Expense and Rent Strategies in Real Estate Management

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Abstract. **A model of the real estate market is developed where the rent-vacancy trade-off also embeds selections on expenses. High expenses and rents or low expenses and rents are explicit strategies, positioning properties along an efficient isoprofit frontier. Instead of a rent-vacancy trade-off, the operator can select either gross or net rent, or some combination as an offset for vacancy. This macrostructure is more in keeping with observed real estate markets, where some managers focus on net operating income, and others on effective gross income. Empirical results for apartments in Portland, Oregon supports the hypothesis that expenses and rents are positively correlated. An aggressive expense-increasing strategy pays off in higher rents, though in not all cases is net operating income positive. There are two implications. First, incentives in management create strategies to maximize gross as opposed to net income. Second, rent-vacancy trade-offs that use gross income may misstate the adjustment toward equilibrium.**

Introduction

Prices and rents in real estate markets are set by negotiation rather than in auction markets. Property managers have flexibility in offering amenities, negotiated with prices as part of a contract package. The effective price of services is therefore a hedonic rent that adjusts for amenities, defined to include frequency and quality of repairs and improvements, overhead associated with tenant services, discretionary capital improvements, degree of rent concessions and marketing effort, and maintained level of tenant improvements. While hedonic pricing has been applied widely in real estate markets, it usually does not embed the decision-making of agents, nor is it part of underlying structural behavior. There has been an extensive application of rent-vacancy trade-offs in adjusting real estate markets toward equilibrium. If the rent in these trade-offs is gross, with no accounting for expenses, there is likely to be a misstatement.

This article develops a model of rent-setting where managers have control over rent-setting. Managers select a strategy with high or low rent-expense combinations along an efficient isoprofit frontier. The positively sloped frontier of rents and amenities yields an equilibrium hedonic rent that determines the short-run inventory of space. Even though the hedonic rent maximizes profit, it usually is not set where tenant

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demand absorbs all the inventory, leading to positive vacancy. Lowering rents increases the risk of receiving lower quality tenants.[1] With locked-in leases to existing tenants, positive vacancy is a walk-up put option to sell or rent space to new tenants with high search costs and inelastic short-term demand.

On the demand side, tenants compare the hedonic rent with returns and affordability of ownership. The return to ownership or user cost depends on capital gains, imputed rental income and operating costs. Affordability is based on the rent-asset price ratio. Although the hedonic amenity-adjusted rent is the relevant price, tenants and other participants cannot observe it directly. They observe actual rent and form expectations about it.[2] If the expectation of actual rent is exact, the market is in equilibrium at given amenities and management styles.[3]

An implication is that the trade-off between rent and vacancy using effective gross income is incomplete. If managers are able to select an expense strategy, rent collection depends on expenses. A manager may seek to recruit or retain tenants by increasing expenses and rents. Data on effective gross rents without either net operating income or a behavioral structure of managers do not provide complete information on the trade-off.

The focus of the model is on empirical implementation. To test whether managers have flexibility to select strategies on expense-rent combinations, the type of product and property, type of market and overall firm are held constant. The sample is a portfolio of apartment buildings in Portland, Oregon, of similar size and date of construction, and having the same ownership, but flexible on-site management. They are observed monthly over an identical reporting period from January 1987 to December 1994. Differences in product, property type, location, market segment, overall management and ownership, and date of construction are all controlled for, and smoothing biases and temporal aggregation are removed.

The results confirm a positive correlation between gross rents and expenses. However, there is not always a positive correlation between net rents and expenses. Net operating income is positive for certain expense additions, and negative for others, indicating that optimization at the margin is not always occurring. There is scope for increases at the margin in certain expense categories and reduction in others, though partly mitigated by the lumpiness of investments.

While all five broad expense categories show positive gross rents, marketing is the only category that consistently generates positive net rents, or net operating income. A dollar more in marketing produces more than a dollar in effective gross income, and positive net operating income. If the optimal management pursued each expense item until net operating income is nonincreasing, there is scope to increase marketing expense. At the other extreme is "noncontrollable" expense, not subject to the discretion of the manager, for property taxes and insurance. Only between 10 and 20 cents per dollar of noncontrollable expense passes through to effective gross income, and the incidence of property taxes is largely on the owner. Controllable general and

administrative expenses similarly have low pass-through effects, implying net negative net operating income and incidence on the owner.

The results have implications for compensation schemes for asset, portfolio and property managers. Property management contracts are frequently proportional on effective gross income, while asset management contracts are frequently proportional on the gross value of the asset prior to debt.[4] There may be conflict between owner and manager in expense and compensation strategies. If increases in all expense categories raise gross income, but only some raise net income, there is an opportunity to structure management contracts that are incentive-compatible.

