

Maintenance of Residential Rental Property: An Empirical Analysis

Thomas M. Springer*
Neil G. Waller**

Abstract. The maintenance costs of 137 residential rental properties in northwestern South Carolina are analyzed. The results show that maintenance cost per square foot increases with property age, tenant turnover, certain amenities, and for higher-rent properties. Compared to other property types, apartments exhibit higher maintenance costs per square foot with larger complexes showing lower per square foot maintenance costs than smaller complexes. This cost economy suggests added value to rental housing for larger complexes. Owners of multiple properties are found to pay higher maintenance costs. Finally, there is no observed relationship between absentee ownership and the level of property maintenance.

Introduction

Real estate investors and property managers alike have an interest in monitoring the level and the costs of property maintenance. In the short run, property maintenance increases operating expenses and lowers profitability. In the long run, maintaining a property stabilizes the quality of the structure by reducing the rate of economic depreciation, thus supporting future rent levels. Knowledge of the level of maintenance activity leads to a better understanding of rental housing quality management by property owners and their agents.

In this paper, a model of rental property maintenance activity is developed and empirically tested using annual maintenance cost as a proxy for the level of maintenance activity. The data describe characteristics of 137 rental properties, including apartments, condominiums, single-family houses, and townhouses. Maintenance cost variability is attributable to physical property features, local rental market characteristics, tenant-related factors, and property management considerations.

The results show that maintenance costs vary considerably with many of the variables. Increases in maintenance costs are consistent with increased age, higher tenant turnover rates, the presence of air conditioning, more bathrooms per unit, higher rent per square foot, and the subcontracting of the maintenance work. Apartments have higher maintenance costs per square foot than other property types. Housing complexes with more units exhibit lower per square foot maintenance costs than those with fewer units. Also, maintenance costs are higher for properties whose owners own multiple properties. Finally, the results show that the number of rental units per project under the same management and absentee ownership do not significantly affect maintenance costs.

*Department of Finance and Real Estate, Florida Atlantic University, 777 West Glades Road, Boca Raton, Florida 33431.

**Department of Finance, Clemson University, 314 Sistine Hall, Clemson, South Carolina 29634-1323.

Date Revised—July 1994; Accepted—December 1994.

Exhibit 1
Breakdown of the Data by Property Type

	Property Type			Total
	Apartments	Single-Family Houses	Condominiums	
Observations	38	42	57	137
Units	269	42	57	383

Source: Authors' analysis

A Model of Residential Property Maintenance

Whether by direct participation or indirectly through a property manager, a rational wealth-maximizing real estate investor monitors and controls property rent and expense levels. A properly motivated property manager has the goal of maximizing the wealth of the owner/investor. Improper managerial motivation, whether the result of a poorly designed property management contract or a consequence of the physical separation of ownership and management, can lead to a divergence of the goals of the manager from those of the owner.¹ Maintenance activity, as influenced by the wealth-maximization strategy and managerial motivation, is a crucial part of residential real estate investment in both the short run, with its impact on profitability, and the long run, with its effect on quality.

The level of property maintenance and the associated maintenance cost interrelate with housing quality and rent levels. A higher level of quality is associated with higher rents and requires more maintenance activity. Many academic studies of housing depreciation (see, for example, Dildine and Massey, 1974; Read, 1991) analyze the relationships between housing quality, rent levels and the level of property maintenance. Rent is a common proxy for housing quality. *Ceteris paribus*, a decline in rent evidences a decline in housing quality, and vice versa. Factors that affect rent logically affect housing quality.² The quality of housing, Q ,

$$Q=f(C_0, I_t, M), \quad (1)$$

is a function of C_0 , physical property characteristics at the time of construction; I_t , additional capital investment since construction; and M , both current and past levels of maintenance activity (Arnott, Davidson and Pines, 1983). Because C_0 is variant, changes in Q result from investment decisions (I_t) subsequent to the time of construction and ongoing maintenance activity (M), which affects the physical deterioration of C_0 .

