# The value of a floor: valuing floor level in high-rise condominiums in San Diego

Stephen Conroy, Andrew Narwold and Jonathan Sandy
*School of Business Administration, University of San Diego, San Diego, California, USA*

## Abstract

**Purpose** – This paper aims to analyze the effect of floor level on condominium prices in San Diego, California. The authors determine whether "higher-floor premiums" exist in the condominium market for a large California city. Further, they investigate how the floor premium varies throughout a building, particularly whether it is quadratic and whether there is a "penthouse premium" for top-floor units.

**Design/methodology/approach** – The paper utilizes a data set of 2,395 condominium sales occurring in San Diego between 2006 and the second quarter of 2011. Using hedonic pricing analysis, the authors model the housing price as a function of condominium, building and neighborhood characteristics.

**Findings** – The results suggest that there is a higher-floor premium for condominiums in San Diego. Specifically, an increase in the floor level is associated with about a 2.2 percent increase in sale price. The higher-floor premium appears to be quadratic in price, suggesting that price increases at a decreasing rate above the mean floor level. The authors also find evidence for a penthouse premium, though this effect disappears once "floor" is controlled for in the model.

**Originality/value** – There has been little direct research on the floor effect in condominium prices. The studies that have used floor level as an explanatory variable have been predominately in Southeast Asia. The results suggest that the floor effect is more complex than previously modeled.

**Keywords** Hedonic pricing, Penthouse, Higher-floor premium, Value of floor, Condominium, San Diego, United States of America, Housing, Prices

**Paper type** Research paper

## Introduction

There is a growing body of research that suggests that higher condominium floors confer higher sale prices, controlling for square footage and other relevant attributes. Evidence for this "higher-floor premium," however, has been somewhat narrowly presented in two regards. First, reporting of a higher-floor premium has been largely incidental, as "floor," "level" or "story" are included merely as control variables for investigations of other matters. As such, there is a dearth of analysis of this particular finding, i.e. whether it is linear, nonlinear, monotonically increasing by floor, etc. Second, the investigations have occurred primarily in Southeast Asia, Hong Kong in particular.

## Background

Mok *et al.* (1995), estimate a hedonic pricing model for 1,027 condominiums sold in Hong Kong in August 1990. While they seem to have little information on the structural characteristics of the condominium (other than gross floor area and the age of the building), they do include the floor level of condominium within the building and

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whether there is a sea view. Using sales price as the dependent variable, the authors estimate four different specifications and find floor level to have a positive and significant impact on price in all four specifications. Other studies of Hong Kong offering similar conclusions include So *et al.* (1997), Chau and Ng (1998), Chau *et al.* (2001), Tse (2002) and Chau *et al.* (2003).

Two other studies find similar results for Singapore. Ong (2000) investigates 15 large (over 200 units) residential condominium developments in Singapore from 1988 to 1998 and finds that the higher the floor of the unit, the higher the probability of observing a subsequent sale within the time frame studied (i.e. higher turnover rate) and the higher the (mortgage) prepayment rate. Ong (p. 595) comments that the finding of a higher probability of a subsequent sale is "consistent with the commonly held perception that units on higher floors are more desirable." Similarly, Sun *et al.* (2005) analyze condominium sales data for Singapore from 1990 to 1999 using several models that control for spatial autocorrelation and find a consistent, positive relationship between floor level and sales price. Chin *et al.* (2004) examine 442 condominium sales in Malaysia for the years 1996 and 1998. Through several different specifications, the coefficient on floor level remains positive and statistically significant.