Rent and Expense Strategies

The operator, the owner or a manager with delegated authority, has a profit function $\pi(R,Q,X)$ for supplying services per square foot or per unit. The posted rent is R, the quality of amenities Q and the financial condition of the property X. The profit function is increasing and concave in rent and decreasing in amenities Q, or $\partial\pi(R,Q,X)/\partial R \geq 0$ and $\partial\pi(R,Q,X)/\partial Q \leq 0$. Amenities include building and tenant improvements and discretionary expenses. Discretionary expenses to attract and retain tenants include higher costs associated with the frequency and quality of repairs and maintenance, operating overhead and marketing. The financial condition of the property includes its solvency and leverage. Solvency is measured by the debt-coverage ratio, or the net operating income (revenues less operating expenses) divided by debt service. Leverage is either the loan-to-value ratio or debt service cost per unit. An aggressive strategy involves increased expenses and tenant improvements to raise gross rents. Some amenities in Q increase continuing costs of operation. Other amenities are funded up-front as tenant improvements.

Differentiating totally and holding profits constant, $d\pi = \pi_R\, dR + \pi_Q\, dQ = 0$, so $dQ/dR = -\pi_R/\pi_Q \geq 0$ where subscripts denote partial derivatives, and there is a positive trade-off between rents and amenities when the property is operated efficiently. Efficient operators select from isoprofit combinations of high or low rent and amenities. Each π contains combinations of rent and amenities that correspond to a unique hedonic rent $R^*(R,Q,X)$. The efficient choices are along a supply of space $S(R,Q,X) = \partial\pi(R,Q,X)/\partial R$ measured in units such as square footage and fixed in the short run.[5]

Although applicable to any income-producing real estate, the market considered is for rental housing. For tenants, the actual and not the hedonic rent affects the budget constraint. Tenants have an alternative in ownership with return or user cost $g(m,p)$, where m is the mortgage rate including a financial risk premium and capital gains are $p = (P - P_{-1})/P_{-1}$. The price of houses is P, and P_{-1} its lag. Capital market restrictions on down payments and debt coverage lead to an affordability constraint $A = R/P$, the relative price of renting a house as compared to a purchase.[6]

The household decision is:

$$U(R,g,A) = I(H > 0)\ U(R,A) + I(H = 0)\ U(g,A), \quad (1)$$

where I is an indicator variable equal to unity for tenants and zero for owners, U is the indirect utility level and H is the housing consumed during tenancy. For tenants, the conditional demand function for housing is

$$H(R,g,A|H > 0) = -[\partial U(R,g,A)/\partial R]/[\partial U(R,g,A)/\partial A]. \quad (2)$$

The housing demands of renters take into account returns in ownership and the affordability of purchase, as well as the rent R and associated amenities Q they are offered in the rental market.

Lower rents attract households with greater default and other delinquency risk. Positive vacancy allows profit-maximizing operators to hold a walk-up option to rent space to those with high search costs. Therefore R^*, the maximizing rent, is set at a level above where the rental demand $H = S$ the inventory available, though in the short term it can be above or below its long-run equilibrium. The actual vacancy rate is the proportion of notional capacity occupied plus an adjustment rate θ from the previous period, or

$$V(R^*,g,A) = [1 - H(R,g,A)/\pi(R,Q,X)] + \theta V_{-1}. \quad (3)$$

If $\theta = 0$, households satisfy their planned housing demand immediately. Otherwise, for positive θ vacancy drifts and remains above or below trend for persistent periods. The market is summarized in Exhibit 1.

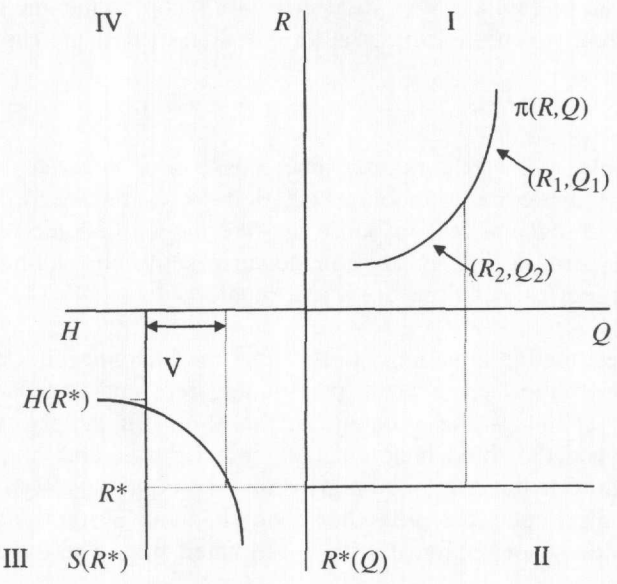
In Quadrant I of Exhibit 1, firms position themselves along the isoprofit contour $\pi(R,Q)$ in the short run. A technological change that reduces operating costs at a given rent shifts π to the northwest in rent-amenity space. An operator selecting a high rent-amenity package is at (R_1, Q_1). Other efficient properties are positioned at lower rent-amenity packages such as (R_2, Q_2).