At any time, maintaining a desired level of quality, Q_d , requires a given level of maintenance activity. Changes in the demand for rental housing affect rent and can cause changes to Q_d , thus affecting the level of maintenance activity. Economic theory (see, for example, Vorst, 1987) suggests an optimal level of maintenance activity at which the owner's wealth is maximized. This optimal level of property maintenance varies over time, as economic conditions change and as the housing unit depreciates. Assuming that the desired level of housing quality, Q_d , is optimal to maximizing the wealth of the property owner, the associated level of maintenance activity, M_d , of the landlord is

$$M_d=f(Q_d, C, D, Mg), \quad (2)$$

where C are physical property characteristics; D are current demand characteristics; and Mg are factors relating to property management.

While optimal maintenance is a goal, actual activity can reflect either under-maintenance or overmaintenance of the rental property. Some maintenance costs are unavoidable and independent of the level of quality. For example, maintenance expenses required to maintain habitability, namely health or safety concerns, are nondiscretionary unless termination of the rental activity is the wealth-maximizing choice. Other maintenance costs are incurred voluntarily and reflect a conscious attempt by the owner to enhance rents by increasing either the quality of the housing stock or the level of the offered amenities. Assuming that all owners operate at Q_d and that maintenance costs per square foot, MC , proxy for maintenance activity, M_d , we test the model:

$$MC = f(C, D, Mg) + e, \quad (3)$$

where C , D and Mg are vectors of property, market and managerial characteristics and e is a random error vector.³

Determinants of Maintenance Cost Variability

Many factors contribute to the variability of maintenance costs across residential rental properties. These factors include physical characteristics of the property, including structural features and optional amenities; demand characteristics, including certain features of the local rental market; and property management factors. Property management factors can include differences in both actual management practices and the relationship between the manager and the property owner.

Age often proxies for the economic depreciation of a real estate asset. The relationship between age and housing quality, and the consequent relationship to maintenance activity, varies with the type of property and both the time and method of construction. For example, apartment units are typically smaller than single-family houses and are expected to have higher maintenance costs per square foot. Vintage effects (Randolph, 1988), resulting from variability in construction techniques across property types over time, cause properties to age differently.⁴ For instance, flimsier construction depreciates more rapidly and requires a higher level of maintenance activity to sustain the quality of the rental property. Conversely, better quality construction requires less activity to maintain the same relative housing quality.

As properties age they become more costly to maintain. Also, holding housing quality and demand constant, an older property generates less rent per square foot relative to a newer property. A landlord must continually decide whether to maintain quality and incur higher costs or to increase short-term profitability by reducing maintenance activity and lowering quality. The landlord's decision evolves from the trade-off among housing quality, rent and maintenance activity.

The injection of additional capital into an older property alters the relationship between age and maintenance costs. The renovation of an older property can impact both the quality and the appearance of the property. However, the impact of a renovation upon property maintenance costs is unclear because the renovation can be intended to reduce future maintenance costs or to upgrade housing quality to increase competitiveness and rental income. Randolph (1988) notes the impact of renovation on the age/rent

relationship as another apparent example of a vintage effect. Rosenberg and Corgel (1990) incorporate capital expenditures as a proxy for the age effect and find that operating expenses increase with capital expenditure, thus with age.

The amenity package included in the rental unit affects maintenance costs. Amenities can include appliances and quality space. By choosing to provide amenities in the rental package, a landlord must consider whether the additional costs, including the incremental increase to maintenance costs, are justifiable in comparison to increases to rental income. For instance, given that the value of the incremental rent increase justifies the investment, the addition of an extra bathroom may not be justifiable when potential increases in maintenance are considered. Frequently, the addition of the amenity does not increase rent but serves to keep the property competitive at existing rent levels. For instance, in many markets air conditioning is considered virtually essential.

Clientele characteristics, such as the type of tenant or characteristics of the local rental market, can affect maintenance expenditures. A property whose tenants turn over more frequently requires more maintenance. Also, rental housing demand is segmented by the level of rent charged for a specific housing unit. The rent of a housing unit not only proxies for the quality of the property and the neighborhood, but also for tenant income. However, a high rent may also be coincident with more tenants per unit. Rosenberg and Corgel (1990) find that both tenant turnover and rent levels have a positive impact on rental operating expenses.

