

Determinants of Market Rent

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Abstract Recent empirical work has investigated substantial lists of factors that have been employed to explain market rents for residential income property. These factors range from physical attributes to vacancy rates. To better understand the myriad factors that have been demonstrated to affect apartment rent and, in turn, the valuation of apartment complexes, this paper reviews the existing literature on the apartment rent determination process. Our analysis extends the extent contributions by discussing some of the consistencies and the unresolved issues concerning the factors employed in estimating apartment rent. This survey should provide information for appraisers who make market-derived rent adjustments, for property managers who set apartment rents, and for developers who design apartment projects.

Introduction

To explain the determination of market rent for income-producing real estate, recent empirical work has produced substantial lists of attributes and characteristics. These factors range from physical attributes to property management quality characteristics. In addition, the literature shows that market rent is affected by deviations of observed vacancy rates from natural vacancy rates and by such factors as rental concessions and length of residency discounts.

To better understand the myriad attributes that have been demonstrated to affect market rent, this paper reviews the existing literature on market rent determination. This survey addresses some of the conflicting results and unresolved issues concerning the determinants of rent and thus will provide important information for market participants and academics interested in the rent formation process. The study should also be important to appraisers who make market-derived rent adjustments, to property managers who must set rent, and to developers who design real estate projects.

The literature has established that rent plays a vital role in property valuation. One might also argue that effective rent rather than contract rent should be used in the valuation process. Only recently, however, have other factors that may cause effective rent to vary from contract rent been addressed in the literature. These areas are: (1) the influence of amenities, services, and external factors on rent, (2) the presence of rental concessions, and (3) the impact of professional management on rent.

This paper addresses three areas of rent determination: first, those papers that have explored the effect of property-specific variables on rent are examined. Included are

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studies that measure the effects of physical characteristics, amenities and services, and external factors. Second, the influence of market incentives such as rental concessions, property management, taxes, and length of residency discounts is examined. Third, the relationship between rent and vacancy is studied, a relationship documented by literature that analyzes the rate of change in rent and the deviation of observed vacancy from the natural vacancy rate. Exhibits 1–3, which parallel the text, encapsulate each study reviewed. In addition, a concise description of the type of paradigm and database employed by each study is included. Exhibit 4 summarizes those variables that determine rent.

The Effect of Property-Specific Factors on Rent

Rent research has explored the relationship between several groups of factors and market rent. These groups include (a) amenities, services, physical attributes, (b) locational factors such as proximity to an economic focal point or a college campus, and (c) characteristics of renters themselves and their willingness to pay.

Amenities, Services, and Physical Characteristics

Most rent studies employ some measures of physical characteristics. These usually include square footage or a proxy such as bedrooms. In addition, several studies investigate the effects that amenities and services have on the rent determination process. Sirmans, Sirmans and Benjamin [23] examine multifamily housing amenities, services and external factors affecting rent. Their empirical results show that some amenities and services such as covered parking, swimming pool, all utilities paid, and modern kitchen (built-in disposal, electrical appliances, etc.) are consistently important positive determinants of rent. In addition, external factors such as traffic congestion and access to public transportation affect rent.

A later study by Sirmans, Sirmans and Benjamin [24] examines the extent to which certain amenities and services affect rent and provides some guidance in the process of adjusting comparable data. Based on a linear model, the results show that characteristics such as patios, playgrounds, barbecue areas, and boat/camper parking do not have significant effects on rent. Other amenities, however, such as designated parking, maid service, and modern kitchen seem to be consistently valued by the tenant.

To analyze rent variations, Guntermann and Norrbin [7] use regression analysis. While houses and apartment projects produce a fundamentally similar flow of services, there are significant differences between services and these differences result in a somewhat different set of variables explaining variations in apartment rent. This phenomenon is most notable with common area amenities, such as swimming pools and hot tubs, which often are not available to individual owners. In their analysis of various submarkets, results for the university submarket show that age and condition, common area amenities (highly significant where extensive) and extra bedrooms for a given apartment unit size have significant effects on rent. The authors argue that their results can be used by appraisers for market-derived adjustments, by property managers for setting rents, and by feasibility analysts for designing apartment projects.

Marshall [14] categorizes features as “hard” attributes (features that builders would

prefer to include during the construction phase) and “soft” attributes (items that can be more readily changed). After conducting a survey of student rentals to determine the relationship between rent and these characteristics, he finds expected behavior from these variables: number of bedrooms, swimming pool, distance from campus and complex size. A variable with a counterintuitive sign is patio (having a patio lowered rent). Pet restrictions raised rent.

Malpezzi, Ozanne and Thibodeau [12] provide a measure of economic depreciation in residential real estate, i.e., the decline in value due to aging. Although not reviewed here, studies covered in their review find, in general, that economic depreciation rates do exist but that these rates vary significantly across samples. The authors find themselves that rents consistently decrease with age at a nearly constant rate and that depreciation rates and discounts for age differ among SMSAs.

Smith and Belloit [29], who employ apartment data to demonstrate regression techniques in their appraisal book, identify twenty variables as important determinants of rent. Variables having significantly positive coefficients are amenities such as dishwasher, tennis court, sauna, utilities included, and furnished units. Coefficients for variables representing the number of bedrooms and bathrooms are also positive and significant. Significantly negative coefficients are found for leasing period, neighborhood quality and location convenience.

Amenities, services, and physical characteristics have been demonstrated to affect rent. However, data in the above studies yield different estimates for these factors. Thus location may play a role in establishing the estimated value of these attributes (i.e., certain cities have populations that demand selected attributes).

