Intra-Project Externalities and Layout Variables in Residential Condominium Appraisals

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Abstract. **This study examines the impact of intra-project externalities and layout variables on the selling prices of 897 condominium units in the cities of Irvine and Santa Ana in Orange County, California. It documents that, at a micro-level, proximity to intra-project externalities such as greenspace, swimming pools, recreational areas, traffic noise, and the like, and project layout variables representing the location of individual condominium units within multiunit structures, have significant effects on the property values of units within a condominium project. The results indicate that, when cost is not prohibitive, both appraisers and underwriters should take intra-project externalities and layout variables into consideration when estimating property values or underwriting residential mortgages for condominium properties.**

Introduction

The valuation of real estate is generally more difficult than the valuation of financial assets because real properties are nonhomogeneous and property transactions are infrequent. Because of the unique asset and market characteristics of real estate, the quantity and quality of the available data play an important role in selecting a suitable valuation model for appraisal assignments.

The adjustment-grid method is the method most frequently used by appraisers. However, the multiple-regression method, widely used in valuation studies by academic researchers, is gaining popularity as a tool for mass appraisals and as a complement to the grid method by providing estimates of adjustments for differences between the comparables and the subject property. For both the adjustment-grid and multiple-regression methods, limited data availability and high data gathering costs are constraints on variable selection.[1] As a result, although it is well known that a property's value is affected by favorable and unfavorable influences from its

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surrounding environment, externality variables (for example, proximity to a park, to a swimming pool, or to a playground) are largely neglected in appraisals.

Moreover, how individual units are located relative to other units are not fully considered in condominium appraisals, even though the location of units within condominium projects can influence property values by affecting the extent to which unit occupants are exposed to noise and other negative externalities from neighboring units. In this study, variables relating to the location of individual units within multiunit structures in condominium projects (such as whether they are end, interior or corner units, or first-floor or second-floor units) are called project layout variables.

Neglecting relevant externality and layout variables can produce both statistical and business decision problems arising from misspecification of the valuation model. From the point of view of appraisers using hedonic pricing techniques to estimate the price effects of individual property characteristics, failure to include relevant variables in the model leads to biased coefficients. From the point of view of a lender that uses appraisals in the loan decision-making process, failure to include significant variables in the valuation model can result in an appraisal that either over- or underestimates the true value of the property. When the omitted variables have a net negative influence on property values, the appraisal will overestimate the property's value. This can mislead a lender into originating a loan for an amount too high to achieve a target initial loan-to-value ratio, thereby increasing the lender's risk of default and also of foreclosure losses once default occurs. On the other hand, if the omitted externality and layout variables have a net positive impact on property value, the appraisal can lead the underwriter to reject a profitable lending opportunity by underestimating the property's value.

The purpose of this study is to analyze the impact of project externality and layout variables on the selling prices of residential condominium units. First, the study identifies material externality variables within condominium projects (such as greenspace, dumpsters, mailboxes and street noise) and estimates the price effects of relative distance to these externalities. Second, the study also estimates the price effects of variables describing the location of individual units within condominium structures (such as end units versus interior units or second-floor versus first-floor units).

The next section reviews the literature on the impact of externalities on property values. Section three discusses the sample and addresses methodological issues. Section four reports the empirical results. The last section is the conclusion.

Literature Review

The pioneering studies on the impact of externality variables on property values focused on neighborhood parks (see, for example, Kitchen and Hendon, 1967; Weicher, Weicher and Zerbst, 1973; Hendon, 1971, 1973, 1974; Correll, Lillydahl and Singell, 1978; and Vaughan, 1981). One interesting finding of these studies is that

parks can exhibit either a positive or a negative effect on the values of properties close to the park. On one hand, there are benefits of being close to a park (such as a pleasant view or convenient access to the park). On the other, there are also costs of being close to a park (such as noise and other nuisances). Another interesting finding is that people in different socioeconomic groups might value the benefits and costs of parks differently, which would lead to differences among these groups in the trade-offs between the benefits and costs of parks. Thus, the net impact of a park on property value can differ among various socioeconomic groups.