The local rental housing market may be segmented by property types, as well as rent levels. Maintenance costs per square foot are expected to be higher for apartments not only because of their typically smaller size, but because they serve a different clientele. Differences may also exist for condominiums, single-family homes and townhouses. Finally, within the localized market, there may be neighborhood effects. Properties, located in neighborhoods that are perceived to be of better quality, may require greater upkeep. An example would be the effort dedicated to yard care and landscaping or the frequency of exterior painting. Wang, Grissom, Webb, and Spellman (1991) study differences in selling prices between single-family rental properties and single-family residences within the same neighborhood and find evidence for both quality deterioration of rental properties and a "neighborhood" effect whereby the density of rental homes has a negative effect on selling prices.

Agency costs can arise from the contractual or physical separation of the owner from the manager.⁵ In the case of geographic separation of ownership and management, the owner's costs of monitoring and control increase dramatically with the distance separating the owner from the manager. Also, because the property manager, as a leasing agent, receives income when an apartment is initially rented, the manager is motivated to higher tenant turnover, not necessarily to an optimal maintenance policy or to a tenant base that is less risky.

Agency effects may also arise when a single property owner has multiple properties under the same property manager. Owners of multiple properties tend to be more sophisticated in their real estate and investment knowledge. They are more likely to exert their influence on the property manager and to maintain the property optimally. Although the monitoring costs of ownership are higher because of the multiple ownership, the per property monitoring costs are lower with the use of a single manager.

Whether or not the property manager subcontracts the maintenance work may affect the level of maintenance expenditures. Inefficient documentation of expenses can result in

understated maintenance costs for work performed internally. Also, in-house maintenance employees may not report many tasks. However, in-house maintenance employees often are assigned to make-work projects or may otherwise be under-employed, resulting in overmaintenance and higher maintenance expenses. Finally, with the variable expense structure coincident with subcontracting, maintenance priorities may change so that only major problems are handled, thus resulting in a quality loss.

Finally, there is a possible economy-of-scale effect when a manager has multiple units under a management contract. The manager can lower maintenance costs because of increased operational efficiency. Economies of scale are also expected for large housing complexes relative to smaller complexes or solitary housing units. Rosenberg and Corgel (1990) find mixed results for the impact that the number of units per project has on operating expenses.

The Data

To estimate the residential rental property maintenance model, data were collected from 137 rental properties, including apartments, condominiums, single-family houses, and townhouses, located in northwestern South Carolina. For each rental property, the 1990 annual maintenance cost and other attributes were collected.

The 137 rental properties include a total of 383 rental housing units (see Exhibit 1). Fifty-seven of the observations are houses. Thirty-eight apartment complexes having a total of 269 rental units are represented. The remaining 42 observations are for condominiums and townhouses. All of the properties are professionally managed by one of three local real estate firms. Several rental housing complexes have multiple managers, reflecting condominium ownership of individual units.

The independent variables are:

<i>Air Conditioning</i>	1 if air conditioning is present, 0 otherwise;
<i>Age</i>	the age of the property in years;
<i>Appearance</i>	1 if the condition and appearance of the property is rated good or better by the property manager, 0 otherwise;
<i>Appliances</i>	1 if the unit contains a dishwasher, a clothes washer and dryer, a refrigerator, and a range, 0 otherwise;
<i>Bathrooms</i>	the number of bathrooms in the rental unit;
<i>Renovated</i>	1 indicates evidence of renovation, 0 no evidence;
<i>Apartment</i>	1 indicates an apartment, 0 other housing type;
<i>Condominium</i>	1 indicates a condominium, 0 other housing type;
<i>Townhouse</i>	1 indicates a townhouse, 0 other housing type;
<i>Large Complex</i>	1 indicates a housing complex of thirty or more units, 0 otherwise;
<i>Neighborhood</i>	1 if the neighborhood where the property is located is rated good or better by the property manager; otherwise 0;
<i>Rent/Sq. Ft</i>	annual unit rent per square foot;
<i>Turnover</i>	the annual frequency of tenant change for a rental unit;
<i>Absentee Owner</i>	1 if owner lives more than seventy miles away, 0 otherwise;

