Determinants of Operating Costs of Multifamily Rental Housing

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Abstract

Operating costs are an important, but not much studied, component of apartment financial performance. This paper establishes an economic framework for interpreting operating costs and uses a unique data set to investigate the determinants of operating costs. Empirical results are consistent with theory and indicated that housing quality is a strong driver of operating costs; older properties must incur more expense to achieve a level of housing quality; economies of scale in property operations are significant but top out at around 200 apartments; and a property's operating expense/rent ratio Is influenced by local area input costs and short run apartment market fluctuations. The paper concludes with a discussion of some implications for affordable housing policy.

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Real estate economists spend a lot of time analyzing rents, property values, mortgage flows and pricing, and construction costs. This is the case for all income property types, including apartments.

But we researchers do not pay much attention to the operating costs of these properties. There seem to be at least two reasons. First, operating costs are not as exciting as some other financial variables in real estate. Operating costs generally are not highly volatile, and property owners and managers have limited control over some of these costs. Second, real estate operating costs are not as visible as some other financial variables in real estate. Although several surveys of apartment operating costs are available, they are annual compendia, in contrast to the quarterly, monthly, or even daily readings available on other real estate financial variables.

Despite this lack of attention, the importance of operating costs for a property's financial performance is unquestionable. Over a building's life cycle operating costs can rival the capital costs of building it. This can be illustrated by a simple example using realistic values. An apartment property with a total development cost, and market value at time of construction, of $1 million would be expected, at an 8 percent capitalization rate and an operating expense ratio (operating expense/rental revenue) of 40 percent, to have rental annual revenue of roughly $140 thousand and operating expense or cost of roughly $60 thousand.[1] Capitalizing the operating cost, again at an 8 percent rate, results in a present value of $750 thousand, or three-quarters of the original development cost.

The softness of apartment rents since 2000 has put added pressure on operating cost reductions as a way of boosting, or at least maintaining, net operating income. Operating costs have also been spotlighted by recent hikes in utility costs, property tax bills, and insurance premia in some jurisdictions, and by mold eradication efforts nationwide.

The purpose of this paper is to shed new light on operating costs of multifamily rental housing, also referred to here as apartments. The specific contributions are to establish an economic framework for interpreting operating costs and their

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[1] Total development cost includes all "hard" construction costs for labor and materials, "soft" costs of professional fees and development taxes, interest on construction loans, and the cost of purchasing and improving the land. The capitalization rate is defined as net operating income divided by property value, and net operating income is defined as rental revenue less operating expense.

determinants, and then to employ a unique data set to empirically estimate those determinants.

Previous Research

Most of the analysis of apartment operating costs has been applied. The nation's largest apartment REITs, as publicly traded companies, release considerable information about operating costs at their properties. To cite just one recent example, Archstone-Smith in its 2003Q2 quarterly release, presents data on its operating costs by local market and property type and on cost changes from a year earlier.[2]

Another applied research use of operating cost information is by architects and engineers, who investigate operating costs in making their building design decisions. Life cycle cost analysis calibrates the tradeoffs between construction costs and maintenance costs, with the goal being the minimization of total costs over the expected life of the property. One of the most obvious tradeoffs requiring life cycle analysis is between insulation costs at time of construction and energy costs for heating and air conditioning over the life of the building.

Real estate trade groups have long been active in collecting and disseminating data on operating income and expense at apartment properties. The National Apartment Association, Institute of Real Estate Management, and Urban Land Institute all conduct annual surveys. Results of these surveys are widely used by apartment owners and managers in benchmarking their own properties' performance. The figures are reasonably current and the publications group results by local market and property type, facilitating peer group comparisons. While very useful for that purpose, these annual compendia have not typically been used for more analytic work, one reason being that the income and expense data for individual properties have not generally been released. Thanks to the National Apartment Association, this study is able to analyze property level information, enabling multivariate analysis not possible with the grouped data.

In addition to these applications by industry, government also has interest in the operating costs of multifamily rental housing. In public housing and government assisted privately owned housing, tax revenues are used either directly or indirectly to defray operating deficits. Reductions in operating costs therefore can reduce the claims on public funds. Operating costs of public housing have been a focus of housing policy analysts for more than thirty years, with several efforts fielded over the years to devise better methods of compensating local public housing authorities for costs over which they have no control while not rewarding inefficient management. Most recently, a research team was charged by the U.S. Congress with answering the question: "What should it cost to

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2 See http://www.archstonesmith.com/investors/pdf/ASN%202Q%2003%20Earnings.pdf

administer good quality public housing?" The Public Housing Operating Cost Study, or PHOCS, included an extensive econometric analysis of operating costs at multifamily properties with FHA-insured mortgages (Graduate School of Design, 2003). We will return to results of that study later.

Policy interest in operating costs extends well beyond public housing, however. Operating costs are important for preservation of the affordable stock of rental housing – both government assisted and purely private unassisted "market rate" properties. Operating costs in excess of rental revenues can lead to property abandonment or to "repositioning" of the property through renovations or redevelopment that bring it into a higher rent bracket.

