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Security Measures and the Apartment Market†

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***Abstract*. This study examines the effect of security measures on apartment rent and occupancy. Three variables representing various security measures are estimated in a simultaneous model of rent and occupancy. Providing *24-hour security* has a significant positive effect on both rent and occupancy. Having a *manager living on site* or a *manned front desk/restricted entry* does not significantly affect rent. All three variables, however, have a significant positive effect on occupancy. It would appear that, although landlords cannot extract higher rents for some security measures, all three measures included in this study act to increase occupancy.**

Introduction

The effect of apartment complex location and amenities (such as square footage, number of bedrooms, etc.) on house prices and rent has long been the subject of real estate research (for reviews, see Benjamin and Sirmans, 1994; Jud, Benjamin and Sirmans, 1996; and Sirmans and Benjamin, 1991). Some features have been shown to be determinants of real estate prices and rents; the value that owners and tenants attach to other features, however, has not uniformly been established. Of particular interest, for example, is the effect on rent of security measures such as restricted access. This study measures the impact of security measures on apartment rent for high-rise apartments.

While it is expected that security measures will produce a rent premium, the existence and extent of any rent premium have yet to be confirmed through empirical research. Tenants' preferences for security systems and controlled access are more useful to real estate investors, property managers and community groups when the premium that tenants are willing to pay for such security measures is known. The process of determining the premium can be complex. For example, apartments located in crime areas that necessitate heightened security measures may realize a rent premium for the benefits of added security, but this premium may be offset by a rent discount caused by the negatively perceived location. This study seeks to determine the effect of security measures on apartment rent and occupancy while accounting for location. Evidence on the impact of security measures on apartment rent and occupancy would have important implications for investors, developers and others who hold financial stakes in the supply of apartment space.

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Information on apartment features for a set of high-rise apartments in the Washington, D.C. metro area is used. A sample of eighty-one high-rise apartments in this Washington, D.C. area provides 230 observations for 1992. Hedonic regressions are used to determine the impact of restricted access or other security measures on apartment rent and occupancy.

Literature Review

Location and Value

Of the considerable research devoted to the determination of real estate values, some has concentrated on the effect of location on property value. Location has long and frequently been considered a primary determinant of real estate value. An early study in 1926 addresses the role that location plays in determining land use and rents (Pearson, 1991). Location has since been examined from various aspects. While traditional location theory has focused on transportation costs rather than specific real estate features, often the value of physical attributes of real estate is obscured by values that tenants or owners attach to location and to direct property amenities. Within the complex bundle of services and amenities included in real estate transactions, research has shown neighborhood environment to be a key determinant in the value of the real estate package (Kain and Quigley, 1970).

Research on urban property values has determined that factors such as zoning and distance from the city center significantly affect rents and/or property values (see Crecine, Davis and Jackson, 1967; Ball, 1973; Grether and Mieszkowski, 1974; Rueter, 1973). Several models have found that fundamental physical characteristics and location explain more than 90% of the variation in the selling prices of properties (Miller, 1982). Neighborhood-specific characteristics of urban housing, as shown by one study, explain between 15% to 50% of the variation in urban housing market values (Linneman, 1980). This study also finds that neighborhood traits may induce differential values up to 100% across structurally identical sites.

Location choice has often been examined in terms of the trade-off between commuting and land consumption (Wheaton, 1977). Location produces services of convenience and exposure for the owner or tenant. Location factors such as travel time and distances as well as neighborhood features such as proximity to schools or shopping centers have been examined in the literature, but few studies have examined and drawn conclusions about the impact of both location and security measures on property values or rents (see Asabere, 1990; Colwell, Guijral and Coley, 1985; Linneman, 1980).