Although the methodologies used by the park studies are not as sophisticated as more recent hedonic studies,[2] the results of the studies provide useful insights into the appraisal issues addressed in this study. First, proximity to an externality (such as a park, greenspace or recreational area) affects property values. Second, the net positive or negative impact of a given externality on property values depends on the trade-off between the benefits and costs of proximity. Third, the net impact of externalities on property values depends on the socioeconomic characteristics of the neighborhood.[3]

As the park studies indicate, the signs of externality variables are often difficult to determine. For example, is it a favorable attribute of property location if a condominium unit directly faces a swimming pool? It is not clear whether a homeowner would prefer the pool-side view and convenience of access, on the one hand, or less noise, on the other. Likewise, with respect to the location of individual units within structures, it is not obvious in the case of stacked units whether a homeowner would prefer to live in a first-story unit or in a second-story unit. When view is not a consideration, a clear trade-off exists in the choice of floors between the added convenience (of being on the first floor) and possible noise (from being underneath another household's unit).

Besides the sign of these variables, the other major question concerns the magnitude of their impact. Indeed, empirical evidence indicates that the magnitude of externality variables is significant. Wang, Grissom, Webb and Spellman (1991) examined the impact of proximity to rental properties on the selling prices of single-family homes, and found that proximity to a rental agglomeration could account for 2% to 5% of the property selling price. This study examines both the direction and the magnitude of the price impact of project externalities and layout variables.

Sample and Variable Selections

The sample consists of 897 condominium unit sales from a total of twenty-seven projects located in the cities of Irvine and Santa Ana in Orange County, California from the first quarter of 1993 through the second quarter of 1995. During the 1993–95 period, the price level in the Orange County area was relatively stable when compared to the earlier 1989–92 period, although there was a modest downward trend. Data about condominium sales was obtained from the *Single Family Sales Data* for Orange County, California compiled by the California Market Data Cooperative (CMDC).

CMDC is the largest appraisal data-sharing cooperative in the U.S.[4] Its membership consists of savings and loan associations, commercial banks involved in real estate lending, government agencies concerned with real estate (such as FHA and VA) and a majority of independent real estate appraisers in California. Its sales data comes from appraisal reports submitted by its membership and from public records.

The units of analysis for this study are condominium units within multi-unit condominium structures (buildings). Condominium units provide a good sample for studying the impact of externalities on property selling prices. Units within a condominium project are differentially exposed to common property facilities and features designed as components of a structured residential community. Furthermore, condominium units are more homogenous than single-family residences with respect to property attributes (such as construction quality and building style). Controlling for differences among unit physical characteristics can reduce the statistical error when estimating the price effects of the externality variables. It also helps to alleviate statistical estimation problems that arise when using statistical tests on small samples.

The sample area selected had to meet two selection criteria: be an area where geographical attributes are relatively homogeneous in order to minimize the impact of geography on property selling prices,[5] and yet be one that contains a sufficient number of property transactions within the sample period for appropriate statistical analysis. Among the thirty-one cities in Orange County, the cities of Irvine and Santa Ana best met both criteria. Each has a large number of transactions and, except for small sections, the two cities have a similar geographical landscape with no dramatic geographical features. Furthermore, because condominium projects in these communities are in general quite large, they tend to contain more transactions than smaller projects in other cities. It is more convenient to physically observe the externality variables for each transaction in the sample if the transactions are concentrated in relatively few projects.

Once the sample period and sample area were selected, the CMDC books were examined to identify all completed condominium transactions in the selected projects. From the initial sample, transactions were deleted that had incomplete information, specifically missing data (*e.g.*, no record of unit size or time of sale), and that the CMDC data indicated had atypical (*e.g.*, favorable) financing. After this screening process, the final sample was reduced to a total of 897 condominium sales.

This study uses a hedonic pricing model to obtain estimates of the price effects of the externality and layout variables. The dependent variable of the model is selling price. The independent variables include time, property attribute, project externality and project layout variables. The dependent and independent variables (with their predicted signs) are listed and briefly described in Exhibit 1.