This broad policy interest in operating costs was one motivation behind HUD's support for the 1995-1996 Property Owners and Managers Survey (POMS), conducted under contract to HUD by the U.S. Census Bureau. Like the FHA data used for the PHOCS study, the POMS data are available at the property level,[3] enabling multivariate analysis. Other strengths include the availability in POMS of a variety of variables describing property operations, residents, and financing. Among the drawbacks of POMS are its lack of geographic coding other than region, its moderate sample size (about 5700 units), which restricts subsampling and multivariate analysis, and its age (the financial data refer to 1994 or 1995). The biggest drawback of the POMS, however, is the uncertain accuracy of responses. In addition to high levels of non-response, it is unclear if the respondent was always informed on the questions being asked. The POMS questions on operating costs are particularly suspect on these grounds.

Academic research on operating costs of apartment properties is practically nonexistent. When operating costs do appear in scholarly studies, it is usually as an independent variable in investigations of some other outcome. In particular, some studies of multifamily mortgage loan default use operating costs is as an input to net operating income which in turn is a trigger for mortgage default (e.g., Goldberg and Capone, 2002).

An Economic Framework

Operating costs first enter into apartment decision making as a developer is deciding what to build on a particular site. As illustrated below in Exhibit 1, the rent that can be commanded for apartments depends on their quality. Quality here is a single-dimensional summary measure of the physical and service

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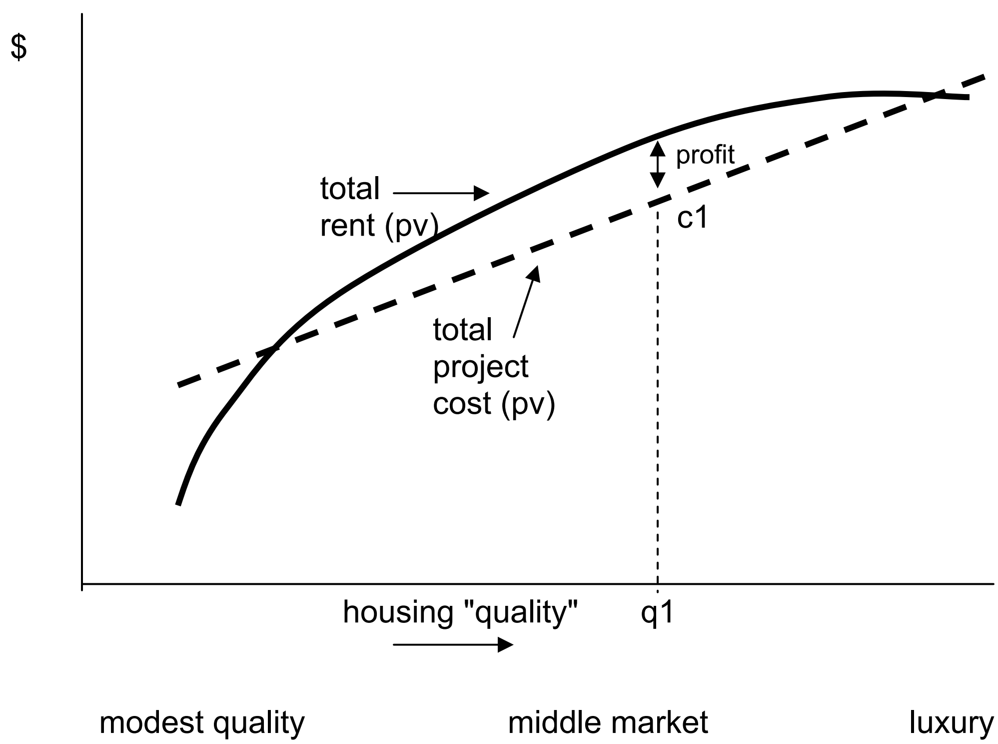
[3] Technically, the unit of analysis in POMS is the housing unit, rather than the building or property. But many of the questions in the survey pertain to the property, and through use of appropriate weights, the survey results can be made representative of either all rental housing units or all rental properties.

attributes of an apartment and the property in which it is located. Market rent will go up with quality, but the level of rent and its sensitivity to quality depend both on the location and the time period. Rent is shown in the chart as the present value of the expected rental revenue over the life of the property, as forecasted at the time of the development decision.

Also shown in the exhibit is the total cost of providing housing of different quality levels, again at that location and as of a specified time period. The total cost is the sum of the development cost (as defined earlier) and the present value of operating costs over the expected life of the property. Like rent, total cost depends on both location and time.