Property Features and Value

Research on how property values are affected by their location and property features has sometimes produced surprising and conflicting results. For example, being located on a cul-de-sac results in a 28% increase in property value. Other neighborhood traits and neighboring nonresidential land uses, such as a nearby shopping center, have been shown to have both negative and positive effects on property values (Asabere, 1990; Colwell et al., 1985). Gatzlaff and Smith (1993) find that the development of a Miami Metrorail weakly influenced the values of nearby residential values. When examining residential data in New Haven, Connecticut, Grether and Mieszkoski (1980) conclude that adjacent

nonresidential land use has no systematic effect on housing values, partially confirming an earlier study by Crecine (1967) that found no systematic evidence that residential property values in Pittsburgh are negatively affected by adjacent nonresidential land uses.

Proximity to a specific land use has been shown to be a primary determinant of property values (Rueter, 1973), although little systematic research has focused on the identification and measurement of economic externalities. Some studies have addressed property features, but the existence and extent of external effects on urban property markets is a complex issue, and many property characteristics have yet to be examined empirically. While increased security measures may appear to result in increased rents, this effect may only be acting as a surrogate variable for a property feature or an environmental characteristic.

Crime and Value

Proximity to specific facilities or environments such as high crime areas can impact apartment rents and the value of single-family homes (Colwell et al., 1985). A neighborhood with a high incidence of crime may create a greater demand for security measures, but this demand may not necessarily result in higher rents or occupancy. In residential areas, the need for various security measures often arises with proximity to particular facilities. Public facilities such as parks, schools, reservoirs, shopping centers, and power plants have been found to affect property values to some degree. One study concludes that there are two contrasting elements of the influence that a public facility has on residential housing prices: accessibility, which positively influences prices, and the visual or noise effect based upon proximity to the facility, which negatively influences prices (Miller, 1982).

Characteristics of real estate and location choice are of growing concern to property owners. As crime and other factors become popular public policy issues, property owners are confronted with determining the effect on rent and occupancy of parks, bodies of water, crime-prone areas, etc. For the period 1981–94, there was an average, by state, of 516 violent crimes in the U.S. North Dakota had the lowest average at 47 while Washington, D.C. had the highest average at 2,922 (Feinberg, 1996). Over the same period, the average number of property crimes by state was 4,594 with West Virginia having the lowest at 2,053 and Washington, D.C. having the highest at 8,839 (Feinberg, 1996). As shown by previous research, crime does have an effect on property values. Diamond and Tolley (1982) discuss the importance of public safety along with amenities such as schools and culture. Burnell (1988) as well finds that housing values are adversely affected by crime rates. Nevertheless, existing academic studies are silent on the interaction of security measures with apartment rent and occupancy.

Empirical Model and Data

To determine the effect of security measures on apartment rent and occupancy, a hedonic model is estimated based upon July 1992 apartment rents for 230 rent observations from eighty-one apartment complexes in the Washington, D.C. area.[1] A rent equation is estimated in a simultaneous model with occupancy. Summary statistics for the variables included in the model are given in Exhibit 1.

Exhibit 1
Summary Statistics for Washington, D.C. Apartment Data

Variables	Mean	Std Dev.	Min.	Max.
Rent				
Rent	812	311	404	2375
In Rent	6.64	0.33	6.00	7.77
Occupancy				
Occupancy Rate	95	4.70	80	100
In Occupancy Rate	4.60	0.05	4.38	4.61
Security Variables				
24-Hour Security	0.79		0.00	1.00
Manager Lives on Site	0.84		0.00	1.00
Front Desk/Restrict. Entry	0.66		0.00	1.00
Physical Characteristics				
No. of Bedrooms	1.19	0.66	0.50	3.00
No. of Bathrooms	1.15	0.35	1.00	2.00
Size of Complex	250	179	57	795
Distance to Metro	1.17	1.09	0.00	5.00
Amenities				
Utilities Included in Rent	0.67		0.00	1.00
Modern Kitchen	0.61		0.00	1.00
Parking Available	0.91		0.00	1.00
Fireplace	0.13		0.00	1.00
W/D in Unit	0.11		0.00	1.00
Cable TV	0.91		0.00	1.00
No Pets Allowed	0.59		0.00	1.00
Mgmt Characteristics				
Rent Deposit Required	0.66		0.00	1.00
Cosign Required for Student	0.89		0.00	1.00
Manager/Owner	0.88		0.00	1.00
Max. Occupancy	2.36	1.02	1.00	6.00
Sublet with Permission	0.54		0.00	1.00
Location Variables				
Z20001	0.04		0.00	1.00
Z20005	0.08		0.00	1.00
Z20007	0.05		0.00	1.00
Z20008	0.23		0.00	1.00
Z20009	0.14		0.00	1.00
Z20016	0.08		0.00	1.00
Z20036	0.06		0.00	1.00
Z22201	0.04		0.00	1.00
Other Zip Codes*	0.28			

