate to high	0.055	0.027	2.034
Tenant income diverse	0.007	0.036	0.181
*Omitted - Tenant income moderate			
Lower tenant turnover desired	0.019	0.019	0.973
Location			
North suburban	0.040	0.036	1.105
Midwest urban	-0.046	0.041	-1.113
Midwest suburban	-0.004	0.043	-0.089
South urban	-0.010	0.038	-0.266
South suburban	0.024	0.042	0.583
West urban	-0.017	0.040	-0.427
West suburban	-0.040	0.043	-0.934
*Omitted - North urban			
Rent control	0.000	0.030	0.011
Rent control in the North	-0.003	0.045	-0.067
Constant	-0.028	0.050	-0.566

Number of Observations	1534
Adjusted R-squared	0.034

Table 5.5 - Plumbing System Upgrade Equation

	B	Std. Error	t
Dependent Variable			
Plumbing upgrade			
Management Characteristics			
Owner employs manager	-0.060	0.021	-2.814
Competes for tenants with subsidized properties	-0.038	0.018	-2.045
Competes for tenants with public housing	-0.010	0.020	-0.469
*Omitted - Competes with private, nonsubsidized only			
10%-19% of rental income spent on maintenance	-0.028	0.017	-1.694
20% or more of rental income spent on maintenance	-0.013	0.020	-0.629
*Omitted - Less than 10% spent on maintenance			
Ownership Characteristics			
Owner purchased within past 2 years	0.075	0.024	3.174
Owner intends to hold property for 5 or more years	0.012	0.020	0.610
Individual owner	0.015	0.033	0.466
Individual owner in the midwest	0.066	0.045	1.474
Individual owner in the south	-0.001	0.043	-0.025
Individual owner in the west	0.046	0.043	1.073
Real estate corporation	-0.036	0.029	-1.218
*Omitted - Limited partner or other owner			
Financial Characteristics			
Property profitable last year	-0.019	0.015	-1.262
Property more profitable than similar properties	0.029	0.021	1.388
10%-19% of tenants delinquent	0.024	0.021	1.147
20% or more of tenants delinquent	0.003	0.024	0.115
*Omitted - Less than 10% of tenants delinquent			
Value increased	0.014	0.017	0.805
Location			
North suburban	0.011	0.034	0.337
Midwest urban	0.005	0.039	0.131
Midwest suburban	-0.007	0.040	-0.164
South urban	0.031	0.036	0.871
South suburban	-0.004	0.039	-0.093
West urban	0.041	0.038	1.074
West suburban	-0.019	0.041	-0.467
*Omitted - North urban			
Rent control	0.038	0.028	1.362
Rent control in the North	-0.032	0.043	-0.743
Physical Characteristics			
Built prior to 1940	0.109	0.029	3.739
Built 1940-1959	0.117	0.028	4.160
Built 1960-1979	0.042	0.019	2.221
*Omitted - Built 1980 or after			
20-49 units	0.060	0.025	2.441
50-99 units	0.021	0.029	0.738
100-199 units	0.052	0.028	1.882
200-299 units	0.063	0.031	2.022
300+ units	0.063	0.031	2.036
*Omitted - 5-19 units			
Neighborhood Characteristics			
Vandalism	-0.007	0.019	-0.349
Theft	0.034	0.019	1.828
Tenant Characteristics			
Tenant income low or low to moderate	0.011	0.018	0.611
Tenant income high or moderate to high	0.022	0.026	0.870
Tenant income diverse	0.067	0.034	1.959
*Omitted - Tenant income moderate			
Lower tenant turnover desired	-0.013	0.018	-0.727
Constant	-0.002	0.048	-0.036

Number of Observations   1534
Adjusted R-squared   0.039

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Table 5.6 - Heating System Upgrade Equation