In Quadrant II, the R^* that summaries the efficient combinations of rent and amenities is horizontal. In Quadrant III, the supply consistent with the efficient hedonic rent is $S(R^*)$. Housing demand is $H(R^*)$ from the utility maximization, and risky tenants and walk-up options cause R^* to be set above market-clearing. In Quadrant IV, posted rents are R, without quality correction for amenities and tenants when rents fall. There is no guarantee of a downward-sloping demand function in actual rent R as opposed to hedonic rent R^*.

Specification

The hedonic rental function is $R = \beta_R + Q\beta_Q + T\beta_T + \varepsilon_R$, with parameters β and ε_R an additive error. If T is a matrix of time variables, the hedonic rent index is $R^* = R^*(\beta_T)$ from the estimated time coefficients. Households cannot observe the hedonic

Exhibit 1
The Real Estate Market



rent $R^*(\beta_T)$, and construct an estimate R^e to use in the vacancy function $V(R^e,g,A,X) = [1 - H(R,g,A)/S(R,Q,X)] + \theta V_{-1} = h(R^e,g,A,X) + \theta V_{-1}$. Households are quoted actual rents R and not hedonic rents R^*, and there are search and transaction costs in obtaining information on offerings in the market. Specifying a first-order linear approximation for h yields the vacancy function:

$$V = \gamma_V + \gamma_R R^e + \gamma_g g + \gamma_A A + X\gamma_X + \theta V_{-1} + \varepsilon_V, \tag{4}$$

where ε_V is an additive error and R^e is the fitted hedonic rent. A downward-sloping demand implies that $\gamma_R > 0$ in the vacancy function, since $\partial H/\partial R < 0$ and H enters V negatively. The fitted vacancy is V^e.

Actual rent growth is $r = (R - R_{-1})/R_{-1}$ or $R = (1 + r_{-1})R_{-1}$. Households expect hedonic and actual rent to grow at the same rate $r^e = \rho r_{-1}$. When rent grows at the expected rate, the vacancy is ν and is in equilibrium. Actual rent increases depend on lagged increases ρr_{-1}, the fraction of the disequilibrium in vacancy covered in the current month at speed λ, or $\lambda(\nu - V^e)$ and the financial condition of the property $X\delta^*$, where δ^* is a parameter. Since financial obligations for debt service are a priority claim on the cash flow, a leveraged property is less able to pursue an expense-increasing strategy to raise rents. Rent growth is $\rho r_{-1} + \lambda(\nu - V^e) + X\delta^*$, and substituting for the fitted vacancy:

$$r = \lambda\nu - \lambda[\gamma_R(1 + r_{-1})R^*_{-1} + \gamma_g g + \gamma_A A + \theta V_{-1}] + \rho r_{-1} + X\delta + \varepsilon_R, \tag{5}$$

with error ε_R, where $\delta = \delta^* - \lambda\gamma_X$.

The autoregression of r provides information about the returns to holding real estate. The total return is the income capitalization rate, the ratio of net operating income to value, plus the rate of capital gains. Rent growth affects the income and capital gains components of returns. The first-order autoregression of rent increases is:

$$a_{-1} = \partial r / \partial r_{-1} = \rho - \lambda \gamma_R R^*_{-1}. \tag{6}$$

Rent increases and real estate returns have positive or negative serial correlation depending on the autocorrelation of expectations ρ, λ the speed of adjustment to equilibrium, γ_R the demand rent response and the lagged hedonic rent R^*_{-1}. Because of the additional term $\lambda \gamma_R R^*_{-1}$, positive or negative serial correlation can occur even when $\rho = 1$ and rent expectations are a martingale.

There are three estimating equations. In the first, the hedonic rent determines supply and the isoprofit frontier, given profit-maximizing rent and expense decisions. The second equation estimates the vacancy at the short-run supply, with households substituting between the fitted hedonic rents and the user cost and affordability of ownership. The third is the rental autoregression with contemporary rent and vacancy. The second and third equations are either a simultaneous system with V endogenous in the rent adjustment, or recursive with V estimated first. The estimating equations are:

$$\begin{aligned}
R &= \beta_R + Q\beta_Q + T\beta_T + \varepsilon_R \qquad \text{(hedonic rent, isoprofit style contour)} \\
V &= \gamma_V + \gamma_R R^e + \gamma_g g + \gamma_A A + X\gamma_X + \theta V_{-1} + \varepsilon_V \qquad \text{(vacancy)} \\
r &= \lambda \nu - \lambda V^e + \rho r_{-1} + X\delta + \varepsilon_R \qquad \text{(rent adjustment)} \\
&= \lambda \nu - \lambda[\gamma_R(1 + r_{-1})R^*_{-1} + \gamma_g g + \gamma_A A + \theta V_{-1}] + \rho r_{-1} + X\delta + \varepsilon_R,
\end{aligned} \tag{7}$$

with R^e and V^e being fitted values.[7]