n=206
*The Other Zip Codes variable is a cumulation of zip codes where less than 3% of the observations in the sample come from each area.

The Rent Equation

Rent is specified with the following model:

$$RENT_i = r(OCC_i, SECURITY_{ij}, PHY_{ij}, AMEN_{ij}, MGT_{ij}, LOC_i) \ ,$$

where:

$RENT_i$ = the observed monthly rent on the i^{th} apartment unit.
OCC_i = the occupancy rate for the apartment complex as a percentage of total units in the complex.
$SECURITY_{ij}$ = three variables identifying the security measures for the i^{th} apartment. These are:
a 0–1 variable indicating whether the complex has 24 hour security;
a 0–1 variable indicating whether the complex has a manager who lives on site; and
a 0–1 variable indicating whether the complex has a front desk operator and/or restricted entry.
PHY_{ij} = a set of j physical characteristics for the i^{th} apartment including:
the number of bedrooms (efficiency, one, two, and three bedrooms);
the number of bathrooms (full and half-bath); and
the distance to the closest metrorail station (in tenths of miles).
$AMEN_{ij}$ = a set of j amenities for the i^{th} apartment building:
0–1 dummy variable for parking available;
0–1 dummy variable for fireplace;
0–1 dummy variable for washer/dryer in unit; and
0–1 dummy variable for no pets allowed.
MGT_{ij} = a management characteristic variable for the i^{th} apartment:
0–1 dummy variable requirement of rent deposit.
LOC_i = a set of location variables identifying the i^{th} apartment by zip code.

Occupancy. The relationship between rent and occupancy is unclear. In a market of high or excess demand (a surplus of tenants), demand (occupancy) should drive rent and a positive relationship would result.[2] If occupancy is a function of rent (as in a market of excess supply), however, there would be an inverse relationship between rent and occupancy.

Security. The security measures represent three aspects of security: providing *24-hour security*, having a *manager living on site*, and having a *manned front desk/restricted entry*. If tenants are willing to pay a rent premium for these various aspects of security, a positive coefficient should be observed for each variable.[3] Also, if a more secured environment increases demand for apartments, a positive effect on rent would result. On the other hand, if tenants are not willing to pay for these services but simply require them as a condition of occupancy, the variables would have no significant effect on rent.

Physical Characteristics. The *number of bedrooms* acts as a proxy for apartment unit size. Since *rent* should increase with size, the coefficient is expected to be positive. Likewise, a positive relationship is expected between *rent* and *number of bathrooms*. Closer proximity to *metrorail* stations is expected to result in higher *rent*.

Amenities. The coefficients for *parking available, fireplace* and *washer/dryer* are expected to be positive. The effect of the variable *no pets allowed* is less clear. A negative coefficient would be observed if renters are willing to pay a premium to keep pets on the

premises. On the other hand, if pets are considered a nuisance (noise, etc.) by non-pet-owning tenants, the relationship could be positive.

Management Characteristics. The requirement of a *rent deposit* expressed as a percentage of monthly rent is expected to have a negative effect on rent.

Location. The *location zip code* variables are used to account for location influences; their coefficients will depend on the relative desirability of the area.

The Occupancy Equation

Occupancy is specified as the following:

$$OCCUPANCY_i = o(RENT_i, SECURITY_{ij}, PHY_{ij}, AMEN_{ij}, MGT_{ij}, LOC_i) \ ,$$

where:

$RENT_i$ = the observed monthly rent on the i^{th} apartment unit.