	B	Std. Error	t
Dependent Variable			
Heating system upgrade			
Financial Characteristics			
Property profitable last year	-0.040	0.015	-2.686
Property more profitable than similar properties	0.000	0.021	0.017
10%-19% of tenants delinquent	0.007	0.020	0.338
20% or more of tenants delinquent	-0.038	0.023	-1.680
*Omitted - Less than 10% of tenants delinquent			
Value increased	0.016	0.016	0.948
Ownership Characteristics			
Owner purchased within past 2 years	0.087	0.023	3.801
Owner intends to hold property for 5 or more years	-0.005	0.020	-0.271
Individual owner	0.002	0.032	0.074
Individual owner in the midwest	-0.039	0.043	-0.896
Individual owner in the south	-0.040	0.042	-0.951
Individual owner in the west	-0.005	0.041	-0.125
Real estate corporation	0.008	0.029	0.296
*Omitted - Limited partner or other owner			
Management Characteristics			
Owner employs manager	-0.032	0.021	-1.569
Competes for tenants with subsidized properties	0.005	0.018	0.276
Competes for tenants with public housing	0.036	0.020	1.811
*Omitted - Competes with private, nonsubsidized only			
10%-19% of rental income spent on maintenance			
20% or more of rental income spent on maintenance			
*Omitted - Less than 10% spent on maintenance			
Physical Characteristics			
Built prior to 1940	0.073	0.028	2.591
Built 1940-1959	0.092	0.027	3.370
Built 1960-1979	0.077	0.018	4.182
*Omitted - Built 1980 or after			
20-49 units	0.028	0.024	1.171
50-99 units	0.020	0.028	0.709
100-199 units	0.045	0.027	1.674
200-299 units	0.030	0.030	1.029
300+ units	0.014	0.029	0.485
*Omitted - 5-19 units			
Neighborhood Characteristics			
Vandalism			
Theft			
Tenant Characteristics			
Tenant income low or low to moderate	0.025	0.018	1.421
Tenant income high or moderate to high	0.037	0.025	1.485
Tenant income diverse	0.060	0.033	1.803
*Omitted - Tenant income moderate			
Lower tenant turnover desired	-0.003	0.018	-0.189
Location			
North suburban	0.044	0.033	1.329
Midwest urban	0.053	0.038	1.407
Midwest suburban	0.066	0.039	1.681
South urban	0.060	0.035	1.703
South suburban	0.078	0.038	2.063
West urban	0.010	0.037	0.275
West suburban	0.005	0.039	0.139
*Omitted - North urban			
Rent control	-0.027	0.027	-0.983
Rent control in the North	0.082	0.041	1.994
Constant	-0.017	0.046	-0.370

Number of Observations	1534
Adjusted R-squared	0.024

higher the likelihood of a kitchen renovation, to some degree. The individual owner type's effect varied by region of the country. Individual owners in the north and west had higher likelihoods of remodel than those in the midwest and south by a significant margin. The midwest and south individual owners had a probability of remodel similar to the omitted classes of owners. Real estate corporations were less likely to remodel than northern and western individuals, but more likely than the other owners. Regional effects were investigated for real estate corporations, as well, but no significant differences emerged. As is, the real estate corporation coefficient is of low significance.

None of the management characteristics were significant in determining the likelihood of kitchen remodel. In previous analyses, the maintenance expenditures were insignificant in estimations for three of the four dependent variables and were removed for the presented analysis for those variables.

As common sense dictates, all properties older than those built in the '80's and '90's were more likely to be remodeled. Ceteris paribus, properties built in the '40's through the '70's had similar probabilities. Properties older than this had an even higher likelihood. Building size also has some influence. Most building sizes larger than the base case, buildings with less than 20 units, were more likely to have kitchens renovated. The increase varies to some extent but does not show a clear pattern. Other factors that we do not have in our data are no doubt at work here.

Our neighborhood characteristic variables had no significance in three of our four equations and were dropped from the presented analysis for those three. The presence of vandalism or theft at the property apparently does not say enough about the neighborhood conditions. Many other factors outlined in the previous section are required.

Tenant characteristics were similarly insignificant. Neither the composition of the tenants by income nor the landlord's desire to minimize turnover were related to the likelihood of kitchen remodel.

Controls on the location by region had no significant effect, except as described above for individual owners. The rent control variable also has no significance until interacted with the northeast region. As a proxy for New York City, it indicates that less remodeling activity was undertaken there in 1995.

5.3.2 Comparison to Other Capital Improvements

Bathroom replacement is viewed as similar to kitchen replacement in that they are both more discretionary in nature. It was expected that determinants would be similar between the two. Some similarities come to light, but unexplained differences exist. Plumbing and heating systems are both less discretionary in nature. They are replaced when functionally obsolete or broken. A comparison of their determinants with those of kitchen replacement and each other reveals many differences but some core similarities. See Table 5.7 for a summary of coefficients.