Data and Empirical Results

Empirical implementation requires controlling for the type of property, market, ownership and overall management that otherwise leads to differences in expense strategies. The data are monthly observations on a portfolio of apartment properties in Portland, Oregon from January, 1987 to December, 1994. The monthly data have high frequency and are consistent with the reporting intervals of property managers. The vacancy and rents are property-specific. There are no rent restrictions, and no tenants receiving rent subsidies such as Section 8 allowances. The properties are either former condominium projects or eligible for conversion having between 20 and 90 units, and some were converted and sold during the sample period. With assets that can and do switch between ownership and rental, the occupants, properties and owners have an effective tenure choice.[8] On-site management differs at the properties but they have the same property, asset and portfolio management. This structure controls for overall strategy while leaving discretion for each property manager to set rents and expenses depending on submarket and property-specific financial conditions.

The rent roll is the total cash collected if all apartments are rented. Total income includes the rent roll and other income from application fees, forfeited deposits, laundry and vending machines. Rent roll and total income are alternative definitions of R. The growth of income is $r = (R - R_{-1})/R_{-1}$. Vacancy V is in economic form, the rental income not collected from units not occupied, plus losses from bad debt, skips and delinquency, expressed as a percentage of the rent roll.

The amenities are in five categories: general and administrative overhead, repairs, capital expenditures, noncontrollable taxes and insurance, and marketing. General and administrative overhead includes on-site staff, property management fees and office expenses. Repairs are noncapitalized expenditures including plumbing, electrical and utilities. Capital expenditures include recurring and nonrecurring items. Recurring items are for appliances, carpeting and turnover costs or tenant improvements such as refurbishing apartments. Nonrecurring expenditures include roof replacement, additions and asphalt resurfacing.

Taxes are for property, occupancy, sales and business registration purposes. Insurance is for liability, fire and general, and specific hazards such as earthquakes and floods. Property taxes dominate the taxes and insurance category. Marketing expenses cover advertising, rent concessions including commissions to locators and cable television costs not billed back to tenants. The five amenity categories q_i, $i = 1,...,5$ for overhead, repairs, capital expenditures, taxes and insurance, and marketing are measured monthly. Rental and total income and expenses for the five amenities are on a square foot basis, to facilitate comparability across properties.

Less liquid and more leveraged properties must use cash flow to service debt, leading to constrained or deferred maintenance, lowering the amenities offered to the tenants. Conversely, more solvent properties have funds available to spend on expenses, increasing amenities and potentially allowing higher rents to be charged. The converse argument is based on free cash flow. A leveraged entity has less free cash flow available for wastage on expense preference, plus has monitoring from the lender.

The financial solvency is the monthly debt coverage ratio of net operating income divided by total debt service. Net operating income is collections less expenses for overhead, repairs, taxes and insurance and marketing. Debt service costs are monthly payments on all mortgage debt. Leverage on a cash flow basis is the monthly mortgage payment per square foot. Other hedonic variables include the age, square footage and number of units. For a tenant, the user cost of ownership is:

$$g = (1 - \tau)(m + \tau_p) + k - p, \tag{8}$$

where m is the mortgage rate, the property tax rate is τ_p and τ is the rate of income taxation. The operating expense rate exclusive of property taxes is k, and capital gains are p. The 30-year fixed mortgage rate m is from the Federal Housing Finance Board of the United States Department of Housing and Urban Development. Maintenance k is presumed to be 2% annually, property taxes τ_p 1.5% annually as a percentage of the property value and the income tax rate is 30%.[9] House prices P are from monthly

transactions in the metropolitan Portland Multiple Listing Service. Capital gains are $p = (P - P_{-1})/P_{-1}$ and households expect the actual gains each month.

Affordability is R/P, the annual unit rent at a given apartment building divided by the average price of a house in Portland that month. When rents are high relative to house prices, a tenant is more likely to purchase. The data capture cross-sectional variation, since at properties with higher rents tenants are more likely to switch to ownership. Sample statistics are in Exhibit 2.

Exhibit 3 reports the hedonic rent equation, where the time and month coefficients summarize the price index. The results indicate a positive expense-rent correlation for three category types: general and administrative overhead, taxes and insurance, and marketing. There is no significant effect for repairs and capital expenditures. The results are similar for the rent roll and total income.