$SECURITY_{ij}$ = a set of j security variables for the i^{th} apartment. These are the same as those included in the rent equation.

PHY_{ij} = a set of j physical characteristics for the i^{th} apartment building. These include:
the number of total units in the complex; and
the distance to the closest metrorail station (in tenths of miles).

$AMEN_{ij}$ = a set of j amenities for the apartment i. These include:
0–1 dummy variable for utilities included in rent;
0–1 dummy variable for modern (updated) kitchen;
0–1 dummy variable for fireplace; and
0–1 dummy variable for cable tv.

MGT_{ij} = a set of management characteristic variables for the i^{th} apartment. These include:
0–1 dummy variable for requirement of a rent deposit;
0–1 dummy variable for required student cosigning;
0–1 dummy variable for owner/managed;
0–1 dummy variable maximum unit occupancy; and
0–1 dummy variable for subletting with permission.

LOC_i = a set of location variables identifying the i^{th} apartment by zip code.

Results

The model is estimated in semilog form with the results for the rent equation presented in Exhibit 2. To account for the likely simultaneity between rent and occupancy, the rent equation is estimated with OLS, two-stage least squares (2SLS), and three-stage least squares (3SLS) methodologies. The results for the occupancy equation are given in Exhibit 3.[4]

Exhibit 2
Regression Results for Rent Equation for Washington, D.C.
High-Rise Apartments
(Dependent Variable=ln Rent)

Variables	OLS	2SLS	3SLS
Intercept	3.224	2.657	3.495
	(2.68)***	(2.00)**	(2.64)***
Occupancy			
ln Occupancy Rate	0.622	0.746	0.561
	(2.35)**	(2.56)**	(1.93)*
Security Variables			
24-Hour Security	0.111	0.114	0.113
	(2.54)**	(2.64)***	(2.60)***
Manager Lives on Site	−0.012	−0.008	−0.012
	(−0.28)	(−0.19)	(−0.27)
Front Desk/Restrict. Entry	0.016	0.015	0.020
	(0.48)	(0.43)	(0.60)
Physical Characteristics			
No. of Bedrooms	0.264	0.267	0.265
	(11.57)***	(11.61)***	(11.53)***
No. of Bathrooms	0.109	0.105	0.108
	(2.53)**	(2.41)**	(2.49)**
Distance to Metro	−0.068	−0.070	−0.070
	(−4.40)***	(−4.55)***	(−4.50)***
Amenities			
Parking Available	0.141	0.143	0.149
	(2.75)***	(2.78)***	(2.90)***
Fireplace	0.076	0.077	0.084
	(1.43)	(1.45)	(1.60)
W/D in Unit	0.336	0.338	0.332
	(6.95)***	(7.00)***	(6.88)***
No Pets Allowed	−0.087	−0.090	−0.079
	(−2.35)**	(−2.44)**	(−2.14)**
Mgmt Characteristics			
Rent Deposit Required	−0.125	−0.124	−0.133
	(−2.87)***	(−2.84)***	(−3.05)***
Location Variables			
Z20001	−0.218	−0.215	−0.211
	(−3.27)***	(−3.22)***	(−3.18)***
Z20007	0.262	0.271	0.253
	(4.10)***	(4.20)***	(3.93)***
Z20008	0.202	0.202	0.198
	(5.53)***	(5.51)***	(5.43)***
Z20016	0.309	0.311	0.310
	(5.44)***	(5.47)***	(5.46)***
Z20036	0.451	0.459	0.452
	(7.90)***	(8.03)***	(7.91)***
Z22201	−0.133	−0.139	−0.125
	(−1.72)*	(−1.78)*	(−1.61)*
R^2	0.75	0.75	0.72
n	206	206	206

t-statistics in parentheses; ***, **, * denote significance at the .01, .05 and .10 levels, respectively.