All four improvement types are less likely to be performed if the property has been profitable in the past year. The coefficients of the other types are smaller than that of the kitchen remodel, but all are negative. These reinforce the theory that the unprofitable property owner is actively pursuing profit-maximizing activities, while the profitable property owner may be more unresponsive. Plumbing replacement has the lowest coefficient and is not quite significant at the 0.20 level.

Relative profit is also marginally significant for plumbing replacement but is insignificant for bathroom and heating system replacement. Similar to kitchen replacement, an owner who feels his property more profitable than similar properties is more likely to remodel. The low significance level of the coefficients where they are positive indicates that this relationship is weak. Absolute profitability discussed above is more important than relative profitability.

Neither tenant delinquency nor property value increase affects the likelihood of renovation of these other systems. The repositioning effort thought to accompany moderate delinquency is not apparent in probability of bathroom improvements. One strained explanation could be that kitchen improvements are more effective at drawing new tenants than bathroom improvements. Kitchens are a more immediately visible part of a home and have had some atrocious styles through the years. Plumbing and heating improvements are less expected than cosmetic improvements in a repositioning effort.

Table 5.7 - Coefficient Summary

Dependent Variable	Kitchen	Bath	Plumbing	Heat
	B	B	B	B
Financial Characteristics				
Property profitable last year	-0.058 ***	-0.043 ***	-0.019	-0.040 ***
Property more profitable than similar properties	0.033 *	0.011	0.029 *	0.000
10%-19% of tenants delinquent	0.067 ***	0.023	0.024	0.007
20% or more of tenants delinquent	0.029	0.011	0.003	-0.038 **
*Omitted - Less than 10% of tenants delinquent				
Value increased	0.037 **	-0.006	0.014	0.016
Ownership Characteristics				
Owner purchased within past 2 years	0.030	0.057 ***	0.075 ***	0.087 ***
Owner intends to hold property for 5 or more years	0.039 *	0.011	0.012	-0.005
Individual owner	0.090 ***	0.047 *	0.015	0.002
Individual owner in the midwest	-0.093 **	0.039	0.066 *	-0.039
Individual owner in the south	-0.102 **	-0.061 *	-0.001	-0.040
Individual owner in the west	0.001	0.046	0.046	-0.005
Real estate corporation	0.043	0.024	-0.036	0.008
*Omitted - Limited partner or other owner				
Management Characteristics				
Owner employs manager	-0.017	-0.038 **	-0.060 ***	-0.032 *
Competes for tenants with subsidized properties	-0.003	-0.011	-0.038 ***	0.005
Competes for tenants with public housing	-0.018	-0.015	-0.010	0.036 **
*Omitted - Competes with private, nonsubsidized only				
10%-19% of rental income spent on maintenance			-0.028 **	
20% or more of rental income spent on maintenance			-0.013	
*Omitted - Less than 10% spent on maintenance				
Physical Characteristics				
Built prior to 1940	0.116 ***	0.111 ***	0.109 ***	0.073 ***
Built 1940-1959	0.091 ***	0.085 ***	0.117 ***	0.092 ***
Built 1960-1979	0.095 ***	0.052 ***	0.042 ***	0.077 ***
*Omitted - Built 1980 or after				
20-49 units	0.078 ***	0.082 ***	0.060 ***	0.028
50-99 units	0.009	0.069 ***	0.021	0.020
100-199 units	0.077 ***	0.056 **	0.052 **	0.045 **
200-299 units	0.097 ***	0.092 ***	0.063 ***	0.030
300+ units	0.056 *	0.072 ***	0.063 ***	0.014
*Omitted - 5-19 units				
Neighborhood Characteristics				
Vandalism			-0.007	
Theft			0.034 **	
Tenant Characteristics				
Tenant income low or low to moderate	0.014	0.049 ***	0.011	0.025 *
Tenant income high or moderate to high	0.030	0.055 ***	0.022	0.037 *
Tenant income diverse	-0.017	0.007	0.067 ***	0.060 **
*Omitted - Tenant income moderate				
Lower tenant turnover desired	0.027	0.019	-0.013	-0.003
Location				
North suburban	0.025	0.040	0.011	0.044 *
Midwest urban	-0.016	-0.046	0.005	0.053 *
Midwest suburban	-0.014	-0.004	-0.007	0.066 **
South urban	0.018	-0.010	0.031	0.060 **
South suburban	0.011	0.024	-0.004	0.078 ***
West urban	-0.051	-0.017	0.041	0.010
West suburban	-0.072	-0.040	-0.019	0.005
*Omitted - North urban				
Rent control	0.005	0.000	0.038 *	-0.027
Rent control in the North	-0.091 **	-0.003	-0.032	0.082 ***
Constant	-0.035	-0.028	-0.002	-0.017