<i>Multiple Properties</i>	the number of properties in the sample owned by the same owner;
<i>Owner/Manager</i>	1 if the property is owned by the property manager, 0 otherwise;
<i>Subcontractor</i>	1 if property manager subcontracts maintenance work, 0 otherwise;
<i>Units Managed</i>	the number of housing units under single management. ⁶

Specifically, maintenance costs are the costs of maintaining a housing unit and do not include property taxes, utilities, insurance, replacement reserves, advertising expenses, and capital expenditures.⁷ Maintenance costs are expected to increase with increasing, *Age*, *Bathrooms*, *Turnover* and *Rent/Sq.Ft.* For the binary variables, *Air Conditioning*, *Appearance*, *Appliances*, *Apartment*, *Neighborhood*, and *Absentee Owner* are expected to have positive coefficients. Maintenance costs are expected to decrease with increasing *Units Managed*, for larger housing complexes and if the property shows evidence of having been renovated. The data are summarized in Exhibit 2, with Panel A showing summary statistics and Panel B the correlation matrix for the nonbinary variables.

Results

The model of residential rental property maintenance is estimated using the previously described data. The dependent variable is the 1990 maintenance cost per square foot. To account for nonlinearity, the continuous variables, *Age* and *Rent/Sq.Ft.* are modeled in the logarithmic form. A revised covariance estimator (White, 1980) corrects for heteroskedasticity with a Breusch-Pagan test statistic verifying the correction.⁸ The impact of outliers is assessed by reestimating the model after removing extreme values of *Maintenance Cost* and *Rent/Sq.Ft.* The outliers do not substantially affect the results. The stability of the model is evaluated by testing alternative specifications. Generally, the following results are stable with respect to the signs, significance and the relative magnitude of the coefficients.

The results (Exhibit 3) show that the selected variables effectively represent the factors influencing the variability of maintenance costs across rental units. The *F*-ratio for the model is statistically significant, indicating rejection of the null hypothesis that the combined influence of the variables is zero. The coefficients for ten of eighteen independent variables are significant at better than a 10% significance level. Excepting *Appliances*, all of the significant coefficients have the expected sign. As evidenced by an adjusted-*R*² of .394 the model explains approximately 40% of the variability in rental property maintenance costs.

The positive coefficient on *Age* shows an age effect consistent with expectations. Maintenance costs increase with age, but at a decreasing rate. Sensitivity analysis using the results shows that *ceteris paribus*, for properties over eighteen years of age, based on the impact of age alone, expected maintenance costs as predicted by the model increase less than \$.01 per square foot per year of age. Surprisingly, the results indicate that renovation of a property has no significant impact on maintenance costs. The insignificance of *Renovated* may be a result of measurement error. The variable accounts for evidence of a renovation, but does not consider the timing, the extent, or the quality of the renovation. Theoretically, additional capital investment, such as renovation, shifts