Data for the dependent variable (*Selling Price*) and for three control variables, *Date of Sale, Size* and *Age,* were obtained from the CMDC data books. *Date of Sale* is calculated as the number of months between the month of sale and the beginning of the sample period, which is January, 1993 (*Date of Sale* takes a value of zero for

Exhibit 1
Variable Description

Variable (Expected Sign)	Variable Description	Source
Selling Price	Without an impact of financing	CMDC
Date of Sale (−)	No. of months since January, 1993	CMDC
Size (+)	Square feet	CMDC
Age (−)	Years since 1995	CMDC
Detached Parking (−)	Carport 3 units away from the unit	Map
Garage Parking (+)	Garage parking	Map
Face Entrance (−)	Face project entrance	Map
Face Pool or Spa (?)	Next to pool or spa	Map
Close to Pool or Spa (+)	Within 3 units of pool or spa	Map
Face Recreations (?)	Next to recreational facility	Map
Close to Recreations (+)	Within 3 units of recreational facility	Map
Face Greenspace (+)	Face green space	Map
Face Major Road (−)	Face major street	Map
Face BBQ (−)	Next to BBQ	Map
Face Freeway (−)	Face a freeway	Map
Close to Freeway (−)	Within 2 blocks of freeway	Map
Near Mailbox (−)	Within 3 units of mailbox	Map
Face Laundry (−)	Next to laundry	Map
Near Dumpster (−)	Within 3 units of dumpster	Map
Single Unit (+)	No unit above or below	Map
Second Floor (−)	On second floor	Map
Corner Unit (+)	At corner of structure	Map
End Unit (+)	At end of structure	Map
Santa Ana Area (−)	In Santa Ana	CMDC

January, 1993). The sign of the variable is expected to be negative because properties in this market area generally depreciated in value during this period. *Age* is calculated as the number of years between the date of construction and 1996,[6] with a negative expected sign. *Size* is the square footage of the unit, with a positive expected sign. The number and type of rooms were not included in the model because of the high correlation among the room and unit size variables. This multicollinearity problem can cause the regression coefficients to be biased and counter-intuitive. In addition, these variables were excluded because of the errors in variables problem. Although CMDC provides guidance on how to calculate the number of rooms, it is doubtful that property agents apply the definition uniformly. For some transactions, for example, the number of rooms listed are different for identical condo units.

Independent variables other than *Date of Sale*, *Size* and *Age* had to be identified by physical inspection (observation). In order to identify these variables, an attempt was made to obtain a site plan or plot map for each condominium project from the appropriate departments of the cities of Irvine and Santa Ana. If the map was not available or was not readable, individual condominium associations were contacted to obtain project maps. After the project maps were collected, a visit was made to each condominium project to physically observe project externalities and layout

characteristics. The observed externalities and layout characteristics for each project were marked on the project's map. The units that sold within the sample period were then located on the appropriate project map. Finally, from the annotated maps, the proximity of each unit to project externalities was measured.

Following the three control variables (*Date of Sale*, *Size* and *Age*), the next two independent variables listed in Exhibit 1 relate to parking facilities. *Garage Parking* takes a value of one if the condominium unit has a garage instead of a carport. *Detached Parking* indicates the distance of a detached parking facility from the condominium unit and was created to capture any adverse impact of the inconvenience of distant parking facilities. It has a value of one if the parking facility is more than three condominium units from the subject unit, indicating that the facility is ''far'' from the unit.[7] These distances were determined from the maps of each condo project. A positive sign is expected for *Garage Parking* and a negative sign for *Detached Parking*.

Thirteen binary externality variables follow the parking variables in Exhibit 1. A value of one for the *Face Entrance* variable indicates that the unit is located at an entrance to the project. A negative coefficient is anticipated for this variable because of potential noise and other traffic-related nuisances.

The *Face Pool or Spa* variable takes a value of one if a condominium unit is directly next to or directly across an alley or minor street from a pool or a spa. *Close to Pool or Spa* takes a value of one if a pool or a spa is within three condominium units from (but not directly next to) the subject property. It is difficult to predict the sign of the *Face Pool or Spa* variable. On the one hand, being next to a pool might provide a pleasant or stimulating view for the unit occupants and convenient access to the facility. However, increased noise from the pool area and possible loss of privacy due to the closeness of people using the pool area might offset the benefits. The *Close to Pool or Spa* variable is expected to have a positive sign because ''close'' is near enough to have convenient access yet distant enough to be exposed to less noise and loss of privacy than units in very close proximity.

Similar to the *Pool*/*Spa* variables, *Face Recreations* and *Close to Recreations* are established to measure the impact of recreational facilities (other than a pool or a spa) on property selling prices. Recreational areas include such facilities as basketball courts, tennis courts, volleyball courts and horseshoe rings. Tot lots (play areas for children including such playground-type facilities as swings, slides and sandboxes) are also included in this category. The tradeoff involving these facilities is similar to that of the *Pool* or *Spa* variables, convenience and possible pleasant view versus noise and possible loss of privacy.