Location

Three studies validate the idea that proximity to an economic focal point such as the city center or a campus positively affects market rent. Jaffe and Bussa [9] present a model that can be used by appraisers and developers to predict market rents based on market data. The authors argue that their model is pragmatic in its ability to estimate rent directly as a function of distance from an economic focal point, based upon the adjusted rent per square foot relationship. The adjustment factors include amount of utilities included in rent, additional parking charges assessed, lease adjustments, and an age factor. The results indicate that, although distance from city center is important, analysis of these other factors in conjunction with distance in an operational model may be useful in estimating the value of urban residential property. Prave and Ord [17] also indicate the importance of being located near the university campus. (See further discussion in the next section.)

Marks [13] likewise shows that rents are higher for units closer to the city center. Other factors in his study having a significant effect on rent are neighborhood quality, age, and number of bedrooms.

Characteristics of Renters and Their Willingness to Pay

Several studies published primarily by Smith and Kroll focus on the characteristics of renters and their willingness to pay for certain rental features. Smith and Kroll [26]

Exhibit 1 Studies Examining the Determinants of Rent

Author(s)	Title	Source	Purpose, Data, Comments
Amenities, Services, and Physical Characteristics			
Sirmans, Sirmans and Benjamin	Determining Apartment Rent: The Value of Amenities, Services, and External Factors	<i>Journal of Real Estate Research</i> (Summer 1989), 33-44	<ul style="list-style-type: none"> ● Estimates a hedonic rent model to examine the effects of various amenities, services, and external factors on rent for multifamily housing. ● Data: 188 observations for 92 apartment complexes in Lafayette, Louisiana for September, 1986. ● Presents a model whereby the present value of the incremental increase in rent for a particular amenity or service can be compared to the costs of providing the amenity or service.
Sirmans, Sirmans and Benjamin	Examining the Variability of Apartment Rent	<i>Real Estate Appraiser and Analyst</i> (Summer 1990), 43-48	<ul style="list-style-type: none"> ● Uses a linear rent equation to examine the effect of amenities, services, and external factors on rent from the appraiser's perspective of adjusting for market comparables. ● Data: 188 observations for 92 apartment complexes in Lafayette, Louisiana for September, 1986. ● Nonsignificant variables: restrictions on students, children, and pets. ● Discusses variable coefficients for use in making adjustments.
Guntermann and Norrbirn	Explaining the Variability of Apartment Rents	<i>AREUEA Journal</i> 15:4 (1987), 321-40	<ul style="list-style-type: none"> ● Estimates a rent model to analyze variations in apartment units relative to physical characteristics, amenities, and location. ● Data: 291 observations for 104 apartment projects in Mesa and Tempe, Arizona for the first quarter of 1984. ● Finds different results for different market segments, e.g., university students.
Marshall	The Influence of Property Characteristics on Rents	Working paper (October 1990)	<ul style="list-style-type: none"> ● Estimates a linear rent equation to examine the relationship between rent and various characteristics for residential property rented exclusively to students. ● Data: gathered from surveys of students about 14 different features in 29 apartment complexes and 32 houses for 1990. ● Defines features as "hard" (parking, bedrooms, bathrooms, locations, etc.) and "soft" (laundry, air conditioning, patio, modern appliances, pool, furnished, etc.).

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| Malpezzi, Ozanne and Thibodeau | Microeconomic Estimates of Housing Depreciation | <i>Land Economics</i> (November 1987), 372-385 | <ul style="list-style-type: none"> ● Provides estimates of metropolitan area-specific rates of economic depreciation for residential real estate where economic depreciation is defined as value decline due to aging measured in years. ● Data: 59 SMSAs from the Annual Housing Survey from Census Bureau for April, 1974 to March, 1977. ● Provides regressions for each SMSA. |
| Smith and Belloit | Appendix: Multiple Linear Regression for Appraisal | <i>Real Estate Appraisal</i> , 2nd ed., 97-104 (1987) | <ul style="list-style-type: none"> ● Uses a multiple linear regression analysis to explain the determination process. ● Data: 133 observations (95% of the data set) with 20 variables for an unnamed community's rental complexes of size greater than six units. |
| Location | | | |
| Jaffe and Bussa | Using a Simple Model to Estimate Market Rents: A Case Study | <i>Appraisal Journal</i> (Jan./Feb. 1977), 7-13 | <ul style="list-style-type: none"> ● Presents a model to predict market rents on a square-foot unit basis as a function of distance from a central location: $Value = AR/SF \times SF$, where AR is rent adjusted to reflect standardized lease terms and SF is estimated square footage. ● Data: 600 student surveys at University of Illinois at Champaign-Urbana for June, 1975. |
| Prave and Ord | An Evaluation of Apartment Preferences Using Conjoint Analysis | Working paper (1987) | <ul style="list-style-type: none"> ● Uses conjoint methodology to study segmented subgroups of renters based on preferences for apartment preferences. ● Data: a sample of 49 Penn State University students from 1986. |
| Marks | The Effect of Rent Control on the Price of Rental Housing: An Hedonic Approach | <i>Land Economics</i> (February 1984), 81-94 | <ul style="list-style-type: none"> ● Presents a hedonic price index to measure variations in rents for controlled and uncontrolled sectors of Vancouver. The main issue is: the "true" prices relative to "observed" prices when distortions are injected into the market pricing mechanism. His model is $R = a_i + \sum_j P_j Z_j$, where R is observed rent, Z_j is the amount of characteristic j contained in the unit, and P_j is the marginal characteristic price. The model is estimated in linear and semilog form. ● Data: 3,385 apartments in Vancouver during 1978, with 82% controlled units versus 18% uncontrolled. ● An F-test of the two indices shows that the two sets of coefficients for controlled and uncontrolled are significantly different at the 1% level. ● Results show that binding rent controls will lower implicit prices. |

Exhibit 1 (continued)