**Exhibit 2A
Descriptive Statistics of the Data**

	Mean	Std Dev.	Minimum	Median	Maximum	Units of Measure
<i>Maintenance Costs</i>	.5637	.6677	0	.3318	4.7640	Dollars per sq. ft per year
<i>Air Conditioning</i>	.9124	.2837	0	1	1	1 if present
<i>Age</i>	19.9120	15.3730	1	15	91	Number of years
<i>Appearance</i>	.4453	.4988	0	0	1	1 if good or better
<i>Appliances</i>	.1971	.3993	0	0	1	1 if present
<i>Bathrooms</i>	1.6946	.6162	1	2	3	Number per unit
<i>Renovated</i>	.0949	.2941	0	0	1	1 if renovated
<i>Apartment</i>	.2774	.4493	0	0	1	1 if an apartment
<i>Condominium</i>	.2117	.4100	0	0	1	1 if a condominium
<i>Townhouse</i>	.1022	.3040	0	0	1	1 if a townhouse
<i>Rent/Sq.Ft</i>	5.8882	4.3821	1.9940	4.7957	49.0900	Dollars per sq. ft per year
<i>Neighborhood</i>	.4599	.5002	0	0	1	1 if good or better
<i>Turnover</i>	.4872	.4440	0	.5	1	Percentage of units turned over
<i>Absentee Owner</i>	.4745	.5012	0	0	1	1 if owner lives more than 70 miles from unit
<i>Multiple Properties</i>	1.3869	.9255	1	1	5	Number per owner
<i>Owner/Manager</i>	.0365	.1882	0	0	1	1 if the owner is the manager
<i>Subcontractor</i>	.7226	.4493	0	1	1	1 if management is subcontracted
<i>Large Complex</i>	.1606	.3685	0	0	1	1 if complex has more than 30 units
<i>Units Managed</i>	2.7956	5.0848	1	1	32	Number per manager

**Exhibit 2B
Correlation Matrix of Selected Nonbinary Variables**

Variables	Maintenance Costs	Rent/Sq.Ft	Age	Bathrooms	Multiple Properties	Units Managed	Turnover
<i>Maintenance Costs</i>	1.000						
<i>Rent/Sq.Ft</i>	.446	1.000					
<i>Age</i>	-.000	-.289	1.000				
<i>Bathrooms</i>	-.097	.187	-.314	1.000			
<i>Multiple Properties</i>	.258	-.125	.151	-.275	1.000		
<i>Units Managed</i>	.056	.047	-.059	-.300	.253	1.000	
<i>Turnover</i>	.177	.062	.082	-.077	.062	-.084	1.000

Source: Authors' analysis

Exhibit 3
Estimated Results for the Property Maintenance Costs Model^{a,b}

	Variable	Coefficient (Std Error)
	Intercept	-2.6475* (.5625)
Physical Characteristics (C)	<i>Air Conditioning</i>	.2423* (.1434)
	<i>Age</i>	.1750* (.1055)
	<i>Appearance</i>	.0127 (.1501)
	<i>Appliances</i>	-.4369* (.1699)
	<i>Bathrooms</i>	.1801* (.0993)
	<i>Renovated</i>	-.1174 (.2066)
	Demand Characteristics (D)	<i>Apartment</i>
<i>Condominium</i>		-.1810 (.2872)
<i>Townhouse</i>		.1193 (.2714)
<i>Large Complex</i>		-.3505* (.2105)
<i>Rent/Sq.Ft</i>		1.0863* (.2377)
<i>Neighborhood</i>		.0153 (.1267)
<i>Turnover</i>		.2779* (.1109)
Property Management Factors (Mg)	<i>Absentee Owner</i>	.1026 (.0959)
	<i>Multiple Properties</i>	.1309* (.0500)
	<i>Owner/Manager</i>	.1676 (.3085)
	<i>Subcontractor</i>	.2281* (.1218)
	<i>Units Managed</i>	-.0125 (.0078)

^aStandard errors, corrected for heteroskedasticity, are in parentheses. The Breusch-Pagan *Chi*-squared value is 78.49 with 18 degrees of freedom. An asterisk (*) indicates statistical significance at 10% or better.

^bThe model has an adjusted- R^2 of .394. The *F*-statistic has a value of 5.92, with 18 and 118 degrees of freedom.

Source: Authors' analysis

the property to an earlier point on the age, or depreciation, function. Given evidence of the stabilization of maintenance costs beyond a certain age, the most critical factor of the renovation may be its timing. That is, if the renovation is done on a property that is sufficiently old, reductions in maintenance costs may be either negligible or for a shorter duration.