Exhibit 3
Regression Results for Occupancy Equation for Washington, D.C. High-Rise Apartments
(Dependent Variable=ln Occupancy Rate)

Variables	OLS	2SLS	3SLS
Intercept	4.547	4.771	4.799
	(61.65)***	(45.94)***	(46.35)***
Rent			
ln Rent per Unit	−0.017	−0.054	−0.059
	(−1.48)	(−3.24)***	(−3.51)***
Security Variables			
24-Hour Security	0.031	0.033	0.033
	(3.27)***	(3.40)***	(3.67)***
Manager Lives on Site	0.023	0.024	0.024
	(2.57)**	(2.54)**	(2.54)**
Front Desk/Restrict. Entry	0.020	0.025	0.026
	(2.37)**	(2.87)***	(3.00)***
Physical Characteristics			
Size of Complex	−0.000	−0.000	−0.000
	(−2.05)*	(−2.65)***	(−2.69)***
Distance to Metrorail	−0.006	−0.006	−0.006
	(−1.83)*	(−1.67)*	(−1.66)*
Amenities			
Utilities Included in Rent	0.055	0.059	0.059
	(7.19)***	(7.36)***	(7.35)***
Modern Kitchen	0.018	0.022	0.022
	(2.45)**	(2.94)***	(2.94)***
Fireplace	0.038	0.045	0.045
	(3.49)***	(3.91)***	(3.98)***
Cable TV	0.056	0.056	0.053
	(4.68)***	(4.49)***	(4.30)***
Mgmt Characteristics			
Rent Deposit Required	−0.039	−0.039	−0.039
	(−4.64)***	(−4.46)***	(−4.43)***
Cosign Required for Student	0.032	0.040	0.041
	(3.42)***	(3.98)***	(4.05)***
Owner/Managed	−0.036	−0.044	−0.045
	(−3.80)***	(−4.35)***	(−4.52)***
Max. Unit Occupancy	0.003	0.010	0.010
	(0.82)	(3.39)***	(2.57)**
Sublet with Permission	0.010	0.013	0.014
	(1.47)	(1.90)*	(2.07)**
Location Variables			
Z20005	0.004	−0.010	−0.011
	(0.36)	(−0.74)	(−0.86)
Z20007	−0.125	−0.119	−0.118
	(−10.22)***	(−9.40)***	(−9.29)***
Z20009	−0.038	−0.047	−0.048
	(−3.55)***	(−4.09)***	(−4.21)***
Z20036	−0.030	−0.036	−0.037
	(−2.32)**	(−2.74)***	(−2.78)***
Z22201	0.026	0.021	0.020
	(1.62)*	(1.27)	(1.22)
R^2	0.56	0.55	0.72
n	206	206	206

t-statistics in parentheses; ***, **, * denote significance at the .01, .05 and .10 levels, respectively.

Results for the Rent Equation

For the rent equation, the variables generally behave as expected, shown in Exhibit 2. The positive effect of occupancy in all three estimations seems to indicate a market of strong demand. All the physical characteristics are significant with the correct sign in all estimations. The amenities are generally significant with the correct sign. The exception is *fireplace* which is not significant. The negative sign on *no pets allowed* indicates that tenants seem to be willing to pay higher rents to be allowed to keep animals.

The significance of the *rent deposit required* with a negative sign indicates that rents are less, on average, for those units that require a deposit.

The *location* variables are significant with varying signs.

The variables of interest are the security measures. Only one of the three variables is significant. The positive sign for *24-hour security* indicates that, on average, rents are higher for those units that provide 24-hour security. Having a manager living on site or having a manned front desk and/or restricted entry does not have a significant effect on rent.

Results for the Occupancy Equation

Results for the occupancy equation, given in Exhibit 3, show that variables in the model behave generally as expected. The *rent* variable has a negative effect on occupancy. (Recall that the coefficient on occupancy in the rent equation is positive.) Taken together, these findings seem to imply that, as occupancy increases with increased demand, landlords raise rents. Tenants, in turn, seem to be rent-sensitive since occupancy is lower for apartments with higher relative rents. Occupancy declines as the size of the complex increases. Also, occupancy decreases with distance from a metrorail station. All the amenities variables are significant with the expected positive effect on occupancy.