Different from a park, which exists beyond the confines of the project, greenspace refers to an area within a project that has been landscaped to present an attractive view. *Face Greenspace* takes a value of one if a unit is located next to or directly across from a greenspace.[8] A positive sign is predicted for this variable since

greenspace is not expected to be a noise generator, which makes it more in the nature of an unmixed amenity than other externality variables.

Three externality variables are established to measure the impact on property values of vehicular traffic bordering the project. The first is *Face Major Road*. A major street means a major arterial roadway, which does not include subdivision streets or even connector streets linking subdivision streets with major streets. This variable takes a value of one if the unit is adjacent to a major street. This externality is hypothesized to have a negative impact on property values because of potential noise and emissions from passing traffic.

Two variables, *Face Freeway* and *Close to Freeway*, are used to measure the impact of a nearby freeway on property value. *Face Freeway* takes a value of one if a unit directly faces a freeway. *Close to Freeway* takes a value of one if the unit is within two blocks of (but not directly facing) a freeway. Negative coefficients are anticipated for these two variables because freeways expose nearby residents to a great deal of noise and to large doses of pollutants from vehicle emissions and road dust.

Four externality variables capture the impact on property value of being close to certain project services or utilities. All of these variables involve a trade-off between the convenience of proximity and certain negative side effects such as noise, traffic or unpleasant sights or odors. First, a few projects have barbecue grills dispersed throughout. *Face BBQ* takes a value of one if a unit directly faces a barbecue grill. On balance, we believe the smoke from these grills would adversely affect units located adjacent to them, thus making the grills a net disamenity for these units, which implies a negative sign for this variable.

In addition, a number of projects in the sample have centralized mailboxes. *Near Mailbox* takes a value of one if a unit is located close to the centralized mailbox, which is defined as within three condominium units of a mailbox. Being close to the unit's mailbox is a convenience. However, the nuisances created by the increased pedestrian and vehicular traffic around the mailboxes are expected to outweigh the convenience of proximity, making the mailbox a net disamenity for adjacent units.

Several projects in the sample are converted apartment projects. A few of these projects continue to provide laundry facilities. *Face Laundry* takes a value of one if a unit is next to or directly across from a laundry facility. Because of possible noise, traffic and laundry-room odors, a negative sign is expected for this variable, particularly since many households have laundry appliances and thus receive no benefit from a project laundry facility.

Finally, the *Near Dumpster* variable is used to capture the impact of a unit being located close to a dumpster (trash receptacle). This variable takes a value of one if a unit is close to (within three condominium units) or directly across an interior street or alley from a garbage dumpster. The net impact of this variable is expected to be negative because the unattractive appearance of a dumpster and the potential of

unpleasant odors and even pests are assumed to outweigh the convenience of a close location.

Four variables relating to unit location within structures are used to capture aspects of the design and layout of a project on property selling prices. They are *Single Unit*, *Second Floor*, *End Unit* and *Corner Unit*. As mentioned, the condominium units examined are all located within multi-unit buildings.

Single Unit takes a value of one if a unit has no other units above or below it. A positive sign is predicted for this variable because of both the absence of nuisances caused by upstairs or downstairs neighbors and the convenience of direct street-level access.

A number of projects in the sample contain stacked condominium units (all of which are in two story structures). If a unit is a stacked unit, the *Second Floor* variable takes a value of one if a unit is on the second floor. It should be noted that none of the units in the sample has a golf course or city view. Absent a compensating view, a negative coefficient is hypothesized for this variable because the inconvenience of having to climb steps to reach the second floor unit is assumed to outweigh the advantage of less noise from having no upstairs neighbor.[9]

Two variables are used to indicate the placement of a unit within a building. *End Unit* takes a value of one if the unit is at one end of the structure. End units share side walls with only one other unit. *Corner Unit* takes a value of one if a unit is located on one corner of a building.[10] The third possibility for placement within a building is that of an interior unit. Interior units can share walls with as many as three other units. Positive signs are hypothesized for both the *End Unit* and *Corner Unit* variables because of greater privacy and the reduction of noise and other potential nuisances from fewer adjacent neighbors. Privacy and noise reduction are greatest for the end units.