Exhibit 1: New Construction: Developer’s Quality Decision



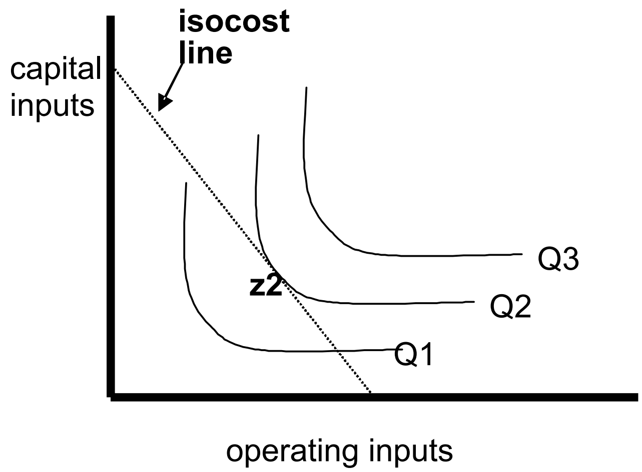
The developer chooses a quality level, usually referred to as a “price point,” at which to build a property so as to maximize the difference between total revenue and total cost. For simplicity, we assume here that it is the absolute difference that is maximized, although rate of return maximization might call for selecting the quality level at which the percentage difference between revenue and cost is maximized. In the example in Exhibit 1, that quality level is indicated by q1. Again, the profit maximizing quality level will depend on both place and time. At many locations, there will be no quality level at which revenue exceeds cost, and consequently apartments are not built there. At others, a non-apartment use offers a greater return and will be built to that use. And at others, apartment development is prohibited by local zoning.

Although not featured in this framework, another dimension of decision making by developers, in addition to property quality, is property size – how many apartments to build. Constrained only by the zoning ordinance, developers can decide how dense or tall to build on any site. Both rental revenue and total costs will increase with property size, and the developer presumably will attempt to build to a density that maximizes the difference. One might think of a version of Exhibit 1 in which total number of apartments, rather than quality level, is on the horizontal axis. Because demand at any one site is less than infinite, the total revenue line should be concave to the x axis, reflecting diminishing marginal revenue to additional units. Furthermore, the engineering complexities of adding to density and building height imply that, beyond some density, the marginal cost of additional units will increase and the total cost curve will be convex. In any case, our framework assumes that the property is built to a profit-maximizing density.

Once the quality level of the housing is decided, cost minimization requires that the developer evaluate the tradeoff between capital inputs and operating (or service/maintenance) inputs. One tradeoff mentioned already is between insulation and utility expenses. Another is between automated security systems installed during construction or labor costs of on-site staff over the life of the project. Another is between durable construction materials and less expensive materials requiring additional maintenance over the property's life.

These tradeoffs can be illustrated by a simple Econ 101 production possibilities chart, shown in Exhibit 2. The "isoquants" labeled Q1 through Q3 represent increasing levels of housing quality. These levels can be attained by various combinations of capital and operating inputs, as determined by the production technology at the time of development. Having already decided that the profit maximizing level of quality at which to build is level "Q2" in this chart, the developer must now decide on the cost minimizing combination of capital and operating inputs for achieving that quality level. This is the level represented by point c1 back in Exhibit 1.

Exhibit 2: Cost-Minimizing Production of Housing Quality



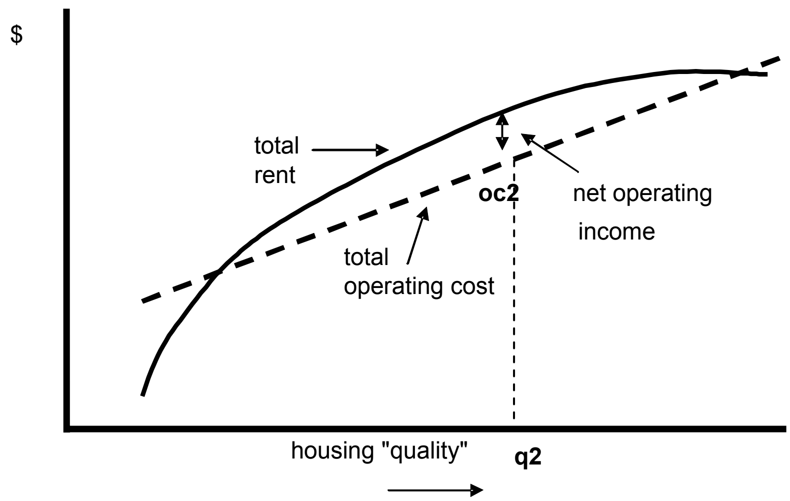
The cost minimizing combination of capital and operating inputs will be determined by both their relative prices and by the production technology, as reflected in the shape of the isoquants. As drawn, the isoquants are fairly sharply angled to reflect the limited opportunities for substituting capital and operating inputs in achieving a quality level. I offer no proof that this is the relevant technology, but it seems intuitively true. Referring back to Exhibit 1, the developer must decide what combination will allow the cost minimizing level c1 to be achieved. The relative input costs for capital and operations determines the slope of the isocost line in Exhibit 2, representing the combinations of inputs of equal total cost. With the technology implied by these isoquants, similar combinations will be the cost minimizing selections for a wide range of relative input prices. In this example, the cost-minimizing combination is z2, which is the combination that results in c1 in Exhibit 1.