The management characteristic variables show that requiring a rent deposit has a negative effect on occupancy. Being an owner/manager also tends to reduce occupancy. On the other hand, three other variables—requiring a cosign for students, restricting the number of occupants per unit, and allowing subleasing—all increase occupancy.

Some of the location variables are significant with varying signs and coefficients.

The security measures variables produce some interesting results. In the rent equation, only *24-hour security* is significant, but in the occupancy equation all three security variables have a significant positive effect on occupancy. The *24-hour security* variable has the largest coefficient and thus the greatest effect on occupancy. To a lesser degree, having a *manager on site* and having a *manned front desk* and/or *restricted entry* also increase occupancy.

Overall, these results provide some interesting insight into the effect of security measures on the apartment market. First, the presence of *24-hour security* seems to increase demand for apartments and to produce higher market rents. On the other hand, the presence of a *manager on site* and having a manned *front desk/restricted entry* do not significantly affect rent. Second, occupancy for those apartment complexes that provide *24-hour security* is higher, on average, than for those that do not. Also, having a *manager living on site* and having *restricted entry* either by a manned front desk or locked doorways increase occupancy. Thus it would appear that, even though landlords cannot capture higher rents for providing some security services, they can increase occupancy by

providing all or some of these services. In turn, increased occupancy would likely lead to increased revenues and higher property values.

Summary

This study has examined the effect of the various security measures on apartment rent and occupancy. Using a sample of apartment complexes from the Washington, D.C. metropolitan area, a simultaneous model of rent and occupancy is estimated with three security measures variables included. The results show that providing *24-hour security* has a positive effect on both rent per unit and occupancy. Providing a *manager living on site* and having a *front desk/restricted entry*, however, do not have a significant effect on rent. Increased occupancy occurs with provision of *24-hour security*, an *on-site manager*, and *front desk/restricted entry*. Thus it appears that, although providing some security is a prerequisite for residency, the landlord cannot extract higher rents. Providing these security measures, however, does increase occupancy.

Notes

[1]The apartment complexes were located in northwest Washington, D.C. or the adjoining Maryland and Virginia suburbs. Crime statistics revealed slightly higher rates for Washington, D.C., but otherwise the neighborhoods are fairly homogeneous. The use of zip code dummy variables captures differences in crime rates between neighborhoods.

[2]As an astute reviewer points out, this relationship can exist only until full occupancy is reached. In this view, excess demand should drive occupancy to full capacity and then into a rent-inflationary period with no change in occupancy until a new rent equilibrium is attained. Once occupancy equals supply and the independent variable cannot increase, a positive rent/occupancy curve cannot exist.

[3]No attempt is made to determine whether the expenses of security measures are being priced into rent. However, our results show the relative importance of security measures in determining rent and occupancy. We have no measures of the costs of providing security so as to examine the cost side of the equation. Thus we cannot answer the question of whether security features increase building revenue sufficiently to cover the expenses associated with security feature installation and maintenance. It may be logical to assume that, if providing security features is not revenue enhancing, then it is at least cost minimizing.

[4]Tests for multicollinearity yielded no indication of its presence in either equation. Due to the large number of variables, an initial stepwise regression is used to specify both the rent and occupancy equations. In the three-stage least squares estimation, the equations are "stacked" and GLS is applied to the system as a whole. The parameters of all equations are then estimated simultaneously using all the information in the model. A 3SLS system assumes non-zero correlations between the disturbance terms across the equations. If this is the case, the 3SLS estimators will be more efficient than those obtained by OLS. By contrast, 2SLS involves regressing each endogenous variable on the exogenous or instrumental variables of the system and using the predicted values to estimate the structural equation of the model. The predicted values of the instrumental variables have non-zero correlations with the disturbance terms.

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