Finally, a Santa Ana area dummy variable measures the price effect of sample condominium projects being located in Santa Ana instead of Irvine.

Sample Statistics and Empirical Results

Exhibit 2 reports the sample statistics of the 897 transactions. Except for the *Face BBQ* (mean=0.01) and *Face Laundry* (mean=0.02) variables, all the externality variables have a mean no less than 0.04. This suggests that, except for these two variables, each externality variable has at least thirty-six transactions (calculated as 4.0% of 897 total transactions). These figures indicate that the sample is sufficiently large for the purposes of this study.

Exhibit 3 reports the empirical findings.[11] The *Size*, *Age* and *Date of Sale* variables exhibit the expected signs and are highly significant. Ten of the thirteen externality variables have the expected signs, the exceptions being *Face Major Road*, *Face BBQ* and *Face Laundry*. Likewise, *Detached Parking* also has a sign contrary to

Exhibit 2
Sample Statistics

Variable	Mean	Min.	Max.	Std. Dev.
Selling Price	145073	39000	302000	47793
Date of sale	14.99	0.00	31.00	7.98
Size	1132	468	2192	280
Age	14.83	1	31	6.93
Detached Parking	0.15	0	1	0.36
Garage Parking	0.59	0	1	0.49
Face Entrance	0.07	0	1	0.26
Face Pool or Spa	0.05	0	1	0.22
Close to Pool or Spa	0.15	0	1	0.36
Face Recreations	0.04	0	1	0.20
Close to Recreations	0.07	0	1	0.26
Face Greenspace	0.08	0	1	0.28
Face Major Road	0.09	0	1	0.29
Face BBQ	0.01	0	1	0.10
Face Freeway	0.04	0	1	0.19
Close to Freeway	0.05	0	1	0.23
Near Mailbox	0.22	0	1	0.42
Face Laundry	0.02	0	1	0.12
Near Dumpster	0.22	0	1	0.41
Single Unit	0.58	0	1	0.49
Second Floor	0.21	0	1	0.41
Corner Unit	0.25	0	1	0.43
End Unit	0.38	0	1	0.48
Santa Ana Area	0.25	0	1	0.43

expectation. But none of the coefficients of these four variables are significant at the 10% significance level.[12]

The coefficient of *Garage Parking* is positive and highly significant, which is expected given that this variable is often included in appraisal reports. The coefficients of the externality variables *Close to Recreations* and *Face Greenspace* are both positive and significant. This implies that certain amenities in the immediate surroundings of a property are important to its value. The magnitude of the price impact of these variables, moreover, is significant. The coefficient of the *Close to Recreations* is $5,004.98, which is 3.5% of the average price of the properties in the sample. A plausible explanation of why this variable is significant is that many of the nonpool recreational facilities in the sample projects contain nicely landscaped playground areas that could be attractive to families with young children. The coefficient of the *Face Greenspace* is $3,773.44, which is 2.6% of the average price of the sample properties.

The *Face Pool or Spa, Face Recreations* and the *Close to Pool or Spa* variables are insignificant. A possible explanation is that the benefits and costs of close proximity to these project externalities offset one another. The noise and other possible nuisances resulting from being close to pool, spa or recreational facilities could offset the

Exhibit 3
Regression Results

Independent Variables	Equation (1) Coeff.	*t*-Stat
Date of Sale	(687.78)	(11.8)**
Size	84.56	35.3**
Age	(368.70)	(2.4)**
Detached Parking	2606.18	1.5
Garage Parking	13607.87	8.1**
Face Entrance	(342.79)	(0.2)
Face Pool or Spa	(1754.28)	(0.8)
Close to Pool or Spa	521.22	0.4
Face Recreations	2242.11	0.9
Close to Recreations	5004.98	2.5**
Face Greenspace	3773.44	2.1**
Face Major Road	113.76	0.1
Face BBQ	5221.19	1.1
Face Freeway	(6543.30)	(2.7)**
Close to Freeway	(2608.59)	(1.3)
Near Mailbox	(2327.37)	(1.7)*
Face Laundry	3885.37	1.0
Near Dumpster	(4038.11)	(2.9)**
Single Unit	8412.47	5.2**
Second Floor	(2463.51)	(1.7)*
Corner Unit	489.48	0.3
End Unit	5425.43	5.0**
Santa Ana Area	(37982.59)	(17.7)**
Intercept	64429	
R^2	.921	
Standard Error	13,638	
No. of Observations	897	

*Significant at the 10% level.
**Significant at the 5% level.

benefits of pleasant views and being able to use the facilities more easily. These findings provide evidence that facilities that generate noise and other nuisances, even though designed as project amenities, could end up being disamenities for nearby units.