Author(s)	Title	Source	Purpose, Data, Comments
Smith and Kroll	An Analysis of Tenant Demand for Amenities	<i>Journal of Property Management</i> (Nov./Dec. 1987), 14-17	<ul style="list-style-type: none"> ● Assesses and quantifies tenant demand for a given amenity. ● Amenities that at least some tenants expressed a willingness to pay for include fireplace, washer/dryer, covered parking, pool, jacuzzi, exercise room, patio, more square feet, microwave oven, and ceiling fans.
	Buyers' Response Technique—A Framework for Improving Comparable Selection and Adjustment in Single-Family Appraising	<i>Journal of Real Estate Research</i> (Spring 1988), 27-36	<ul style="list-style-type: none"> ● Uses one-way ANOVA with Scheffe's test to test for significant differences between demographic categories. ● Data: 62 observations for each variable based on responses of recent homebuyers to a series of questions. ● The authors conclude that while adjustment values on average may not provide a great deal of useful information, there is a wide variance about those averages, and the use of demographic variables can more effectively define what the appropriate adjustment amount should be.
Smith and Kroll	Improving Estimates of Potential Gross Income in Multi-Family Properties Through Market Research	<i>Appraisal Journal</i> (January 1988), 118-25	<ul style="list-style-type: none"> ● Introduces consumer-level market research techniques to the appraisal process by questioning tenants on how much more or less they would pay to have to be without certain amenities. ● Data: survey responses from 454 residents of 48 complexes in 4 geographical zones of suburban Houston, Texas. ● ANOVA is used to make comparisons across geographic, demographic, and property categories. Results show that differences exist in the marginal values of selected features.

Smith and Kroll

Utility Theory and Rent Optimization: Utilizing Cluster Analysis to Segment Rental Markets

Journal of Real Estate Research (Spring 1989), 61-71

- Demonstrates how selected tenant demographic profiles and unit characteristics affect responses when tenants are asked to value specific amenities.
- Data: 400 surveys of renters from suburban sectors of Houston.
- Cluster analysis according to age and income indicates different price elasticities for some variables across clusters:
 1. Older people with higher incomes pay more for a jacuzzi;
 2. Size of unit is related to age and income;
 3. No clear pattern appears for washer/dryer connections; and,
 4. Older, higher income groups pay more for covered parking and covered patio.

Ogur

Higher Education and Housing: The Impact of Colleges and Universities on Local Rental Housing Markets

American Journal of Economics and Sociology (October 1973), 387-94

- Examines the effect of the presence of a college or university on local rental markets and assumes that demand varies positively with the percentage of total population enrolled in an institution of higher learning.
- Data: for 40 New York State non-metropolitan counties as reported in the 1960 census.
- Results indicate that rent for housing units with non-white heads is not affected by the presence of a college or university, thus refuting the argument that this presence causes rent to be higher per poorest renters. Data show, however, that 95% of college students in this sample are white.

survey tenants to assess how much they desire a given amenity and how much additional rent they are willing to pay for that amenity. Tenants express a willingness to pay for amenities such as fireplace, washer/dryer, covered parking, pool, jacuzzi, exercise room, patio, additional square feet, microwave oven, and ceiling fans.

Presenting an adjunct technique to improve the adjustment process in multifamily rental rate estimates, Smith and Kroll [27] combine market research (specific dollar amounts for specific amenities, and basic respondent and property profiles) with selected statistical techniques (analysis of variance procedure with multiple comparison performed using the Scheffe test). In this and related papers (see also Kroll and Smith [26] and Smith and Kroll [28]), they demonstrate that differences exist in the marginal values placed on selected features by apartment dwellers. Accounting for these differences are geographic zones, tenant profiles such as sex, marital status, income, children, etc. and property profiles such as age of the complex, covered parking, etc. The authors contend that their approach is a superior method for appraisers to use in selecting comparables and for making more accurate adjustments in estimating potential gross income.

Utilizing cluster analysis to segment apartment dwellers into demographically homogeneous groups, Smith and Kroll [28] try to identify those groups with higher marginal utility preferences for selected project or unit amenities. Their study is unique in that it asks apartment dwellers in person how much more or less they would pay to either have or give up a specific amenity. The results reveal that distinct clusters of unique demographic groups based on age and income variables do exist and that price elasticity is different across clusters in certain cases. This identification of market segments may allow the portfolio manager to optimize rental rate structures in multifamily properties, thus maximizing the value of the entire portfolio.

Prave and Ord [17] utilize a conjoint methodology (i.e., a decompositional method for modeling of consumer preferences) to model tenants' preferences for apartment rent, location relative to a university campus, condition of unit, types of neighbors occupying adjacent units, size of apartment, and whether or not units are furnished. Conjoint methodology consists of a series of management science and marketing research methodologies for the decompositional modeling of consumer preferences for multi-attributed products such as apartment rent. Their results indicate that a majority of students desire an apartment unit located within a twenty-minute walk to campus (85.7%), a monthly rent of \$250 (75.5%), in excellent physical condition (89.8%), and with undergraduates as neighbors (69.4%). The average graduate student ranks the apartment's condition and monthly rent as more important than does the average undergraduate who places more importance on location. The authors show that such segmentation methodology successfully models the market's heterogeneity with respect to the relative importance fixed on each attribute.

Ogur [16] tests a model of rental housing demand that proposes that median monthly contract rent is a function of median income, percentage of manufacturing employment, population density and college enrollment as a percentage of population. Rent is seen to be positively affected by income and college enrollment and negatively affected by manufacturing employment. These same variables prove significant (except college enrollment for whites) when the data is segmented by white and non-white heads of households.

Discussion

Of the variables analyzed in the studies examining the effect of property-specific factors on rent, several show positive relationships to rent. Among them are distance, extra bedrooms, complex condition, common areas with pool, and size. Economic depreciation as measured by age of structure is shown to have a negative effect on rent. Positively related amenities include utilities paid, modern kitchen, maid service, no children allowed, no pets allowed, and covered parking and/or parking charges. The cost of providing these features in relationship to the additional rent collected is investigated by Sirmans, Sirmans and Benjamin [23] who present a model for such a comparison.