In general, the properties are operating optimally, in that it is not possible to increase expenses or operating scale without reducing profit, as measured by net operating income. Any expense addition at optimal operation should cause net operating income to be nonincreasing, and this condition holds for all expense categories. The only potential exception is for marketing. A one dollar increase in marketing, a discretionary and controllable expense, leads to a dollar recovery in rental income. For the rent roll, the coefficient on marketing expenses is 0.96 and that for total income is 1.10. The implication is that a dollar spent on marketing yields at least a dollar in effective gross income, and positive net operating income.

Exhibit 2
Summary Statistics
Portland Apartments, monthly 1987–94

Variable		Mean	Std Dev.
Rent roll, growth rate (annualized) (%)		7.9	6.2
Total income, growth rate (annualized)	r	8.2	7.0
Scheduled rent ($ per square foot per month)		0.5	0.1
Total income ($ per square foot per month)	R	0.5	0.1
Vacancy rate (%)	V	3.4	3.1
Amenities (expense ratios of total income)			
Overhead: General and administrative (%)	q_1	11.6	4.3
Repairs (%)	q_2	7.8	3.7
Taxes and insurance (%)	q_3	8.8	7.0
Marketing (%)	q_4	1.3	1.3
Capital expenditures (%)	q_5	13.9	13.8
User cost ratio (%)	g	−4.7	4.2
Affordability (annual rent/house price) (%)	R/P	7.1	2.3
Debt coverage ratio (net operating income/debt service)		1.9	1.3
Leverage (debt service/square foot) ($)		0.2	0.1
Age of property (years)		21.8	10.8

Exhibit 3
Rent-Expense Trade-offs

	Rent roll/sq. ft.	Total income/sq. ft.
Expenses/sq. ft.		
Overhead: General and administrative	0.156 (3.2)	0.182 (3.5)
Repairs and operating	−0.017 (−0.3)	0.002 (<0.1)
Capital expenditures	−0.011 (−0.8)	−0.001 (−0.1)
Taxes and insurance	0.112 (2.8)	0.108 (2.6)
Marketing	0.958 (6.1)	1.103 (6.6)
Years		
1987	0.050 (4.7)	0.050 (4.4)
1988	0.078 (7.2)	0.080 (7.0)
1989	0.112 (10.5)	0.117 (10.3)
1990	0.132 (12.4)	0.135 (12.0)
1991	0.176 (16.5)	0.172 (15.8)
1992	0.188 (17.5)	0.189 (16.7)
1993	0.202 (18.9)	0.202 (17.8)
1994	0.232 (23.3)	0.232 (20.2)
Constant	0.353 (28.8)	0.362 (27.9)
R^2	0.879	0.869

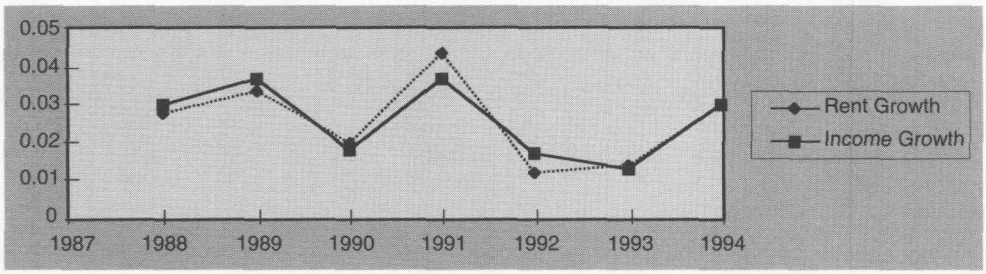
Note: Asymptotic *t*-Statistics in parentheses. ln L for Rent roll/square foot is 2538.9 and for total income/square foot is 2467.7.

By comparison, expenses for taxes and insurance, largely outside of the control and discretion of the property manager, raises rents but the coefficients are smaller than for marketing. A dollar of property taxes leads to only eleven cents more gross rent under both income definitions, and eighty-nine cents less in net operating income. The implication is that property taxes are shifted back to the owner, with the incidence largely avoiding the tenant.

A dollar spent on administration and management expenses leads to a recovery in rental income of between sixteen and eighteen cents. This category is controllable by management, and leads to a reduction in net operating income of between eighty-two and eighty-four cents per dollar spent. These expenses may be a source of friction between nonowning management and ownership, suggesting incentive contracts based on net operating income. The results support rent-expense positioning on an isoprofit contour. Properties have strategies with high rent and expenses, or low rent and expenses. Expenses and gross rents are positively correlated, although there is a difference by type of expense.

The annual hedonic rent index changes, based on the results in Exhibit 3, are in Exhibit 4. Allowing for corrections in quality, rents increase by 3% annually during the sample period, slightly less than the overall increase of the Portland area Consumer Price Index

Exhibit 4
Hedonic Rent and Income Growth



Estimates of the vacancy function are in Exhibit 5. Vacancy depends on the fitted hedonic rent, user cost, affordability, lagged vacancy and the financial condition of the property. Also included are property characteristics and identifying variables. Higher hedonic rents reduce demand for apartments, and at the given short-run supply increase vacancy. The hedonic rent coefficient γ_R of 0.071 is identical for the rent roll and total income, and the demand function is well-behaved and downward sloping. This is an augmented rent-vacancy trade-off, since it includes expenses and implicitly net operating income.