***   indicates significance at the 0.05 level
**   indicates significance at the 0.10 level
*   indicates significance at the 0.20 level

Similarly, if the theory that increased property values allows for funding of renovations is to hold, bathroom replacement probability should increase with increased values. It is unaffected, though. The higher cost of kitchen replacement is one possible explanation why it is affected while bathrooms are not. Again, an analysis with a more complete set of variables is needed to fully understand what is happening. The systems-type improvements are theorized to be repaired when required. The heating system knows not what property values have done recently when it finally quits. Coefficients of zero are expected.

The most significant ownership variable among improvements to bathrooms, plumbing systems and heating systems is the time since purchase of the property. Properties purchased within the past two years have a greater likelihood of renovation. In all three cases the coefficient is relatively large and significant. This supports the theory that a new owner is more apt to have recognized the profit maximizing activity and is more willing to undertake it. While the coefficient is positive in the kitchen equation, it is nowhere near as significant.

Ownership type shows no strong relationship to renovation probability for the other three improvement categories. The strong regional differences among individual owners in the kitchen equation are not present in the other equations. Real estate corporations also have no probability to renovate that is significantly different from the remainder of owner types.

The employment of a property manager is the most consistent and significant of management variables. For bathroom, plumbing and heating improvements, the employment of a manager decreases the likelihood of renovation. The theory that the manager does not have the incentive to look for renovation opportunities is possibly the cause. The coefficient's sign is negative in the kitchen equation, as well, but is smaller and insignificantly different from zero.

Types of competitors for tenants influence probability of renovation in select instances. Plumbing improvements are less likely when the property competes with subsidized properties instead of purely private, unsubsidized ones. Heating system improvements are more likely when the property competes with public housing. No clear pattern emerges and, again, many unavailable factors are no doubt at work.

A moderate level of maintenance expenditures seems to decrease the likelihood of plumbing repairs. This is consistent with the theory that a moderate level of maintenance may prolong the

life of a property's systems. Unfortunately, no significant result was obtained in the heating system equation.

As with kitchen renovations, the age and size of the property have significant relationships with the likelihood to renovate baths, plumbing and heating systems. Bathroom renovation likelihood increases with age. Renovation of plumbing does not increase as much until a building is over 35 years old. Beyond that age, likelihood holds roughly steady. Heating systems' replacement likelihood is increased and approximately constant for all ages greater than 15 years. This difference may be attributable to the different life spans of plumbing and heating components.

All renovation work is more likely in buildings with greater than 19 units. The coefficients vary in magnitude, though, with no clear pattern emerging. Again, many other explanatory variables not included in the POMS are undoubtedly involved.

The crime variables used as a measure of neighborhood conditions are significant only in the plumbing equation. The occurrence of any theft at the property increases the likelihood of plumbing replacement. This supports Mayer's hypothesis that higher rent differentials exist between "good" and "bad" buildings in neighborhoods with crime. Another of his hypotheses states that poor cosmetic conditions increase remodel likelihood while poor systems conditions decrease remodel likelihood. This is not supported by our model. No increase in likelihood of remodel of kitchen or baths is present in our model. Vandalism to the exterior of the property has no relationship to renovation.

While not a determinant in the kitchen equation, tenant income is significant in all three other equations. No sensible pattern is apparent, though. When compared to a property with tenants of moderate income, properties with all other mixes of income are more likely to be renovated. The systems components are more likely to be renovated in a property with a diverse income mix. A bathroom renovation is more likely in properties with both moderate to high-income tenants and moderate to low-income tenants. Tenant turnover desires play no role in any equation.

Similar to the kitchen equation, location is similarly insignificant in most cases. In the heating system equation, properties in midwestern suburbs and southern metropolitan areas were more likely to be renovated than those in northeastern center cities. Other areas also have increased

likelihood to replace heating systems, although less significantly so. The rent control interaction term proxying for New York City also shows a significant and increased probability of heating system renovation there.