While there appears to be empirical evidence for a higher-floor effect, why might this be the case? We posit two potentially competing theories that could affect higher-floor prices. On one hand, higher floors take longer to reach from the ground floor thus increasing travel times. Ceteris paribus, this would likely exert a negative influence on price as higher travel times increase travel costs. The implicit value of time is at the core of economic theory. Research conducted in a myriad of situations has confirmed that individuals place a value on their time and that this can vary based on a variety of factors, including income (i.e. opportunity cost) and impatience. Thus, it should be no surprise to learn that hedonic pricing models for residential housing often find that, controlling for square footage, distance from the central business district (CBD) is negatively related to housing prices – driven by the well-known, "negative rent gradient" (Muth, 1969; Mills, 1972; Colwell and Sirmans, 1978; Kau and Sirmans, 1979; Ohkawara, 1985; Coulson and Engle, 1987; So *et al.*, 1997; Chau and Ng, 1998). In short, ceteris paribus, workers prefer to live closer to work in order to reduce travel times. Thus, to the extent that living on higher-floored units in a multi-floored condominium increases travel times for residents we might expect the price of condominium units (controlling for other factors) to decline with floor level. At a minimum, this effect – call it the "negative travel effect" – would put negative pressure on prices of higher-floored condominium units. This effect is unlikely to occur in the San Diego condominium market, which is characterized by fairly new buildings of moderate height.

At the same time, there is considerable evidence that buyers prefer housing that is located away from traffic or road noise. Brandt and Maennig (2011), for example, find that doubling road noise in Hamburg, Germany would reduce condominium prices by 2.3 percent. Buyers have also been found to value locations and near amenities such as forests (Tyravinen and Miettinen, 2000), lakes (Kilpatrick *et al.*, 2007), trails and greenbelts (Asabere and Huffman, 2009), ponds (Plattner and Campbell, 1978), green spaces (Conway *et al.*, 2010), historically significant buildings (Narwold *et al.*, 2008) and open spaces (Irwin, 2002). For cities located near the ocean, such as San Diego, this could manifest itself as a desire to locate near the coast (Conroy and Milosch, 2011; Rinehart and Pompe, 1994; Major and Lusht, 2004). Similarly, research has found positive view effects from locating near a large body of water. A recent investigation in Europe by Baranzini and Schaerer (2011), for example, found that rent premiums for housing located near "an extended surface of water" were as high as 3 percent and housing with a view of "water-covered area" could be as high as 57 percent. Previous investigations by Rodriguez and Sirmans (1994) and Benson *et al.* (1998) found similar results in the US. Together, these findings suggest that condominium units located on higher floors – those that get above the traffic noise and may include a view – may be valued higher than their lower-floored counterparts. In short, this "positive ambience effect" would drive up prices of higher-floored condominium units. Given these two competing forces on residential unit prices of multi-floored condominiums, it is unclear ex ante whether higher-floored condominium units would sell at higher prices or lower. In this current endeavor, we investigate this issue to determine which effect dominates, i.e. what is the net effect on prices, while controlling for other relevant price determinants or amenities. Put differently, is there a "higher-floor premium" for residential units in San Diego, California?

Further, if higher floors are associated with higher rents, then perhaps units on the top floor – the penthouse units, as they are often called – offer an additional premium? While this seems to be true anecdotally ("penthouse" is often listed as an amenity in rental or real estate sales advertisements), surprisingly, we are not aware of any other studies that have investigated whether penthouse condominium units confer higher value, controlling for square footage and other important amenities. Since this is a natural extension of our "floor" analysis, wish to investigate this here.

## Data

The data for this study come from the sale of 2,395 condominium units in the downtown San Diego market over the five-year period of July 1, 2006 through June 30, 2011[1]. Real estate professionals involved in residential real estate in downtown San Diego generally classify five distinct sub-markets or "neighborhood" in the area. These markets are indentified as the Marina District, East Village, Cortez Hill, the Core, and the Columbia area. These, as well as other major landmarks such as Coronado Island, and San Diego Bay are shown in Figure 1. The Marina District has both close proximity to San Diego Bay, the San Diego Convention Center and the Gaslamp entertainment area, a gentrified area of the city that has become a hot spot for restaurants, bars and entertainment. The dominant feature in the East Village is Petco Park, home of San Diego's professional baseball team, the Padres. Cortez Hill, as its name implies, is an elevated portion of downtown populated with older buildings. The Core is the traditional CBD for San Diego and contains mostly commercial high-rises. Development in the Columbia area is centered around the historic Santa Fe Railroad Depot and, along with the Marina and East Village includes water front.