The physical property characteristics describing amenities show mixed results. A rental unit with air conditioning has higher maintenance costs relative to one with no air conditioning. Also, additional bathrooms increase maintenance costs. A somewhat unexpected result is the wrong sign of the *Appliances* coefficient, especially given its relatively large magnitude. The results suggest that a complete set of modern appliances, namely a dishwasher, a clothes washer and dryer, a refrigerator, and a range, lowers the maintenance costs of a residential rental property. An analysis of the subset of the data including properties having a complete set of appliances shows that, relative to the full sample, these properties are newer, in better condition, located in better neighborhoods, and less likely to be an apartment. Given these characteristics, *Appliances* seems to proxy for better maintained or higher quality rental units, in which case the estimated coefficient has the correct sign.

Maintenance costs (per square foot) are significantly higher for apartments relative to other property types. The additional maintenance cost per square foot is not surprising given the smaller unit size of apartments relative to the other property types included in the sample, namely townhouses, condominiums and single-family homes. The apartment subset shows, that relative to the full sample, apartments provide fewer appliances, are in a perceived worse condition and are located in neighborhoods perceived to be of lower quality.⁹ The results provide evidence that scale economies exist for large housing complexes (*Large Complex*). The combined effect of these two variables, *Apartment* and *Large Complex*, implies that as the number of units increases, maintenance cost per square foot increases at a decreasing rate. Our results provide support for Rosenberg and Corgel's (1990) finding that operating expenses per square foot are higher for smaller apartment projects.

Higher tenant turnover significantly increases maintenance expenses. All else held constant, sensitivity analysis shows that a doubling of tenant turnover from the average increases maintenance costs per square foot to \$.878 from \$.743 (the estimated maintenance cost at the data means), an 18% increase, while halving tenant turnover reduces maintenance costs to \$.676 per square foot, a 10% decrease. Because tenant stability reduces maintenance costs, this result provides justification for rent reductions, or restrictions of rent increases, for continuing tenants relative to new tenants.¹⁰

The results suggest that when a subcontractor is used, maintenance costs are substantially higher than when the property management firm does its own maintenance work. Reporting and accounting methods could explain the differences. Perhaps, "in house" maintenance employees of the property management firm fail to record many of their minor activities. The results show no differences in maintenance costs for properties that are managed by their owner.

Finally, based on the insignificant coefficient for *Absentee Owner*, the model suggests no geographic agency effects. It is likely that any agency effects from absentee ownership would be evidenced by increased tenant turnover or more damages. Because managers are often compensated based on securing a lease, there is potential motivation towards faster tenant turnover, which corresponds to accelerated leasing activity. Also, because of

geographic separation, property managers may not be monitored sufficiently to promote careful tenant screening and selection standards. The net result would be evidenced by increased property damages, relative to increased maintenance costs.

Although there is a strongly significant and positive relationship between rent and maintenance costs, an overly specific interpretation of this result is impractical because *Rent/Sq.Ft* can proxy for many property, demand and property management factors. Also, compared to the observed scale economies associated with large apartment complexes, there is no statistical support of reduced maintenance costs from scale economies to the property manager resulting from multiple units under management (*Units Managed*). At least from this sample, it is apparent that large property managers are no more operationally efficient than small property managers.

Conclusions

The results of the model of maintenance costs for residential rental properties show that the variability of maintenance costs across rental properties can be effectively explained. The model shows that maintenance costs per square foot increase with age, increased tenant turnover and the presence of certain amenities. Apartments and rentals charging higher rent also exhibit higher maintenance costs per square foot.

Notably, there is no evidence of agency problems associated with absentee ownership. That is, there is no significant difference in maintenance cost between local and absentee owners. Also, larger apartment complexes exhibit economies of scale evidenced by lower maintenance costs per square foot. There is direct implication that large ownerships, such as large apartment complexes, add value to housing. Finally, owners of multiple properties evidence a higher level of maintenance costs. This result suggests that either the owners are more attentive to the properties or that there is a tenant selection difference compared to owners of single properties.

The results of this paper lead to a better understanding of housing quality maintenance, maintenance expenses, and property manager decisionmaking. A possible extension of the work is to collect a time-series and estimate a generalized model incorporating contemporaneous changes. A significant contribution would be a similar model estimated with more diverse data, perhaps collected from a major metropolitan area. Also, tenant damages, which are more tenant-specific, can be compared to maintenance costs, which are more property-specific.