As expected, the coefficient of the *Face Freeway* variable is negative and highly significant. The coefficient of this variable is $6,543.30, or 4.5% of the average price of the properties in the sample. This demonstrates that unfavorable property exposures, in this case exposure to significant road noise and pollution, are important factors in determining property value.[13]

The coefficients of *Near Mailbox* and *Near Dumpster* are negative and significant. The coefficients $2,327.37 and $4,038.11, respectively, represent 1.6% and 2.8% of the average price. These findings imply that homeowners do not like to be too close

to facilities that will either increase traffic flows or expose them to undesirable sights or odors, even if the location of the unit makes it more convenient for them to use the facilities.

Variables relating to the design and layout of a project were found to have significant effects on the values of the units in the project. The coefficient of Single Unit is positive and significant with a magnitude of $8,412.47, which is 5.8% of the average selling price. The coefficient of $5,425.43 of the *End Unit* variable is positive and significant, which is 3.7% of the average price of the properties. This indicates that having fewer immediate neighbors, resulting in less noise and greater privacy, is an important consideration in determining property values. Finally, the coefficient of *Second Floor* is negative and significant, which indicates that the inconvenience of climbing a flight of stairs outweighs the benefit of not having a neighbor living above. Its value of $2,463.51 represents 1.7% of the average selling price.

To summarize, the results of this study provide evidence that intra-project externality and layout variables are important considerations in the valuation of condominium units. Attractive view (face greenspace), convenience (close to recreational facilities), noise (face freeway), exposure to undesirable sights/smells (dumpster) or to traffic (centralized mailboxes) and project layout (end unit and second floor) are all shown to have significant effects on the price of condominium units.

To obtain an indication of the possible impact of externality and layout variables on condominium values, the absolute values of the coefficients for the six externality variables that are significant at the 5% (*Close to Recreations, Face Greenspace, Face Freeway, Near Dumpster, Single Unit* and *End Unit*) were summed. Using this measure, the maximum aggregate impact of these six variables is estimated to be 22.9% of the average price of the properties in the sample. This analysis at least approximates an upper bound to the bias (an estimate of the worst possible case) that results from neglecting these variables. Of course, the effects of at least some of these variables are likely to be offsetting. The net impact, although difficult to calculate precisely, is likely to be somewhere between this upper bound and the lower bound of zero.[14] It is, however, safe to conclude that the average impact of neglecting these variables on the estimate of property value will be nontrivial. It is noteworthy that most of these variables are not normally considered by appraisers when estimating the value of residential properties. Neglect of project externality and layout variables by appraisers can bias appraisal estimates because the impact of these variables is not likely to be the same among comparables and the subject property in the real world.[15]

The implication of these findings for appraisal practice is not straightforward. On one hand, the inclusion of relevant intra-project externality and layout variables improves the estimation of property prices and, hence, reduces the default risk of lenders. On the other hand, this improvement comes at a cost.[16] This latter consideration is important given the current concern about the high costs of property transactions, of which appraisals are one contributing factor, that impede home ownership for cash-constrained households. In the future it may be possible to utilize automated mass appraisal models to significantly reduce appraisal costs.

Conclusion

This study examines the impact of project externality and layout variables on the selling prices of 897 condominium units in the cities of Irvine and Santa Ana in Orange County, California. By examining the effect of intra-project externalities (such as project greenspace, swimming pools, spas, nonpool recreational facilities, dumpsters, centralized mailboxes and the like) on the values of condominium units, this study extends previous studies of the effects of localized externalities on property values. The study documents, at a micro-level, that both proximity of individual units to intra-project externalities and the location of individual units relative to other units within multiunit structures have a significant effect on the selling prices of individual units. The magnitude of the impact of intra-project externality and project layout variables on unit selling prices is shown to be significant.