All the decisions discussed so far have to be made at the time of project development. Over the life of the property, the market may evolve in ways not anticipated at the outset. Market rents may not follow the expected course. Operating costs and technologies might also change in unexpected ways. For these reasons, property owners and managers need to periodically re-assess the level of quality that is being provided by a property and whether that is the profit-maximizing level. Even though the capital inputs are fixed, adjustments can be made to operating inputs to alter the quality level.

The quality setting decision of owners of existing properties is illustrated by Exhibit 3, a revised version of Exhibit 1 in which only the labeling and the calibration are changed. For ongoing operations of existing properties, the distinction between current values of revenues and expenses, and their present value equivalents, is not as important as at the time of project development.

Therefore the rents and costs in Exhibit 3 are for the current period rather than present values. The decision problem is, for a given structure and location, to set the level of operating inputs at a level that maximizes net operating income.

3: Existing Properties: the Owner's Quality Decision



These operating inputs have costs. The level of some inputs, and their associated costs, are not much within the control of the property owner: property taxes and insurance are examples. But other operating inputs, with implications for housing quality, are adjustable. Examples here include the maintenance levels of the buildings and grounds, and service amenities requiring additional staffing at the property. Even utilities expenses are to some extent adjustable, as the owner can decide on the amount of heating, air conditioning, and lighting to use in the properties common areas.

Based on this theoretical discussion, and with an eye toward empirical testing, what can be said about the determinants of apartment operating costs? Here is a proposed list:

1. the quality of housing that the owner targets to provide;

2. the production technology – the combinations of capital and operating inputs used to produce housing quality at individual properties;

3. the local costs of the operating inputs required to provide the target level;

4. economies of scale in property operations; and

5. efficiency of operations; how close does the property come to producing the target level of quality at the lowest possible cost? Inefficient operations would be characterized by costs above point oc2 in Exhibit 3, or for costs at level oc2 but quality below level q2.

Data

The data for this study come from the National Apartment Association's annual survey of income and expenses in rental apartment communities. This study uses the data for 1999, collected by the NAA during 2000. Importantly, the NAA granted the author access to the individual survey responses, after the NAA removed addresses and other identifying characteristics and established other confidentiality safeguards. These micro data permit multivariate analysis not previously possible.

The NAA data have several strengths for this study. First, it is a relatively homogenous sample of properties from the largest segment of the nation's apartment stock: "market-rate" low-rise (1-3 stories) apartment communities, most of which are "garden" apartments on campuses of multiple structures. There are 2,133 properties of this type in the NAA sample, with a total of approximately 580 thousand apartments. Also included in the NAA data base but not used in this study are 838 properties that are high-rises or government subsidized. The former are excluded because of different operating costs attributes associated with elevators and close-in locations. The latter are excluded because government regulations impose certain constraints on operations and can alter owner/manager incentives.

Three other strengths of the data deserve mention. One is the probable accuracy of the information. As part of an annual survey in which the same questions are asked of many of the same respondents from year to year, the NAA survey should avoid many of the reporting errors that might otherwise be encountered. Another strength is the detailed cost information, which allows for investigation of the determinants of individual components of operating costs. A third feature is the survey's large number of data providers. More than 25 different ownership entities provided data to the NAA, which assures that a range of management styles and performances is represented in the sample.

Despite these strengths, the NAA data is not without limitations. In particular, the survey does not provide a probability sample of the U.S. apartment stock. All major apartment owners and managers were invited to participate in the survey, and all who did so are included. No sampling weights are applied to the results. For this reason, the sample cannot support definitive statements about, for example, the average U.S. apartment property. However, the sample can support statistical explorations of the relationships among variables at individual properties, the focus of this study. For example, as long as the properties in the sample that were built in the 1990s are not atypical of all market rate properties built in the 1990s, we can use the sample to examine the relationship between property size and operating costs among properties built in that decade.

Descriptive Statistics

In some respects the NAA sample resembles the national stock of market-rate low-rise apartment properties, and in others it does not. Exhibit 4 provides summary descriptive statistics on the sample, compared with those from a subsample of rental apartments from the 1999 American Housing Survey. The time periods match up, and the units shown for the AHS were chosen to approximate the market-rate, low-rise selection of the NAA subsample used in this study. According to the AHS, there were 8.4 million occupied apartments of this type in 1999, suggesting that the NAA sample includes approximately 7 percent of the national total.

The NAA matches up fairly closely with the national stock of market-rate in median rent. However, this seems to result from the NAA sample having a relatively high representation of above-average quality apartments in below-average priced markets. As shown, the NAA apartments are much newer than the national average, and housing quality is at least loosely correlated with structure age. But these new apartments are found disproportionately in the South, where rents tend to be lower than the national average.[4] NAA's survey participants tend to be large institutional investors and their property management firms, and these organizations prefer newer product in large metro areas, and this accounts for much of the difference.

In addition to property age and locations, the NAA properties are distinguished from the national averages in resident turnover. The NAA properties report relatively high turnover, although this might be partly a definitional difference.[5] Turnover is an important statistic for operating costs, because of the need for maintenance between tenancies.