Significant locational variables in addition to the distance from an economic focal or a college campus include degree of traffic congestion, accessibility to public transportation, and locational inconvenience. Proximity to manufacturing employment and minimum lease periods affect rent negatively as do amenities such as patios and barbecue areas, playgrounds, and boat parking. Several demographic studies indicate that some variables show lesser or greater significance with varying groups of renters.

Rent, Rental Concessions, Property Management, Taxes and Length of Residency

Rent literature has studied the effect of rental concessions, property management, taxes, and length of residency. These papers are annotated in Exhibit 2.

The Effect of Rental Concessions on Rent

Studies that have recently examined the effect of rental concessions on rent and/or occupancy include Sirmans, Sirmans and Benjamin [24] who examine the effect of concessions on apartment rent and vacancy and the resulting effect on property values. In their model, rent is specified as a function of physical characteristics, amenities and services, location, restrictions, occupancy, and a binary variable for rental concessions. The results show a positive effect of rental concessions on monthly rent and a positive effect of rental concessions on occupancy.

Frew, Jud and Winkler [4], who also examine the effect of concessions on apartment rent, posit a logit model to estimate that the probability of a rental concession being present is a function of the atypicality of the unit and the size of the apartment complex. They estimate nominal monthly rent as a function of neighborhood characteristics, physical characteristics, amenities and services, and a binary variable for rental concessions. Results show a positive effect of concessions on monthly rent.

Sirmans, Sirmans and Benjamin [21] develop a three-stage, three-equation model for rent, occupancy and concessions which shows that a rental concession should have a positive effect on rent, occupancy and rental housing consumption. Rent is considered a function of physical characteristics, amenities and services, location, occupancy, and the value of the rental concession. Occupancy is considered a function of rent, concessions, square feet per bedroom, number of bedrooms, age, and location. The rental concession is considered a function of rent, occupancy, square feet per bedroom, number of bedrooms, location, and a binary variable for nonconforming apartments (unconventional

Exhibit 2
Studies Examining the Effect on Rent of Rental Concessions, Property Management, Taxes, and Length of Residency Discounts

Author(s)	Title	Source	Purpose, Data, Comments
The Effect of Rental Concessions on Rent			
Sirmans, Sirmans and Benjamin	Rental Concessions and Property Values	<i>Journal of Real Estate Research</i> (Spring 1990), 141-51	<ul style="list-style-type: none"> ● Examines the effect of rental concessions on property values using a two-stage least-squares system of equation for rent and occupancy. ● Data: 544 observations from over 300 apartment complexes in Baton Rouge, Louisiana for 1987. ● Results imply that rental concessions have a positive effect on property value.
Frew, Jud and Winkler	Atypicalities and Apartment Rent Concessions	<i>Journal of Real Estate Research</i> (Summer 1990), 195-202	<ul style="list-style-type: none"> ● Uses a rent model to measure the use and value of rental concessions and a logit model to measure apartment demand through an "atypicality" index. ● Data: 439 rental units for 155 apartment complexes in Greensboro/High Point/Winston-Salem, North Carolina for 1988 with rental concessions reported for 29% of rental units.
Sirmans, Sirmans and Benjamin	Apartment Rent, Concessions, and Occupancy Rates	Working paper (January 1991a)	<ul style="list-style-type: none"> ● Uses a three-stage least-squares system of equations to measure the effects of rental concessions on rent and occupancy rates. ● Data: 544 apartment observations for Baton Rouge, Louisiana for 1987. ● Results show that landlords with higher average rents and higher average occupancy levels are under greater pressure to offer concessions.
Sirmans, Sirmans and Benjamin	Rental Concessions, Effective Rent, and Property Values	Working paper (January 1991b)	<ul style="list-style-type: none"> ● Examines the relationship between contract rent and effective rent and the resulting effects on property value using an equation which includes physical characteristics, amenities and services, location and occupancy. ● Data: 544 apartment observations in Baton Rouge, Louisiana for 1987. ● Included is an illustration of the adjustment process for estimating NOI considering the effect of the concession and the resulting effect on value.

The Effect of Professional Management

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| Benjamin, Lush
and Sinha | Search Costs and
Apartment Rents | Working paper
(January 1991) | <ul style="list-style-type: none"> ● Examines the effect of property management on apartment rent to determine whether managers who are able to reduce search costs for renters can extract higher rents. Their model is estimated in linear and semilog form with search cost measured by the number of apartment unit types managed by the management firm. ● Data: 726 observations for 156 apartment complexes in State College, Pennsylvania over the period 1988-1990. Their market sample of students represents renters with relatively short tenures who are likely to be willing to pay for reduced search time and costs. ● Results indicate that rent increases as the number of units managed increases implying that larger management firms are able to shift more of their fees to renters than smaller firms. |
| Sirmans and
Sirmans | Property Manager
Designations and
Apartment Rent | Working paper
(April 1991) | <ul style="list-style-type: none"> ● Examines the effect of quality of property management (indicated by the holding of professional designations (CPM, CAM, ARM, etc.) on rent. Their hedonic rent model which includes a binary variable with the value of one to represent the professional designation is estimated in linear and semilog form. ● Data: for Tallahassee, Florida for Spring, 1990. |
| Gilderbloom and
Appelbaum | Toward a Sociology of
Rent: Are Rental
Housing Markets
Competitive? | <i>Social Problems</i>
(June 1987),
261-76 | <ul style="list-style-type: none"> ● Attempts to provide a more adequate sociological understanding of rental housing markets assuming that social relations between landlord and between landlords and tenants limit the free market response to changes in the supply of rental housing. ● Data: 140 urbanized areas in the U.S. according to the 1980 Census. |

Length of Residency Discounts

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| Marshall and
Guasch | Occupancy Discounts
in the U.S. Rental
Housing Market | <i>Oxford Bulletin of
Economics and
Statistics</i>
(November 1983),
357-78 | <ul style="list-style-type: none"> ● Examines the effect of length of residency discounts on apartment rent and of a "sit discount," given at the first contract renegotiation to retain a desirable tenant. ● Data: 477 rental units from eleven (11) cities in the U.S. found in the Annual Housing Survey for 1974 to 1977. ● The authors correct for a censoring bias created in the previous research data because the difference between the tenants' offering rent and landlords' asking rent is unobservable for those renters who move out. |
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floor plan, etc.). Their results show that the rental concession has a positive effect on both rent and occupancy, and both rent and occupancy have significant positive effects on concessions.