## Methodology

Following seminal work in the area of hedonic pricing by Ridker (1967), Ridker and Henning (1967) and Rosen (1974), there are four common methods for estimating condominium sales price variations: standard OLS hedonic price function, log-log, semi-log and Box-Cox transformations. While there is no theoretical motivation for any particular functional form, the two most common forms estimated are the semi-log and Box-Cox transformations. Box-Cox transformations have been shown to reduce coefficient bias (Blackley *et al.*, 1984; Cropper *et al.*, 1988) and semi-log transformations are also appropriate in cases such as these where there are long right-hand side tales

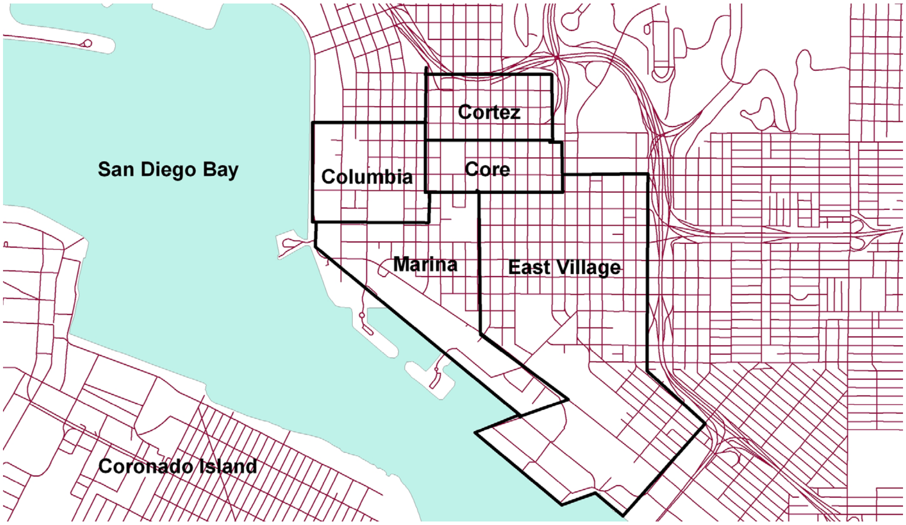


**Figure 1.**
Map of downtown San Diego and neighborhoods

on the dependent variable. Following Brandt and Maennig (2011), Conroy and Milosch (2011), Mahan *et al.* (2000) and Irwin (2002) and many others, we use the semi-log transformation here. The semi-log transformation has the added advantage of ease of interpretation of the coefficients (see below).

In hedonic pricing studies, the value of the house (or condominium unit) is considered to be a summation of the value of the characteristics of that house. The characteristics may be categorized in terms of location, market conditions, or attributes of the structure itself. Differences in the quantity and quality of these attributes then drive the differences in the market value of housing, which is assumed to be in equilibrium. Since there is no market for the attributes that comprise a house, the prices of the attributes are not directly observable. Rather regression analysis is employed to place a value on the attributes. More formally, let there be $i$ site and structural attributes, $j$ location characteristics and $k$ market factors. The semi-log regression equation can be written as:

$$\ln(P) = \alpha + \beta_1 S_1 + \cdots + \beta_i S_i + \lambda_1 L_1 + \cdots + \lambda_j L_j + \mu_1 M_1 + \cdots + \mu_k M_k + \varepsilon, \quad (1)$$

where $P$ is the sales price of a house, $\beta$, $\lambda$ and $\mu$ are coefficients, and $\varepsilon$ is an error term. Site and structural characteristic variables include age, number of bathrooms, bedrooms, and square footage of the unit, which have been found to be important predictors of housing prices (Sirmans *et al.*, 2006). Location characteristics include dummies for each of the neighborhoods, Columbia, Core, Cortez, East Village and Marina as well as our variable of interest, "floor," and related variables such as floor-squared, total number of floors in the condominium, and a top-floor, "penthouse" indicator. We control for market factors by including year indicator variables which should capture any year-specific market effects. Given the changes that were taking place in local housing markets (and, indeed, nationwide) during the survey time (2006-2011), we expect this to be an important control.