[4] As estimated by the 1999 AHS, the median contract rent for low-rise market rate apartments in each region was: Northeast, $586; Midwest, $495; South, $533; and West, $615.

[5] Apartments that turnover twice in 12 months are recorded as two moves in the NAA data, and some properties report more than 100% turnover. In the AHS, turnover is defined as the percent of occupied apartments in which the residents moved in during the previous 12 months; it cannot exceed 100%.

Exhibit 4: Comparison of NAA and AHS Estimates for 1999
(for market-rate apartments in structures of less than four floors)

	NAA	AHS
Median Monthly Rent	$582	$550
Unit Size		
Mean Bedrooms	n/a	1.6
Avg. Square Feet	880	n/a
Median Units in Property	246	9*
Annual Unit Turnover	64%	47%
Regional Distribution (%)		
Northeast	12	12
Midwest	3	20
South	64	37
West	21	31
Top Six Metro Areas (% of sample units)	Atlanta 8%	Los Angeles 6%
	Houston 8%	Dallas 3%
	Dallas 6%	Houston 3%
	Phoenix 5%	Chicago 3%
	Ft Worth 3%	San Diego 2%
	Wash., DC 3%	Orange Co. 2%
Decade of Construction (%)		
pre-1970	8	34
1970s	23	28
1980s	54	26
1990s	15	12

* author's estimate, for all privately owned apartments in structures of 5+ units, derived from the 1995-96 Property Owners and Manager's Survey
notes: percentage statistics refer to properties in NAA sample and apartments in the AHS sample; AHS figures are for renter occupied unsubsidized units in buildings of five or more units and three or fewer floors.

Details on the operating costs of the NAA sample are shown in Exhibit 5.

Exhibit 5: Income and Expense Estimates for 1999 from the NAA Survey
(n= 2,133; figures are for market rate apartments in structures of 1 to 3 floors)

	mean	median	std. dev.	minimum	maximum
Residential Rental Revenue					
per unit per month ($)	608	582	175	242	2194
Operating Expense					
per unit per month ($)	252	243	64	79	762
Component Costs ($ per unit per month)					
salaries	63	62	18	0	285
insurance	7	6	4	0	81
taxes	56	51	31	1	312
utilities	36	34	18	0	236
management fee	24	25	12	0	153
administrative	12	10	13	0	275
marketing	12	11	7	0	90
contract services	21	19	10	0	111
repair/maintenance	21	18	14	1	159
Capital Expenditures					
($ per unit per month)	46	36	45	0	482

source: author's tabulations of data from the National Apartment Association

The cost components refer to costs paid by the property and sum to the total shown. Expenses are assigned to categories by respondents, based on guidance in the questionnaire. The three largest components are salaries, taxes, and utilities, and taxes are the most variable of the components. Salaries are for on-site personnel and include benefits. Insurance is property hazard and liability coverage. Taxes are for real estate and personal property only. Administrative costs are for telephone, materials, and other office expenses. Contract services are landscaping, trash removal, and similar functions generally supplied by vendors. Repair/maintenance includes cleaning, painting, plumbing, and electrical, but excludes non-recurring capital expenditures, which are reported separately and not included in operating costs.

Properties with high per unit expenses in some cost categories tend to have high costs in other categories, as shown in Exhibit 6. Salaries in particular tend to correlate with other components. However, other cost categories are essentially uncorrelated. The slightly negative correlation between management fees and administrative expenses may indicate that these are alternatives; the property can either hire a management company or incur the administrative costs directly.

Exhibit 6: Correlations Among Components of Operating Costs

Highest Pairs	Lowest Pairs
salaries/marketing (r = .37)	taxes/utilities (r=-.08)
management/contracts (.30)	management/administative (-.04)
salaries/management (.29)	taxes/administrative (.00)
salaries/contracts (.29)	insurance/marketing (.02)
salaries/repairs (.28)	repair/administrative (.03)

Source: author's tabulations of data from the NAA for market-rate low-rise properties

Determinants

The approach here for modeling the determinants of operating costs is to regress a property's operating costs on several property and market characteristics that the framework suggests should influence those costs.

As explained earlier, the target level of quality of housing is a key determinant of operating costs of apartment properties. But how to measure housing quality? As a first approximation, rent is a reasonable indicator. It has the advantage of being a single-dimensional summary of the market's valuation of all the physical, service, and locational attributes of an apartment.

Rent is, however, only an imperfect indicator of quality. Even at a particular site and time, the quality/rent relationship is not linear, as illustrated in Exhibits 1 and 3. Other imperfections are more subtle, notably the distinction between observed rents and long-run equilibrium rents. In long-run equilibrium, rent would equal the marginal long-run user cost of providing the housing. In that instance, the rent of an apartment would be the cost of providing housing that was valued enough by consumers for that quality of apartment to be found in the market. But rents in the short run can diverge significantly from their long-run equilibrium, as demand fluctuations in particular can push rents way above or way below long-run user costs.