Chapter 6: Conclusion

The Property Owners and Managers Survey provides much needed insight into the supply side of rental housing. Information collected on financial, ownership, managerial, physical and tenant characteristics allows the study of housing issues from a new perspective. In particular, this study investigated the effects of a number of these factors on the likelihood of property renovation. Four different components were analyzed. These included renovations more discretionary in nature, kitchen and bathroom replacement, and renovations more compulsory, plumbing and heating system upgrade. While several relationships became apparent, the results pointed towards further research required for a more complete and accurate understanding of the forces driving the renovation decision.

Renovation work is undertaken by the rental property owner when it maximizes profits. When a property's condition has moved far enough away from the optimal to make the renovation expense worthwhile, the owner renovates. Property condition, then, is integral to the decision to renovate. Neighborhood characteristics are important when the change in rents with improvement is affected by the neighborhood. These are the first two limitations of using the POMS data for the study of renovation likelihood. The POMS contains very little information on structure and neighborhood conditions. The physical characteristics used in this study were age and size of building. Incidence of crime at the property was the extent of our knowledge of neighborhood condition. The composition of tenant income at the property could be taken to represent structure or neighborhood quality, but it is not a clear measure.

The rental property market is very local in nature. Rents vary widely within and across metropolitan areas. The construction costs of a renovation also vary widely with location. This is another drawback of the POMS data for a study of this type. The POMS only locates the property in one of four regions of the country and specifies whether the property is in a metropolitan area or center city. The different economic conditions the respondents face cannot be incorporated into the analysis.

Despite these limitations, some relationships emerged when a multivariate analysis was performed using the available data. Equations were estimated for the four renovation categories with a dichotomous dependent variable equal to one if the renovation was

undertaken. Of the financial characteristics, profitability had the most consistent and statistically significant effect. Properties that were profitable in a given year were less likely to be renovated in that year. At least two possible reasons could account for this. Owners of unprofitable properties could be renovating to improve profitability, while profitable owners have less reason for activity. The other obvious reason is that the properties were unprofitable because of the costs of the renovation effort.

The most consistent and statistically significant ownership characteristic was the length of time the current owners had owned the property. New owners, those that had purchased within the past two years, were more likely to perform renovations of all types. A new owner has made an active investment decision in buying the property and may be more actively pursuing profit-maximizing opportunities than a long term owner. They may also have more recent knowledge of the market from their property search.

The employment of a property manager consistently decreased the likelihood of renovation. Hiring a manager may distance the owner from the property and the market and diminish his ability to recognize the profit maximizing opportunity. Even if the property manager is able to recognize the opportunity, he may have no incentive to do so.

Structures older than 15 years are more likely to be renovated than those newer. The likelihood does not necessarily increase with age beyond that, though. Kitchens and baths are both most likely to be remodeled in structures built prior to 1940. Plumbing and heating systems are both most likely to be upgraded in buildings built in the '40's and '50's.

Structures containing 20 units or more are consistently more likely to be remodeled than those smaller. However, no clear pattern or rationale is apparent for the different probabilities of the different size groups. Renovation activity does not directly increase in probability with building size, as might be expected given that the POMS question is building specific. Many other unavailable explanatory factors are no doubt at work here.

Other explanatory factors had select significance. Moderate tenant delinquency increased the likelihood of kitchen renovation, while more severe delinquency decreased the probability of heating system upgrade. Properties with tenant income composition anything but moderate had higher probability of renovation. Locational control variables had limited significance and no

clear pattern. When interacted with the individual owner type, some regional differences in renovation probability become apparent.

Despite some statistically significant coefficients, the estimated equations had a low level of explanatory power over the likelihood to renovate. Estimating a dichotomous dependent variable with dichotomous independent variables is partially to blame. More importantly, the lack of critical information on structure and neighborhood conditions leaves a large hole in the analysis. The units surveyed in the POMS were selected from those of the American Housing Survey (AHS). The AHS surveys tenants of the subject units, and the survey field worker fills out an inspection form based on visual observations. Included in the information collected are many of the structure and neighborhood characteristics missing from our analysis. Although not public, the link between the POMS information and the AHS information exists. Future research on this subject should use this linked dataset. A more accurate understanding of the forces driving renovations cannot be achieved without the interplay of information from both sources.

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