In Table I, we present the descriptive statistics of the data set for the condominium buildings within the five geographic areas (or "neighborhoods"). Condominium sales occurred in buildings ranging in age from one to 82 years old. The vast majority have been built in the past ten years. Likewise, there is a large variation in the size of the buildings, with several at four floors (our minimum cutoff for this investigation), and the highest with 43 floors. Comparing this sample to other locations such as Hong Kong, or even New York, Chicago or San Francisco, the average high-rise condominium in San Diego is relatively low[2].

Similar variation exists in the characteristics of the individual condominiums (Table II). Condominium sales prices range from slightly more than $100,000 to over $4 million. The average condominium has a floor area of around 1,100 square feet, but there are units with as few as 296 square feet to as many as 4,528 square feet. Not surprisingly, condominium prices in the San Diego market fell throughout the five-year period included in the data set. We include a series of six "year" dummy variables to capture any changes in market prices over this time that could have been associated with the general real estate market decline. The average floor level on which a unit sold is 8.79, or nearly the ninth floor. The average total number of floors in a condominium for those units who sold is 18.15. The highest volume of sales occurred in the East Village (28.22 percent), with the Core having the fewest (6.40 percent). The five-year data collection period went from the third quarter 2006 through the second quarter 2011. However, the smallest number of sales occurred in 2009 (7.9 percent) due to data collection limitations (see footnote above).

## Results

We estimate three basic models and present them in Table III. In the first estimation, Model 1, we include a "penthouse" indicator variable for units located on the top floor of a condominium building. We do not include a "floor" variable in this model. The results from Model 1 support a positive "penthouse effect," with a coefficient of 0.0452, suggesting that the penthouse is associated with a 4.35 percent higher price, even when controlling for the other factors[3]. Thus, our anecdotal prior belief about the positive value of a top-floor unit is supported by these results. In Model 2, we include our variable of interest, "floor" and note that the coefficient for "penthouse" is no longer significant. The positive penthouse effect seems to disappear once floor level is controlled for.

Results presented in Model 2 are quite similar to those for previously-published papers. The coefficient for "floor," is positive and very significant. In fact, increasing the "floor" by one level is associated with a 2.2 percent increase in sales price. The coefficient for "age" is negative and indicates that each year is associated with about a 0.57 percent decrease in sales price. This may be due to the fact that older housing stock may require more repairs and upgrades due to a depreciating capital stock. As expected, the coefficients for "baths," "bedrooms," and "square footage" are positive

| Sub-market | Units sold | Average total floors | Minimum total floors | Maximum total floors | Average age of buildings | Average sales price ($) |
|---|---|---|---|---|---|---|
| Columbia | 695 | 28.7 | 4 | 43 | 6.3 | 617,904 |
| Core | 165 | 11.5 | 4 | 19 | 7.6 | 339,261 |
| Cortez | 468 | 13.2 | 5 | 40 | 9.8 | 389,009 |
| East Village | 728 | 13.8 | 6 | 33 | 4.7 | 427,916 |
| Marina | 524 | 16.7 | 4 | 41 | 10.3 | 649,478 |
| Total | 2,580 | 18.1 | 4 | 43 | 7.4 | 511,367 |