Price differences across local markets are another source of error in using rent as a measure of housing quality. Rents in Boston average 65 percent higher than those of Bangor, but that does not mean that rental housing in Boston is 65 percent better than that in Bangor.

To the extent that rent differences across properties in a national sample reflect general cost/price differences across markets, a regression of property operating costs on property rents should be self-correcting. But other market-specific influences will affect the operating cost/rent relationship as well, including short-run market disequilibrium and market differences in the relative costs of capital and operating inputs. Because no direct measures of these market-specific differences are available, we use dummy variables as shift factors to approximate the net market influence on operating costs.

In addition to housing quality, two other property specific variables would be expected to influence operating costs: year of construction and economies of scale. A property's vintage influences the technology of construction and, through mere aging, the requirements for maintenance and repair. Newer buildings should have lower operating costs because of both improved technology and reduced current maintenance needs.

Economies of scale would be expected to influence some of the cost components. If, for example, three on-site staff are required for properties with 200 to 400 units, the salary component of costs should be lower, per apartment, for properties with 350 units than for those with 250 units. Similarly, regarding marketing expense, the cost of a newspaper ad is the same for properties with 500 apartments as for properties with 200 apartments. Other cost components, including property tax and repair expenses, might not yield economies of scale.

In the model estimation, the dependent variable, operating costs, is expressed in logarithms, because unit changes in most of the independent variables are expected to cause percentage changes in costs rather than fixed dollar increments. Most of the independent variables are specified as categorical "dummy" variables to allow for non-linear influences on operating costs. Rent, however, is expressed in logs, and its coefficient gives the estimated percentage change in costs associated with a one percent change in rent. These functional form selections are consistent with standard practice.

Results

The model results for total operating costs are shown in Exhibit 7. The first model includes only rent as a predictor, the second adds physical structural characteristics, and the third adds locational identifiers. The adjusted R-square statistics at the bottom of the exhibit show that both structural characteristics and locations add explanatory power beyond that provided by rent alone.

The results for model 3, including all the predictors, are the most meaningful. They indicate that operating costs increase less than proportionally with housing quality. The coefficient on rent in this specification implies that a one percent increase in rent (or quality) is associated with a 0.66 percent increase in operating costs. Vintage matters as well. Properties built since 1980 cost at least 10 percent less to operate than properties built before 1970.[6]

Exhibit 7: Regression Results for total Operating Costs
Dependent Variable: Log(Operating Costs per Unit per Month)

	Specification #		
Independent Variable	One	Two	Three
Log(Rent per Unit per Month)	0.61**	0.64**	0.66**
Decade of Construction			
(omitted=pre 1970 [176])			
1970s [501]		-0.071**	-.064**
1980s [1154]		-0.127**	-0.131**
1990s [302]		-0.108**	-.112**
Property Size			
(omitted = <200 units [711])			
200-299 [710]		-0.043**	-.055**
300-399 [401]		-0.053**	-.062**
400-499 [186]		-0.063**	-.076**
500-699 [85]		-0.046**	-.066**
700-999 [28]		0.007	-.032*
1000-2907 [13]		-0.049	-.071*
Metro Area Dummies	excluded	excluded	included
constant	1.58**	1.53**	1.43**
Adjusted R-Square Statistic	0.46	0.50	0.59

note: * = coefficient > std. error ** = coefficient > twice std. error
n = 2133 in each regression; numbers in brackets are observations in category
Source: author's analysis of data from the NAA

Economies of scale are significant in apartment operations, according to these results. Properties with at least 200 units have costs that average 3-to-7 percent below those of properties with less than 200 units. However, the economies appear to be fully exploited once property size reaches 200 units, because all of the estimated coefficients for the larger size categories are similar.

[6] The tests of statistical significance for decade of construction and property size test whether properties in the specified category are significantly different from those in the omitted category.

The individual components of operating costs vary in their relationships to the cost determinants (Exhibit 8). Some of the components are easier than others to explain, judging from the R-square statistics, and in general the components of costs are harder to explain than are total costs. This is understandable, because of the tradeoffs in operating decisions. Property administration, for example, is required at all properties. But those administrative functions can be performed “in-house,” showing up in salaries and administrative expenses, or “hired out,” appearing as management fees or contracted services. The choice is idiosyncratic, and depends on the property’s features and its owner’s philosophy.

Exhibit 8: Regression Results for Cost Components

Dependent Variable: Log of the Following Components of Operating Costs per Unit per Month