Sirmans, Sirmans and Benjamin [22] further examine the effect of rental concessions on rent, occupancy and property values and discuss the implications for real estate appraisers. They first estimate a hedonic rent equation with observations where no concession is present. Using these coefficients, they estimate a market rent for those observations with concessions. The observed contract rent is then compared to the predicted rent. The same procedure is performed for an occupancy equation. The results show that the average increase in rent for the concession observations relative to the no concession observations is 11.3% or \$37 monthly on average. For occupancy, the increase due to the concession is 7.3%.

To examine the effect of these increased rents on occupancy, Sirmans, Sirmans and Benjamin [22] estimate a model with occupancy as a function of the ratio of observed rent/market rent. For the no-concessions observations, there is no significant relationship; for the concessions observations, however, there is a positive relationship indicating that when contract rent is becoming an increasing proportion of market rent, occupancy rates are also increasing. In other words, higher rents resulting from concessions are not being traded off by lower occupancy.

The Effect of Professional Management

Recent research has investigated the effect of professional management companies on rent. Management provides or monitors services such as tenant screening and intermediation, repair quality, maintenance, security, etc. These services may be valuable to the rental market and may affect rent.

Benjamin, Lusht and Sinha [1] show that the larger the management company, the higher the rent. They argue that the ability of the management company to reduce the search costs of tenants should have a positive effect on the level of rent. They estimate rent as a function of physical characteristics, location, vacancy, time trend, lease provisions, and a variable representing search cost (the number of apartment units types managed by the management firm). Results show that the variable unit types managed has a positive effect on rent per unit.

Sirmans and Sirmans [20] examine the relationship between the quality of property management services and apartment rent. They postulate that the quality of management services would be positively correlated with the holding of professional designations by property managers since such designations could act as a signal indicating the managers' levels of competence based on education, training, and experience. The results in the linear model show that management companies whose managers hold designations earn a higher average monthly rent. The semilog model shows that management companies that have managers with designations earn a higher average monthly rent of about 4%.

Gilderbloom and Appelbaum [6] examine economic and sociological factors affecting the rental housing market. They estimate rent as a function of the vacancy rate, the growth in the rental stock, population, population growth, region in U.S., percent non-white, and percent lacking plumbing, as well as the following which are significant:

percent of rentals built before 1940, median income, median housing cost, climate, and the degree of professionalization (the number of units at a given address).

These three studies support the idea that property management does correlate with rent. Both level of management skill and size of complexes under management seem to have significant relationships with rent.

Length of Residency Discounts

Marshall and Guasch [15] examine the effect of length of residency discounts on rent. Their premise is that landlords offer rent discounts to tenants who remain in their units for more than one contract period and that the discount increases with each additional contract period. They also propose that landlords wishing to retain desirable tenants may also offer tenants a one-time "sit" discount at the first contract renegotiation. Rent is estimated to be a function of a vector of specific physical and other characteristics, a binary variable representing whether the tenant has resided for less than or more than one year, and the above binary variable times the length of time the tenant has occupied the unit. The second variable measures the sit discount whereas the last variable measures the length of residency discount. OLS results show both these variables to be significant and negative. When the data are corrected for censoring bias, however, there is insufficient evidence to conclude that landlords offer residency discounts.

Discussion

The studies that analyze the effect of rental concessions on market rent or on market rent and/or occupancy produce consistent relationships, but produce no dependable estimate of the increase in rent which accompanies landlord concessions. A similar relationship exists when the variables are analyzed in reverse order; that is, rent and occupancy also significantly affect concessions. As for property management as a variable, two studies report positive relationships with rent levels, one specifically concomitant with the size of the management company and the other with the degree of professionalism of the management company. In addition, the length of stay shows a negative relationship to rent levels.

Rent and Vacancy

A number of papers inside and outside the apartment literature have examined the relationship between rent and vacancy. Some studies have proposed a natural vacancy rate and have measured the rate of change in rent relative to the deviation of the observed vacancy rate from the natural rate. Others have attempted to estimate the impact of vacancy on real rent. Exhibit 3 provides a chronological summary of the papers that deal with the relationship between rent and vacancy.

Supply and Demand

Smith [30] proposes that supply and demand factors interact to simultaneously determine the level of rents and the vacancy rate. His model stipulates that the rate of change in rent is a function of the vacancy rate, the vacancy rate lagged one period and

Exhibit 3
Studies Examining the Relationship between Rent and Vacancy

Author(s)	Title	Source	Purpose, Data, Comments
Smith	A Note on the Price Adjustment Mechanism for Rental Housing	<i>American Economic Review</i> (June 1974), 478-81	<ul style="list-style-type: none"> ● Examines the effect of vacancy and property taxes on rent by using a cross-section model with dummy variable for cities. Estimates a distributed lag relationship using the Almon Interpolation Technique. ● Data: annual figures for five Canadian cities for 1961 to 1971. ● Both variables are significant in pooled regression. ● The author concludes that the vacancy rate does significantly affect the rate of change in rents and that landlords are able to pass along a significant portion of operating expenses in the form of higher rents.
Eubank and Sirmans	The Price Adjustment Mechanism for Rental Housing in the United States	<i>Quarterly Journal of Economics</i> (February 1979), 163-83	<ul style="list-style-type: none"> ● Examines the effect of vacancy levels and operating expenses on rent estimating a logged change in the Smith rent equation which includes vacancy, logged vacancy, change in operating expenses, and dummy variables for apartment type. ● Data: observations for four types of apartment buildings across four U.S. cities for the period 1967-1974 as reported in the Institute of Real Estate Management Annual Income/Expense Analysis. ● The authors calculate that approximately 59% to 78% of changes in expenses is passed to tenants in higher rents. They conclude that different building types have different rent adjustment characteristics and that the lack of significance for vacancy is due to the low observed vacancy rate relative to the natural vacancy rate.