Renters do not respond to the user cost of home ownership in substituting between tenures, with the coefficient γ_g insignificant. They are constrained by affordability through the rent-price ratio. Higher rents relative to the price of houses make rental

Exhibit 5
Vacancy Function

Variable		Rent Roll	Total Income
Constant		−0.026 (−2.4)	−0.027 (−2.4)
Hedonic rent (Fitted)	γ_R	0.071 (3.8)	0.069 (3.9)
Debt coverage ratio (X_1)	γ_1	−0.001 (−1.3)	−0.001 (−1.3)
Leverage (X_2)	γ_2	−0.042 (−1.8)	−0.038 (−1.6)
User cost ratio (g)	γ_g	0.002 (0.9)	0.002 (0.9)
Affordability (R/P)	γ_A	0.027 (3.1)	0.026 (3.0)
Vacancy lagged (V_{-1})	θ	0.313 (11.3)	0.312 (11.3)
Year			
1987		0.009 (2.4)	0.023 (2.4)
1988		0.013 (1.4)	0.014 (1.5)
1989		0.009 (0.7)	0.009 (0.9)
1990		0.007 (0.7)	0.007 (0.7)
1991		0.012 (1.2)	0.012 (1.2)
1992		0.005 (0.5)	0.006 (0.6)
1993		0.010 (1.0)	0.010 (1.0)
1994		0.012 (1.2)	0.013 (1.2)

Note: Asymptotic *t*-Statistics in parentheses.

less affordable, leading vacancy rates to rise. Conversely, if house prices increase relative to rents, home ownership is less affordable, rental demand rises and vacancy falls. This qualitative conclusion is borne out, where the rent-price ratio coefficient γ_A for affordability is 0.027 for the rent roll and 0.026 for total income.

There is sluggishness in vacancy adjustment V_{-1}, with a lagged coefficient θ of 0.31 for both specifications. Tenants are constrained by affordability, and in the short run are not able to take advantage of favorable user costs and returns. Regarding the financial condition of the property, the debt-coverage ratio coefficient γ_1 is not significant. Vacancy is decreasing in leverage with the coefficient γ_2 negative. Leveraged properties are under more pressure to generate revenue and cash flow to pay for debt service, so the manager has a higher cost of carry on the vacancy option.

Estimates for the rent increase function are in Exhibit 6. The vacancy coefficient λ in the rent growth equation is -0.755 for the rent roll, and -0.748 for total income. From these estimates of the adjustment coefficient, about three-quarters of the disequilibrium in pricing is covered within a month. The equilibrium vacancy rate is 0.02/0.75 or 3% for each specification. Among the financial variables, the debt-coverage ratio is significant, with a coefficient of 0.004. More solvent properties have cash flow from net operating income available to fund expenses, leading to rent increases. Leverage has no effect on rent increases.

The first-order autoregression in rents is $a_{-1} = \partial r/\partial r_{-1} = \rho - \lambda\gamma_R R^*_{-1}$. Normalizing the hedonic rent index at unity and using the estimates for ρ, λ and γ_R, a_{-1} (rent) =

Exhibit 6
Rent Adjustment

Variable		Rent Roll	Total Income
Constant	$\lambda\nu$	0.025 (2.3)	0.025 (2.3)
Expected vacancy (Fitted) (R^e)	λ	−0.739 (−6.2)	−0.736 (−6.2)
Rent growth lagged (r_{-1})	ρ	−0.280 (−9.8)	−0.280 (−9.8)
Financial			
Debt coverage ratio (X_1)		0.004 (2.8)	0.004 (2.8)
Leverage (X_2)		0.028 (0.7)	0.028 (0.7)
Year			
1987		0.033 (1.9)	0.033 (1.9)
1988		0.022 (1.3)	0.022 (1.3)
1989		0.018 (1.1)	0.018 (1.1)
1990		0.017 (0.7)	0.017 (1.1)
1991		0.020 (1.2)	0.020 (1.2)
1992		0.011 (0.6)	0.010 (0.6)
1993		0.013 (0.8)	0.013 (0.8)
1994		0.027 (1.6)	0.027 (1.6)
R^2		0.16	0.16

Note: Asymptotic *t*-Statistics in parentheses. ln L for Rent Roll is 1989.8 and 1989.7 for Total Income.

$-0.277 - (-0.755 * 0.056) = -0.277 + 0.042 = -0.235 < 0$, and a_{-1} (income) is similar. Rent increases have a short-term negative autocorrelation.