**Table I.** Descriptive statistics of buildings by geographic region

| Variable | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| Sales price | $511,367 | $338,431 | $120,500 | $4,250,000 |
| Ln sales price | 12.99 | 0.523 | 11.70 | 15.26 |
| Age | 7.36 | 9.54 | 1 | 82 |
| Baths | 1.64 | 0.559 | 1 | 4 |
| Bedrooms | 1.53 | 0.631 | 0 | 4 |
| Square footage | 1,093.8 | 408.05 | 296 | 4,528 |
| Penthouse | 0.088 | 0.283 | 0 | 1 |
| Floor | 8.7 | 7.8 | 1 | 43 |
| Floor squared | 139.5 | 254.1 | 1 | 1,849 |
| Relative floor | 0.52 | 0.28 | 0.02326 | 1 |
| Total no. floors | 18.14 | 11.99 | 4 | 43 |
| Columbia | 0.26 | 0.44 | 0 | 1 |
| Core | 0.06 | 0.24 | 0 | 1 |
| Cortez | 0.18 | 0.38 | 0 | 1 |
| East village | 0.28 | 0.45 | 0 | 1 |
| Marina | 0.20 | 0.40 | 0 | 1 |
| Sale in Q2-2006 | 0.05 | 0.21 | 0 | 1 |
| Sale in Q3-2006 | 0.03 | 0.18 | 0 | 1 |
| Sale in Q4-2006 | 0.05 | 0.23 | 0 | 1 |
| Sale in Q1-2007 | 0.07 | 0.25 | 0 | 1 |
| Sale in Q2-2007 | 0.04 | 0.20 | 0 | 1 |
| Sale in Q3-2007 | 0.03 | 0.18 | 0 | 1 |
| Sale in Q4-2007 | 0.04 | 0.19 | 0 | 1 |
| Sale in Q1-2008 | 0.05 | 0.22 | 0 | 1 |
| Sale in Q2-2008 | 0.03 | 0.19 | 0 | 1 |
| Sale in Q3-2008 | 0.03 | 0.18 | 0 | 1 |
| Sale in Q4-2008 | 0.03 | 0.19 | 0 | 1 |
| Sale in Q1-2009 | 0.03 | 0.18 | 0 | 1 |
| Sale in Q4-2009[a] | 0.04 | 0.20 | 0 | 1 |
| Sale in Q1-2010 | 0.05 | 0.21 | 0 | 1 |
| Sale in Q2-2010 | 0.06 | 0.25 | 0 | 1 |
| Sale in Q3-2010 | 0.06 | 0.24 | 0 | 1 |
| Sale in Q4-2010 | 0.04 | 0.21 | 0 | 1 |
| Sale in Q1-2011 | 0.06 | 0.24 | 0 | 1 |
| Sale in Q2-2011 | 0.07 | 0.25 | 0 | 1 |
| Sale in Q3-2011 | 0.05 | 0.23 | 0 | 1 |

**Notes:** $n = 2{,}580$; [a]sales data for Q2- and Q3-2009 were not available

**Table II.**
Descriptive statistics for condominium sales

and significant. Specifically, an additional bathroom is associated with a 5.3 percent increase in sales price, an additional bedroom with a 9.9 percent increase and a 100-foot increase in square footage is associated with about a 7.5 percent increase. The neighborhood dummies are all negative and significant suggesting that there is a negative "neighborhood effect" *vis-à-vis* the reference category (Marina District). The "Core" neighborhood – in the central core of the CBD – has the largest negative "neighborhood effect" among those considered here. Perhaps this is due to a lack of residential amenities (e.g. grocery stores) available to residents in this sector of the city. Sales occurring in 2006-2010 all seem to have had larger average sales prices, compared to 2011 (the reference category), with the largest effect in 2007. The regression overall explains approximately 87.5 percent of the variation in the dependent variable.