From the analysis, it is clear that an inclusion of project externality and layout variables will increase the accuracy of appraisal estimates. When the net impact of these variables on property values is negative, inclusion of these variables in an appraisal would reduce the default risk of financial institutions. When the net impact is positive, the possibility of rejecting a profitable lending opportunity is reduced. However, it is not clear whether the improvement in the underwriting process can be justified given the additional costs of data collection. An optimal decision about how detailed an appraisal assignment should be is an empirical question that can only be resolved by further research investigating the relative costs and benefits of including the additional information in residential appraisal reports.

Notes

[1]When a grid method is used, in order to extract the adjustment of one particular property element (such as location), appraisers often are required to find two comparables where, with the exception of the particular property element, all other property elements are identical. It is clear that, in order for this approach to be feasible, appraisers must overlook less obvious (or less noticeable) property elements and also externality variables. Otherwise, the appraiser's chance of finding a pair of such comparables will be greatly reduced.

[2]Krumm (1980) is the first to examine the impact of a micro-level externality on property values using factor analysis. He demonstrates that the appearance of surrounding properties could have a significant impact on the values of adjacent properties.

[3]Subsequent hedonic studies examining the impact of different externalities on property values report similar findings. See, for example, Pool (1978), Nelson (1978 and 1980), Grether and Mieszkowski (1980), Li and Brown (1980), Webb (1980), Watts (1981), Gamble and Downing (1982), Gabriel and Wolch (1984), Rabiega, Lin and Robinson (1984), Jud and Jud (1985), Farber (1986), Colwell (1990), Michaels and Smith (1990), Walden (1990), Kohlhase (1991), Thayer, Albers and Rahmatian (1992), Smolen, Moore and Conway (1992), Reichert, Small and Mohanty (1992), Murdoch, Singh and Thayer (1993), Do, Wilbur and Short (1994), Flower and Ragas (1994) and Sirpal (1994).

[4]The address is: California Market Data Cooperative, Inc., 18101 Von Karman Ave., Suite 200, Irvine, CA 92715-1030.

[5]This consideration is important since Orange County offers a wide spectrum of dramatic geographic features ranging from picturesque coastline to sweeping mountain and canyon panoramas.

[6]1995 was treated as a complete year (although the sample period ended on June 30, 1995) because the data only reported the year in which construction was completed.
[7]Determining relative distance is admittedly somewhat arbitrary, but observation of how parking facilities were laid out in the projects led to the decision to label parking facilities more than three condo units walking distance from either the front or back door of the unit as being ''far.'' In this study, as a general rule, distance is measured in terms of the number of condominium units between the subject and the facility or environmental feature under consideration.
[8]Units either have a direct view of greenspace or they do not. Thus, in our judgment there is no need for a ''Close to'' variable in this case.
[9]All stacked units in the projects were two-story structures with no elevator access to the second floor units.
[10]Both end and corner units can be either downstairs or upstairs in the case of stacked units.
[11]Following the suggestion of a referee, we estimated a model using the log of the selling price as the dependent variable to allow for nonlinear effects. That model produced results that are very similar to the results reported in Exhibit 3. The results are available from the authors.
[12]The purpose of this study is to identify intra-project externality and layout variables that are significant pricing factors and to measure their effects on the prices of condominium units. Given this purpose, the main focus is the *t*-Statistic of each pricing factor, not the predictive or explanatory power of individual equations. Consequently, results of attempts to improve the explanatory power of the regression model using different functional forms and sets of explanatory variables are not reported. We also experimented with different interaction variables to see if certain amenities would be priced differently when correlated with different intra-project or layout variables. The results were basically unchanged. The results are available from the authors.
[13]Ratcliff (1961, pp. 69–70) uses the terms favorable and unfavorable exposure to refer to positive or negative influences on the utility and value of the subject property arising from the external environment of the property.
[14]The net impact of omitting externality variables is not easy to calculate. For example, suppose a unit experienced all six variables (they are not mutually exclusive). In this case, the net impact is positive 8.3% of the average price. However, a unit is unlikely to experience all six variables at the same time, and the net impact will vary depending on which variables affect particular units.
[15]It should be noted that if the distribution of omitted project externalities among comparables and the subject property is the same, the net impact of the omitted externality variables across these properties will be similar and thus be reflected in the selling price. Under this circumstance, the lack of externality variables will not bias the appraisal estimate. However, this situation is unusual in the real world. We thank a referee for this insight.
[16]Excluding traveling and data purchasing costs (such as project site plans and maps), it took approximately 300 hours to organize the data set for this study.

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