Independent Variable	Salaries	Insurance	Property Tax	Utilities	Mngmnt Fees	Admin.	Marketing	Contracts	Repairs
Log(Rent per Unit per Month)	.509**	.320**	1.38**	0.125	.91**	0.003	0.92**	0.526**	.704**
Decade of Construction (omitted=pre 1970)									
1970s	-.073**	.002	.072*	-.175**	-.004	-.045	.150**	.032	-.140**
1980s	-.109**	-.054*	.170**	-.441**	-.104**	.125**	.146**	-.057*	-.293**
1990s	-.155**	-.020	.176**	-.550**	-.055*	-.064*	.154**	-.038	-.345**
Property Size (omitted = <200 units)									
200-299	-.056**	-.033*	.052**	-.108**	-.040**	-.246**	.157**	-.022	.004
300-399	-.089**	-.041*	.080**	-.091**	-.046**	-.278**	.045*	-.019	.002
400-499	-.102**	-.009	.086**	-.112**	-.069**	-.413**	-.002	-.073*	.028
500-699	-.097**	-.014	.141**	-.170**	-.044*	-.441**	-.006	-.048	.187**
700-999	-.147**	.047	.093*	-.038	-.000	-.553**	.030	.148*	.170*
1000-2907	-.055**	-.113	.163*	-.351**	-.186*	-.519**	.258*	-.009	.141
Metro Area Dummies	included	included	included	included	included	included	included	included	included
constant	.900**	0.05	-5.14**	3.43**	-2.80**	2.8**	-4.74	0.10	-2.33**
Adjusted R-Square Statistic	0.26	0.19	0.56	0.25	0.40	0.17	0.21	0.28	0.14
observations in this regression	2132	2133	2133	2132	1950	2129	2129	2113	2132

(if cost component = $0, its log is not defined)

note: * = coefficient > std. error ** = coefficient > twice std. error

Source: author's tabulations of data from the NAA

As for the relationship of specific costs to property quality, the coefficients on the rent variable in Exhibit 8 show that property taxes and management fees are the most sensitive to property quality. For property taxes, the estimate is that a 1 percent increase in property quality is associated with a 1.4 percent increase in taxes. At the other extreme, property quality appears to have little if any effect on utilities or administrative costs.

Property vintage or age has strong implications for some operating costs. As might be expected, utilities and repair expenses are less for newer properties, but the magnitude of the differences is striking. Utility costs, for example, are estimated to be 55 percent less at properties built in the 1990s than at properties of the same quality, size, and location built in the 1970s.[7] Perhaps related to that pattern, property taxes are higher for newer properties. A possible explanation is that if newer properties have lower non-tax operating costs for a given level of rent, those properties will have a higher (tax-excluded) net operating income, and therefore higher market value. If property tax is calculated on market value, newer properties would be expected to pay a higher tax for any given rental revenues, as indicated by the results in Exhibit 8.

Economies of scale are indicated for most of the cost components in Exhibit 8. As with total costs, those economies generally seem to be fully captured by properties of 200 units. With the exception of administrative costs, there are no clear additional per-unit cost savings at properties in the bigger size categories. Two cost components differ from the pattern of the others. For repairs, the results hint that there may be diseconomies of scale once properties reach 500 units. And property tax appears to be positively related to property size; the reason may be the same as that offered above for the relationship of tax to property vintage.

Interpretations

The empirical results overall are sensible when judged within the theoretical framework offered here.

- Housing quality is a strong driver of operating costs; higher housing quality generally requires more operating inputs. Some of those inputs are more closely related to property quality than are others.

- Achieving a level of housing quality requires more operating inputs, and expense, if a property is old. The technology used to build the property and physical deterioration likely are responsible.

[7] Most (93 percent) of the properties in the sample meter apartments individually for electricity. But "master metered" apartments in which the property owner pays all utilities account for 7 percent of the properties in the sample, and these properties encounter utilities expenses roughly twice those of individually metered properties. Newer properties are more likely to be individually metered, and this accounts for part of the difference in utilities expensese between new and old properties. However, even controlling for differences in metering, properties built in the 1990s have per unit utilities costs 44 percent lower than those of otherwise comparable properties built prior to 1970.

- Economies of scale in property operations are significant, although they are fully realized by properties of at least 200 units and vary by operating input.

- A property's operating expense/rent ratio is influenced by local area differences in the costs of operating inputs and in the short-run demand/supply balance in the apartment market.

Overall, the models here explain nearly 60 percent of the variance in operating costs. What of the 40 percent that goes unexplained? Part is likely attributable to reporting error in operating costs or its determinants. But the larger part probably results from model misspecification, and omitted variable bias in particular. The models here include no more than four predictor variables, and others undoubtedly influence costs. Some of these, like additional property and location attributes, are obvious. Others are more subtle. Management efficiency, for example, can cause otherwise identical properties to incur different operating costs. In practice, it is probably impossible to disentangle this efficiency factor from property attributes that influence costs.

The finding that economies of scale top out at around 200 units is a bit surprising. It may be that some cost elements continue to reap economies of scale beyond that size limit, while others exhibit diseconomies of scale as very large properties encounter additional complexities in management. However, the results of Exhibit 8 do not support this hypothesis. Two other potential sources of scale economies are not included in this analysis. One comes from cross-property economies that do not appear in the accounts of any one property but in the corporate "General and Administrative" account of the ownership entity. Another source of economies of scale comes not from operations but in the capital markets, with the costs of both equity and debt financing reportedly lower for larger players.