Managerial Strategy

The properties have outside management paid proportionately at rate φ on gross income collected. For apartment properties, the prevailing rate runs between 4% and 5% of collections, but can be as low as 2% on large properties or as high as 10% on small duplexes. Total income received by the manager on the gross rent contract is:

$$\begin{aligned} Y_M &= \varphi(1 - V)R \\ &= \varphi(1 - \gamma_V + \gamma_R(\beta_R + Q\beta_Q) + \gamma_g g + \gamma_A A + X\gamma_X + \theta V_{-1})[\beta_R + Q\beta_Q], \end{aligned} \quad (9)$$

given the amenity strategy Q and substituting for equilibrium conditions in vacancy and rent. If the manager is paid proportionately at rate φ(net) on net rent, which does not apply to any of the properties in the sample, the return to the manager is $[1 - \varphi(\text{net})](1 - V)R - Qe]$, where e is the unit vector. If expenses increase to position a property further up the isoprofit frontier, the marginal return to the manager is:

$$\partial Y_M/\partial Q = \varphi(1 - \gamma_V + \gamma_R(\beta_R + 2Q\beta_Q) + \gamma_g g + X\gamma_X + \gamma_A \mathrm{A} + \theta V_{-1})\beta_Q. \quad (10)$$

The owner receives the income remaining after the manager's action. Net returns to the owner are:

$$\begin{aligned} Y_o &= [1 - \varphi](1 - V)R - Qe \\ &= [1 - \varphi](1 - \gamma_V + \gamma_R(\beta_R + Q\beta_Q) + \gamma_g g + \gamma_A A + X\gamma_X + \theta V_{-1}) \\ &\quad \times [\beta_R + Q\beta_Q] - Qe, \end{aligned} \quad (11)$$

if the property or asset manager is on a gross rent contract. This net income to the owner is in equilibrium, after optimal choices of rent and vacancy by households, selection of the operating strategy on expenses and rent by the manager, and given the technology of production. The marginal return to the owner from the expense actions of the manager is:

$$\partial Y_o/\partial Q = (1 - \varphi)(1 - \gamma_V + \gamma_R(\beta_R + 2Q\beta_Q) + \gamma_g g + X\gamma_X + \gamma_A A + \theta V_{-1})\beta_Q - 1. \quad (12)$$

When $\partial Y_o/\partial Q$ is negative, an expense-increasing strategy produces net reductions in net operating income in equilibrium. For a positive derivative $\partial Y_o/\partial Q$, an expense strategy generates increasing net operating income. The compensation of the manager and owner, if different parties, from a given expense strategy is in Exhibit 7.

The three expense categories are controllable marketing, controllable administrative expenses, and largely noncontrollable taxes and insurance. The first line in each block

Exhibit 7
Managerial and Owner Compensation

	Controllable: Marketing	Controllable: General and Administrative	Noncontrollable: Taxes and Insurance
Panel A: Rent Roll			
Manager income base: $(1 - \gamma_V + \gamma_R(\beta_R + 2Q\beta_Q) + \gamma_g g + X\gamma_X + \gamma_A A + \theta V_{-1})\beta_Q$	1.011	0.165	0.115
Manager compensation (10): $\partial Y_M/\partial Q = \varphi(1 - \gamma_V + \gamma_R(\beta_R + 2Q\beta_Q) + \gamma_g g + X\gamma_X + \gamma_A A + \theta V_{-1})\beta_Q$ $\varphi = 0.04$	0.040	0.007	0.005
Owner compensation (12): $\partial Y_o/\partial Q = (1 - \varphi)(1 - \gamma_V + \gamma_R(\beta_R + 2Q\beta_Q) + \gamma_g g + X\gamma_X + \gamma_A A + \theta V_{-1})\beta_Q - 1$	−0.030	−0.842	−0.815
Panel B: Total Income			
Manager income base: $(1 - \gamma_V + \gamma_R(\beta_R + 2Q\beta_Q) + \gamma_g g + X\gamma_X + \gamma_A A + \theta V_{-1})\beta_Q$	1.164	0.192	0.111
Manager compensation (10): $\partial Y_M/\partial Q = \varphi(1 - \gamma_V + \gamma_R(\beta_R + 2Q\beta_Q) + \gamma_g g + X\gamma_X + \gamma_A A + \theta V_{-1})\beta_Q$ $\varphi = 0.04$	0.046	0.008	0.004
Owner compensation (12): $\partial Y_o/\partial Q = (1 - \varphi)(1 - \gamma_V + \gamma_R(\beta_R + 2Q\beta_Q) + \gamma_g g + X\gamma_X + \gamma_A A + \theta V_{-1})\beta_Q - 1$	0.118	−0.815	−0.893

Note: Compensation is dollars of revenue per dollar of expense.

of Exhibit 7 is the income base from a given change in expenses after taking account of household demand, financial conditions and market optimization. A dollar increase in marketing costs causes total revenue to increase by $1.01 on the rent roll and $1.16 in total income collected. For administrative expenses, the total revenue increases are 16.5 and 19.2 cents, less than a dollar. Noncontrollable taxes and insurance generate 11 cents more income per dollar of expenses.