Notes

¹The finance literature is replete with papers on agency relationships and costs. See Solt and Miller (1985) and Rosenberg and Corgel (1990) for real estate applications.

²The literature extensively covers the determinants of real estate rent. See Sirmans and Benjamin (1991) for a relatively current review.

³We relax the maintenance of housing quality assumption commonly used in the literature (for example, Rosenberg and Corgel, 1990). Thus, Q_d varies given different property, market or ownership characteristics.

⁴Randolph (1988) interprets age as an estimate of depreciation that is biased because of vintage effects, which occur when age-invariant rent determinants correlate with the year of construction. To the extent that housing units age differently because of these vintage effects, the same bias exists in this study.

⁵Rosenberg and Corgel (1990) conclude that agency costs exist and are consistent with improper financial motivations not handled by existing standard management contracts. These agency costs relate to the concentration of ownership of the apartment complex and the degree of competition for property management services.

⁶Single-family homes take a value of 1. For housing types occurring in multiple unit complexes, the variable describes the number of units under single management, not the number of units in the complex.

⁷To our knowledge, our maintenance cost measure is consistent with Rosenberg and Corgel's (1990) operating expense measure except that we do not include advertising costs. The MSA effect studied by Rosenberg and Corgel is invariant because all properties are in the same geographic area.

⁸We used LIMDEP to estimate the model. The heteroskedasticity correction is an additional command.

⁹Also, as indicated by the number of tenants signing the lease and higher turnover rates, apartments are used more intensively relative to the other housing types. An excess of missing values precludes including the number of tenants per unit as explanatory variable.

¹⁰We also separated the sample into high and low turnover properties. A comparison of the regressions on the subsamples show some differences. Notably, for low turnover properties, the number of units managed is significant and positive and, for high turnover properties, *Age* is insignificant.

References

- Arnott, R., R. Davidson and D. Pines, Housing Quality, Maintenance and Rehabilitation, *Review of Economic Studies*, July 1983, 50, 467–92.
- Dildine, L. L. and F. A. Massey, Dynamic Model of Private Incentives to Housing Maintenance, *Southern Economic Journal*, April 1974, 40, 631–39.
- Randolph, W. C., Estimation of Housing Depreciation: Short-Term Quality Change and Long-Term Vintage Effects. *Journal of Urban Economics*, March 1988, 23, 162–78.
- Read, C., Maintenance, Housing Quality, and Vacancies under Imperfect Information, *Journal of the American Real Estate and Urban Economics Association*, 1991, 19:2, 138–53.
- Rosenberg, S. M. and J. C. Corgel, Agency Costs in Property Management Contracts, *AREUEA Journal*, 1990, 18:2, 184–201.
- Sirmans, G. S. and J. D. Benjamin, Determinants of Market Rent, *Journal of Real Estate Research*, Fall 1991, 6:3, 357–79.
- Solt, M. E. and N. G. Miller, Managerial Incentives: Implications for the Financial Performance of Real Estate Investment Trusts, *AREUEA Journal*, Winter 1985, 13:4, 404–23.
- Vorst, A. C. F., Optimal Housing Maintenance Under Uncertainty, *Journal of Urban Economics*, May 1987, 21, 209–27.
- Wang, K., T. V. Grissom, J. R. Webb, and L. Spellman, The Impact of Rental Properties on the Value of Single-Family Residences, *Journal of Urban Economics*, September 1991, 30, 152–66.
- White, H., A Heteroskedasticity-Consistent Covariance Matrix Estimate and A Direct Test for Heteroskedasticity, *Econometrica*, May 1980, 48, 817–38.

A previous version of this paper was selected as the winning manuscript in the IREM Asset Property Management Research Manuscript Competition for papers presented at the American Real Estate Society Annual Meeting, 1993. The authors would like to thank the Editor, Dr. G. Donald Jud, as well as two anonymous reviewers, for helping to improve the paper.