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| Rosen and Smith | The Price-Adjustment Process for Rental Housing and the Natural Vacancy Rate | <i>American Economic Review</i> (September 1983), 779-86 | <ul style="list-style-type: none"> ● Examines the effect of vacancy and operating expenses on rent by estimating a rent model which includes rate of change in operating expenses, the observed vacancy rate, and the vacancy rate lagged one period. ● Data: observations for four apartment buildings in 17 U.S. cities for the period 1969 to 1980 reported by the Institute of Real Estate Management. ● In their model the operating expense variable is the ratio of operating expenses to rents times the Bureau of Labor Statistics index of apartment rent for each city. The vacancy variable is the unweighted average of the percentage of gross potential income not collected. The rent variable is the Bureau of Labor Statistics index of apartment rent. Results show vacancy to be significant in 13 of 17 cities and in the cross-section equation. The authors conclude that, within some critical zone of occupancy, vacancy rates exert a significant influence on the rate of change in rents. A natural vacancy rate is estimated for each city along with a model to explain this rate. Results show the natural vacancy rate to be affected by higher degrees of tenant turnover, longer anticipated search time, and the rate of construction. |
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Natural Vacancy Rate

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| Shilling, Sirmans and Corgel | Price Adjustment Process for Rental Office Space | <i>Journal of Urban Economics</i> (June 1987), 90-100 | <ul style="list-style-type: none"> ● Examines the effect of vacancy and operating expenses on rent where the change in rents is regressed on change in operating expenses, the observed vacancy rate, and an interaction variable of the rate of change in rents times the vacancy rate. ● Data: annual BOMA data for office buildings in 17 U.S. cities for 1960 to 1975. ● Results show the operating expense variable to be not significant except in four cities. Vacancy is significant for 11 of 17 cities. The authors conclude that vacancy plays an important role in setting short-run prices and that the greater the number of vacancies, the greater the risk. |
| Gabriel and Nothaft | Rental Housing Markets and the Natural Vacancy Rate | <i>AREUEA Journal</i> (16:4 1988), 419-29 | <ul style="list-style-type: none"> ● Analyzes the price-adjustment mechanism for rental housing. ● Data: metropolitan average vacancy rates from the Census Bureau for 16 U.S. cities from 1981 to 1985. ● The authors argue that the rate of change in rents is partially due to the deviation of short-run vacancy rates from their long-run or natural level. Results of a model treating vacancy as an exogenous variable show vacancy to have a negative effect on rent. Results in which vacancy is treated as endogenous show that natural vacancy rates are higher in areas of high growth and vary positively with the level of median real rents. |

Exhibit 3 (continued)

Author(s)	Title	Source	Purpose, Data, Comments
Wheaton and Torto	Vacancy Rates and the Future of Office Rents	<i>AREUEA Journal</i> (16:4 1988), 430-36	<ul style="list-style-type: none"> Examines the relationship between vacancy and the change in real rent by estimating a model to show the change in real rent on excess vacancy which is the difference in observed vacancy rate and a trending structural vacancy rate. Data: vacancy data found in BOMA (1968-1979) and Coldwell-Banker (1980-1986); rent data is Salomon Brothers average effective rent per square foot for downtown properties in the U.S. deflated to 1982 dollars.
Special Applications			
Frew and Jud	Vacancy Rates and Rent Levels in the Commercial Office Market	<i>Journal of Real Estate Research</i> (Spring 1988), 1-8	<ul style="list-style-type: none"> Develops and estimates a cross-sectional model of rent and vacancy for both OLS and TSLS with the vacancy rate included. Data: observations of 66 office properties in Greensboro, North Carolina for 1984. Non-significant variables are distance to CBD and percent of space devoted to common area. Tests, also provided, determine the correct functional form and the rental demand elasticity. Results show that demand is highly elastic and that a square-root specification of the rent equation is appropriate.
Jud and Frew	Atypicality and the Natural Vacancy Rate Hypothesis	<i>AREUEA Journal</i> 18:3 (1990), 294-301	<ul style="list-style-type: none"> Examines changes in apartment rent based on the natural vacancy rate hypothesis estimating a model where the natural vacancy rate for each unit is based on the atypicality of that unit. Data: surveys of apartment projects in the Greensboro/High Point/Winston-Salem, North Carolina MSA for 1988 and 1989. The authors find that rent adjustments are negatively related to vacancy and that the more typical an apartment unit, the lower the natural vacancy rate.

the rate of change in property taxes (as a substitute for operating expenses). He finds that vacancy has a negative effect and that property taxes have a positive effect on the rate of change in rent. The author concludes that the vacancy rate does significantly affect the rate of change in rents and that landlords are able to pass along a significant portion of operating expenses in the form of higher rents.

Eubank and Sirmans [2] apply the Smith model to four types of apartment buildings including the observed vacancy rate, the observed vacancy rate lagged one period, and total operating expenses. The model is estimated for four cities for each building type as well as for pooled building types by city and for pooled cities by building type. The results show that, in a majority of cases, the vacancy rate is not significant but that operating expenses are significant. As such, their results conflict with those of Smith.