On this managerial income base, the manager's share following Equation (10) is reported at a 4% management fee. The manager receives positive income from all expense strategies on marketing, taxes and administration, as indicated by the second lines. The consequence is that the manager has incentives to increase expenses. The owner suffers a net income loss under most of these strategies. With property taxes largely having an incidence on the owner, each additional dollar in equilibrium costs between eighty-one and eighty-nine cents in lower net operating income.

General and administrative expenses are similarly costly to the owner. The one category that benefits owners is marketing expenses. For total income, the owner receives an additional twelve cents in net operating income from a dollar spent on marketing.

The incidence of property taxes on apartments, including the tenants' substitution and affordability across tenure choices, falls mostly on the owners of the property. Owners bear between eighty and ninety cents per dollar of property taxes. Administrative and managerial expenses are paid to outside third-party firms who also benefit from additional revenues. This incentive issue may explain why the property results confirm the negative correlation between administrative expenses and returns at the firm level. Higher administrative expenses produce increased gross rent, even if net rent is not increased.

Conclusion

The application is to apartment markets, where short-term leases allow flexibility in rents and prices. The model is likely to be more applicable to other real estate markets such as for office and industrial space. There, long-term leases create overlapping contracts, rigidity in relocation and difficulty in using rental adjustments. Adjacent and comparable tenants can be paying different rents. Tenant improvements, concessions and renegotiation, as well as amenities are part of the negotiated package in office and industrial markets, where a hedonic rent and expense positioning are involved.

The results are for a sample with a common fee structure in property and asset management. In the observed real estate market there is a plethora of management compensation contracts. Managers are paid on gross rents, net rents, assets under management, operational fee recovery, fees for acquisition or incentive fees above a preferred return including or excluding initial capital. These contractual obligations influence the performance of a property and the strategy of a manager in positioning along the expense-rent frontier. The isoprofit positioning can be applied not only to other property types and markets, but to other contracts for compensating managers.

Notes

[1]Lower rents lead to an adverse selection of tenants, and there is a moral hazard from the risk of lower care and increased damage. The adverse selection and moral hazard are described by Stiglitz and Weiss (1981) in the loan market. Benjamin, de la Torre and Musumeci (1995) suggest contracting in leases to reduce the perverse incentives that occur in market operation, as noted by Muth (1960).

[2]The adjustment process in real estate markets for rental housing is developed in Eubank and Sirmans (1979) and Smith and Rosen (1983), with an overall structure in DiPasquale and Wheaton (1992).

[3]In single-family housing there is positive autocorrelation in excess returns over relatively short time periods, with mean-reversion over longer periods, as in Case and Shiller (1989) and Cutler, Poterba and Summers (1991).

[4]In the apartment sector, MIG Realty Advisors has a benchmark contract based on net operating income, and Prudential uses a variety of contracts including NOI. Contracts can provide that capital expenses and nonrecurring operating expenses do not enter net operating income.

[5]The prevailing π describes the array of efficient operators, positioned at various rent-amenity packages. Inefficient operators are on a π below, or to the right of the prevailing level. Transaction costs for entry and exit may keep these operators in the industry even in the long-run, but the market supply will predominantly be determined by the prevailing profit contour.

[6]Downpayment floors on single-family houses range between 1.25% on loans with direct federal guarantees to between 3% and 5% for those conforming at government-sponsored enterprises. Debt service ratios have caps at between 28% and 33% of before-tax income.

[7]As fitted values, the R^e and V^e have errors which are transmitted to the estimating equations for V and r. These errors may lead to a overstatement of the t-Statistics. The estimated significance levels in estimated results appear to be sufficient to overcome this issue.

[8]These properties are therefore candidates for purchase by the tenant considering a tenure switch from rental to ownership. The data adjust for any difference in the quality of property between ownership and rental. For the operator, when interest rates fall, households choose to buy condominiums rather than renting them, reducing net operating income from this type of rental property. Over 90% of commercial properties have mortgages with prepayment penalties (Hughes, 1995) including those in the sample. A decline in interest rates increases the prepayment penalty, a financial liability associated with the mortgage contract. An offset is the eventual decline in capitalization rates as rates fall.

[9]Property tax rates were reduced in Oregon in a phased program during 1992–95 as a consequence of an initiative, Measure 5. The capitalization of the benefits is accounted for by having a monthly series on house prices. The other supply-side policy measure that affected house prices during the sample period was the imposition of a greenbelt, the Urban Growth Boundary, restricting development outside the loop and raising house prices inside it.

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