The results here are consistent with many of those from the recent Public Housing Operating Cost Study, or PHOCS (Graduate School of Design, 2003). PHOCS too found operating costs to depend on property quality, age, economies of scale, and location. Furthermore, the overall explanatory power of the PHOCS models was close to that found here. The similarities in findings exist despite substantial differences in variable definitions and especially in the types of properties analyzed. PHOCS used a sample of multifamily properties that had FHA-insured mortgages and financial subsidies through the "project-based" Section 8 program or other HUD programs. In addition, the properties in the PHOCS were of varying ownership forms and structure types. This set of characteristics contrasts with the unassisted, market-rate, for-profit ownership, and exclusively low-rise profile of properties analyzed here.

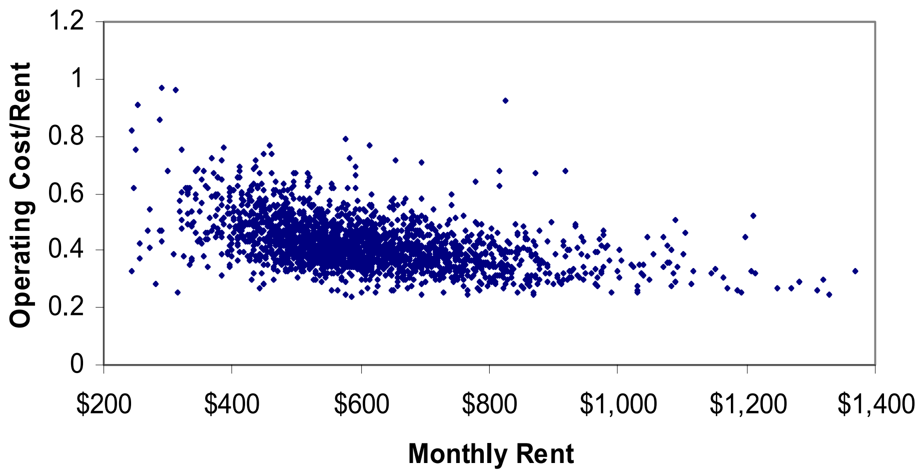
Applications to Policy Issues

The results have implications for strategies and initiatives to promote affordable rental housing for low- and moderate- income households.

The finding that operating costs increase less than proportionally with rents implies that operating cost/rent ratios are highest for the lowest rent properties. This is vividly displayed in a scatter plot of cost/rent ratios against rent levels for the 2033 properties in the NAA sample (Exhibit 9). For properties in the lowest third of the NAA rent distribution, the cost/rent ratio averages 0.48 compared to an average of 0.38 in the top third of the rent distribution.

High operating costs relative to rents threaten the viability of apartment properties and their retention in the housing stock. While operating costs alone do not often exceed rents – at least in newer market rate properties such as those in the NAA sample – most apartment properties are mortgage financed, and mortgage payments put another claim on cash flow. Even a mortgage with a current balance of only 50 percent of the property value can require nearly a 30 percent of the property's total rent revenue to service, under realistic assumptions.[8]

Exhibit 9: Properties by Operating Cost/Rent and Rent



note: 9 properties with rent>$1400 are excluded.

[8] Returning to the example from page 1, a property with current market value of $1 million might have $140 thousand of annual operating revenue and $60 thousand of annual operating expense. If the property carries a 30-year self-amortizing loan at 8% interest and an original principal of $500 thousand, the annual mortgage payments are $41 thousand. In this example, the operating costs and debt service require a combined 72 percent of rental revenue.

Operating costs and debt service together can easily push the cash flow of properties negative. Properties with negative cash flow have been shown to be the most likely to default on mortgages and ultimately be abandoned or otherwise removed from the housing stock (Vandell, 1995; Cohen, 2002, and references therein). The resulting loss of supply increases rents charged at the remaining apartments and thereby reduces housing affordability.

Owners of properties with little or no positive cash flow may be reluctant to invest in capital improvements if these would require additional borrowing. Simple correlations of operating cost/rent ratios with capital expenditures of properties in the NAA sample do not indicate such reluctance, but the debt service expenditures needed for a fair test of the hypothesis are not available from the NAA survey.

What can be done to reduce operating costs? It is easy to say "Be more efficient," but harder to act on that advice, especially for costs that are not controllable by the property owner or manager. One cost not usually considered controllable may, however, be one of the more promising possibilities: property taxes. Property taxes account for 22 percent of total operating costs at the typical property in the NAA sample; even among properties in the lowest third of the rent distribution, property taxes are 18 percent of total operating costs.

Property tax exemption or abatement is available in some jurisdictions for affordable rental housing. In practice, however, tax relief for rental properties is the exception rather than the rule. Tabulations from the 1995-1996 Property Owners and Managers Survey indicate that only 2 percent of all multifamily rental properties receive any property tax abatement, and that properties with below-average rents are no more likely than others to receive this benefit. (Details of these tabulations are available upon request.) Relative to their market value, apartment properties are taxed at a higher rate than single-family houses in most jurisdictions (National Multi Housing Council, 1998). Even a reduction in taxes to parity with single-family houses would be a significant cost saving to most multifamily rental properties.

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