Rosen and Smith [18] provide a further test of the Smith model by proposing that the rate of change in rent is a function of the deviation in the observed vacancy rate from the natural vacancy rate. In modeling, they assume that the natural vacancy rate is constant over time; thus it is reflected in the intercept term. Their equation is estimated with observed vacancy, with observed vacancy lagged one period, and with the rate of change in operating expenses (lagged one period). They find vacancy to be negative and significant for thirteen of the seventeen cities studied and also for the pooled cross-section regression. Using the intercept terms of the individual city equations as estimates of the natural vacancy rate, the authors present a model of determinants of this natural vacancy rate. Variables include rent, standard deviation of rent, population, racial segmentation, renter mobility, change in housing stock, and change in population. All variables are significant except change in population.

The Smith rent and vacancy model is further tested by Shilling, Sirmans and Corgel [19] who measure the rate of change in rent against operating expenses and the observed vacancy rate. Because the risk from holding commercial real estate increases as vacancies increase, their adaptation of the Rosen and Smith model [18] adds an interaction variable consisting of the rate of change in rent times the vacancy rate because the risk from holding commercial real estate increases as vacancies increase. The authors find the vacancy variable is negative and significant for eleven of the seventeen cities and the interaction variable is significant for all cities. The authors conclude that vacancies play an important role in setting rents in the short run and that the greater the number of vacancies, the greater the risk.

The Natural Vacancy Rate

Shilling, Sirmans and Corgel [19] estimate a natural vacancy rate by the intercept term of the individual city equations. They model this natural vacancy rate with the change in stock of office space, the change in nonmanufacturing employment, the change in population, the average property tax rate, and the average level of rent. The variable showing significance is the average level of rent.

To test the relationship between the rate of change in rent and the natural vacancy rate, Gabriel and Nothaft [5] regress the rate of change in rent on the observed vacancy rate and city dummy variables. Based on a vacancy rate variable lagged one year, the results show that the lagged vacancy rate has a significant negative effect on the rate of change in rents for the following period. The authors also estimate the natural vacancy rate for each city from the rent model and specify a vacancy model consisting of the

change in the stock of rental units, median rent, dispersion in rent, proportion of minority population, and the change in population. All variables are significant except dispersion in rent which is significant and negative.

Wheaton and Torto [31] similarly find a significant negative relationship between vacancy and rent changes. They deviate from previous studies by estimating the effect of vacancy on real rent, not nominal rent.

Special Applications

Including the vacancy rate for specific buildings, Frew and Jud [3] estimate a model for rent for commercial office properties. Their theoretical model shows that rent should be positively related to the vacancy rate. Rent per square foot is regressed on the vacancy rate, distance from CBD, building age, number of floors, percent of common area, and location adjacent to a major thoroughfare. The model is estimated in linear, semi-log, square root, and log form. Using OLS, the vacancy rate is positive and significant in all but the log form. When a vacancy rate equation is specified (as a function of rent, building age, and total building space) and TSLS is used, the vacancy rate is significant and positive in the rent equation for the linear and semi-log form. Other variables consistently significant in all four equation forms are age (negative), number of floors (positive) and proximity to highway (negative). The authors additionally provide a Box-Cox transformation of the rent equation and show that demand for office space in a given building is highly elastic due to the presence of close substitutes.

Jud and Frew [10] develop a model in which the natural vacancy rate is determined by an apartment unit's atypicality. Their change in rent equation includes a measure of atypicality, the observed vacancy rate lagged one period, and a binary variable to represent rental concessions. The measure of atypicality follows the index developed by Haurin [8]. Their results show a positive effect of atypicality and a negative effect of vacancy on the change in rent. To estimate the natural vacancy rate for the apartment units, the authors use the estimated coefficients and the sample means and find it to be 6.5%.

Discussion

Using a model that he developed, Smith [30] finds vacancy to have a negative effect and property taxes to have a positive effect, respectively, on rent. Studies that use adaptations of the Smith model do not consistently corroborate his findings. One finds no consistent effect on rent for the vacancy variable while another does and additionally reports a concomitant risk relationship. Further studies that consider natural versus observed vacancy and rent find negative and significant concomitance in both directions of effect. When a vacancy rate equation is specified, a significant and positive relationship exists between vacancy and rent. When real rent is used as a variable, the relationship is significant and negative.

Summary

Recent empirical work has investigated a substantial list of possible factors to explain market rents for apartments. Exhibit 4 summarizes the factors that have been found to

Exhibit 4
Summary of Factors Found to be Determinants of Rent
(Studies Listed in Chronological Order)

Author(s)	Source	Variables Found to Significantly Affect Rent	
		Positive Effect	Negative Effect
Ogur	<i>American Journal of Economics and Sociology</i> (October 1973)	Income, College Population, Population Density	Manufacturing Activities
Jaffe and Bussa	<i>Appraisal Journal</i> (January 1977)	—	Distance from an Economic Focal Point
Marks	<i>Land Economics</i> (February 1984)	Linear Model: Decline in Neighborhood Quality, Bedrooms, Stories, Units/Floor, Caretaker, Furnished	Distance, Age, First Quarter of Year
Gilderbloom and Appelbaum	<i>Social Problems</i> 34:3 (June 1987)	Semilog Model: Decline in Neighborhood Quality, Bedrooms, Stories, Caretaker, Coin Laundry, Furnished	Distance, Age, Units/Floor, First Quarter of Year
Guntermann and Norrbin	<i>AREUEA Journal</i> 15:4 (1987)	Proportion of Housing Stock Rental, Median House Cost, Climate, Median Income, Population Growth, Degree of Professionalization	Proportion of Units Built Before 1940, Percent of Non-white, Region
Malpezzi, Ozanne and Thibodeau	<i>Land Economics</i> (November 1987)	Size, Bedrooms, Condition, Patio, Electricity Paid, Bathrooms, Fireplace, Dishwasher, Pool, Exercise Room	Age, Children Allowed, Distance to Expressway
Smith and Belloit	<i>Real Estate Appraisal</i> , 2nd ed. (1987)	Bathrooms, Number of Rooms, Garage, Basement, Hot Water, Air Conditioning, Neighborhood Dummy, Utilities Included	Age, Persons Per Room, Dummy for Block, Poor Quality Index, Length of Tenure
		Dishwasher, Tennis Court, Sauna Bath, Extra Utilities Provided, Utilities Provided, Furnished Unit, Bathrooms, Square Feet, Bedrooms	Year Leasing Only, Poor Neighborhood, Location Inconvenience, Efficiency Apartment.

Exhibit 4 (continued)

Author(s)	Source	Variables Found to Significantly Affect Rent	
		Positive Effect	Negative Effect
Frew and Jud	<i>Journal of Real Estate Research</i> (Spring 1988)	Vacancy Rate, Number of Floors	Age, Location Adjacent to Major Thoroughfare
Sirmans, Sirmans and Benjamin	<i>Journal of Real Estate Research</i> (Summer 1989)	Linear Equation: Bedrooms, Complex Size, Covered Parking, Modern Kitchen, Pool, Sauna, Utilities Paid, Location	Age, Traffic Congestion, Distance to Bus Stop, Number of Bus Lines in Area
Jud and Frew	<i>AREUEA Journal</i> 18:3 (1990)	Semilog Equation: Bedrooms, Complex Size, Covered Parking, Modern Kitchen, Pool, Sauna, Utilities Paid, Location	Age, Traffic Congestion, No Pets Allowed
Sirmans, Sirmans and Benjamin	<i>Journal of Real Estate Research</i> (Spring 1990)	Atypicality of Unit	Vacancy Rate
Frew, Jud and Winkler	<i>Journal of Real Estate Research</i> (Summer 1990)	Linear and Semilog Equations: Square Footage, Complex Size, Rental Concession, Fitness Room, Washer/Dryer, Washer/Dryer Connections, Fireplace, Balcony, Security, Pets Allowed, Adults Only, Location	Number of Units of a Given Type, Age, Date of Lease, Occupancy Rate, Patio, Efficiency Unit, Townhouse Unit
Sirmans, Sirmans and Benjamin	<i>Real Estate Appraiser & Analyst</i> (Summer 1990)	Log Equation: All above variables except Age, Occupancy Rate and Patio are not significant	Vacancy Rate
Frew, Jud and Winkler	<i>Journal of Real Estate Research</i> (Summer 1990)	Income, Square Footage, Bathrooms, Electricity Included, Vaulted Ceilings, Hardwood Floors, Microwave, Dishwasher, Window Treatments, Pool, Jogging Track, Exercise Room, Handicap Units, Facilities for Elderly, Rental Concession	Distance from MSA Center, Distance Squared
Sirmans, Sirmans and Benjamin	<i>Real Estate Appraiser & Analyst</i> (Summer 1990)	Bedrooms, Complex Size, Covered Parking, Modern Kitchen, Maid Service, Sauna, Pool, Utilities Paid, Proximity to Employment, Location	Number of Units of a Given Type, Age, Traffic Congestion, Distance to Bus Stop, Number of Bus Lines in Area

Marshall	Working paper—The Influence of Property Characteristics on Rent (October 1990)	Full Data: Pets Allowed, Pool, Bathrooms, Large Complex Houses Only: Distance to Downtown Squared Apartments Only: Pets Allowed, Bathrooms, Furnished	Patio, Distance to Campus Squared Distance to Downtown Patio, Bedrooms
Sirmans, Sirmans and Benjamin	Working paper—Rental Concessions, Effective Rent, and Property Values (January 1991b)	Bathrooms Per Bedroom, Square Feet Per Bedroom, Number of Bedrooms, Fitness Room, Pets Allowed, Washer/Dryer Connections, Washer/Dryer, Fireplace, Location	Occupancy Rate, Age, Date of Lease, Playground, Patio, Location
Sirmans, Sirmans and Benjamin	Working paper—Apartment Rent, Concessions, and Occupancy Rates (January 1991a)	Rental Concession, Square Footage, Bathrooms Per Bedroom, Bedrooms, Fitness Room, Fireplace, Washer/Dryer Connections, Washer/Dryer, Playground, Security, Pets Allowed, Adults only, Location	Occupancy Rate, Age, Date of Lease, Patio, Location
Benjamin, Lusht and Sinha	Working paper—Search Costs and Apartment Rents (January 1991)	Bedrooms, Furnished, Modern Kitchen, Utilities Paid, Parking Availability, Vacancy, Time Trend, Number of Unit Types Managed	Walking Time to Campus, Application Fee
Sirmans and Sirmans	Working paper—Property Manager Designations and Apartment Rent (April 1991)	Bedrooms, Baths, Washer/Dryer, Size of Complex, Lease Period, Furnished, Fireplace, High-Quality Kitchen, Pool, Tenant Profile, Designations	Age, Pets Allowed

be determinants of apartment rent. These factors range from physical attributes to vacancy rates.

First, we show that rent researchers have explored relationships between several groups of factors and market rent. These include age, amenities, services, and physical attributes, location factors such as proximity to an economic focal point or college campus, and characteristics of renters and their willingness to pay. Several have significant effects on rent.

Second, our survey examines those authors who study the effects that rental concessions, property management, and length of residency have on apartment rent. The first two variables appear to have a significant positive effect on rent while the latter exhibits a negative relationship. Third, we analyze the literature on rent and vacancy. Although the Smith [30] model is employed in subsequent research, studies using it or an adaptation produce conflicting results. Defining vacancy as natural or defining rent as nominal or real produces varying results.

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