| Variable | Model 1 β | Model 1 *t*-stat. | Model 2 β | Model 2 *t*-stat. | Model 3 β | Model 3 *t*-stat. |
|---|---|---|---|---|---|---|
| Constant | 11.80[a] | 392.3 | 11.77[a] | 501.0 | 11.75[a] | 477.2 |
| Age | −0.0067* | −12.5 | −0.0056* | −13.5 | −0.0057* | −13.5 |
| Baths | 0.0538* | 2.9 | 0.0465* | 3.2 | 0.0439* | 3.0 |
| Bedrooms | 0.1064* | 7.6 | 0.0964* | 8.9 | 0.0960* | 8.8 |
| Square Footage | 0.0009* | 45.4 | 0.0007* | 49.7 | 0.0008* | 49.7 |
| Penthouse | 0.0416** | 2.2 | −0.0157 | −1.0 | – | – |
| Floor | – | – | 0.0215* | 38.9 | 0.0256* | 17.0 |
| Floor Squared | – | – | – | – | −0.0001* | −2.9 |
| Columbia | −0.1066* | −6.7 | −0.1799* | −14.4 | −0.1769* | −14.2 |
| Core | −0.3221* | −12.8 | −0.3064* | −15.6 | −0.3077* | −15.7 |
| Cortez | −0.2503* | −14.8 | −0.1844* | −13.9 | −0.1801* | −13.5 |
| East Village | −0.1276* | −8.1 | −0.0970* | −7.8 | −0.0955* | −7.7 |
| Sale in Q2-2006 | 0.0642** | 2.1 | 0.0494** | 2.1 | 0.0488** | 2.1 |
| Sale in Q3-2006 | 0.3855* | 11.3 | 0.3701* | 13.9 | 0.3695* | 13.9 |
| Sale in Q4-2006 | 0.3141* | 10.9 | 0.3039* | 13.6 | 0.3045* | 13.6 |
| Sale in Q1-2007 | 0.3784* | 14.0 | 0.3537* | 16.7 | 0.3543* | 16.8 |
| Sale in Q2-2007 | 0.3881* | 12.6 | 0.3596* | 15.0 | 0.3576* | 15.0 |
| Sale in Q3-2007 | 0.4084* | 12.4 | 0.3810* | 14.9 | 0.3808* | 14.9 |
| Sale in Q4-2007 | 0.3842* | 12.5 | 0.3643* | 15.2 | 0.3640* | 15.2 |
| Sale in Q1-2008 | 0.4244* | 14.7 | 0.3297* | 14.5 | 0.3312* | 14.6 |
| Sale in Q2-2008 | 0.2694* | 8.6 | 0.2563* | 10.4 | 0.2558* | 10.4 |
| Sale in Q3-2008 | 0.2314* | 7.1 | 0.2265* | 8.9 | 0.2273* | 9.0 |
| Sale in Q4-2008 | 0.1348* | 4.2 | 0.1389* | 5.5 | 0.1390* | 5.6 |
| Sale in Q1-2009 | 0.1370* | 4.1 | 0.1024* | 3.9 | 0.1046* | 4.0 |
| Sale in Q4-2009 | 0.1079* | 3.5 | 0.0875* | 3.7 | 0.0883* | 3.7 |
| Sale in Q1-2010 | 0.0458 | 1.5 | 0.0359 | 1.5 | 0.0355 | 1.5 |
| Sale in Q2-2010 | 0.0322 | 1.1 | 0.0224 | 1.0 | 0.0218 | 1.0 |
| Sale in Q3-2010 | 0.0586** | 2.0 | 0.0537** | 2.4 | 0.0549** | 2.5 |
| Sale in Q4-2010 | 0.0346 | 1.1 | 0.0140 | 0.6 | 0.0155 | 0.6 |
| Sale in Q1-2011 | 0.0308 | 1.1 | −0.0136 | −0.6 | −0.0125 | −0.5 |
| Sale in Q2-2011 | 0.0182 | 0.6 | −0.0150 | −0.7 | −0.0153 | −0.7 |
| *F* stat. | 342.5 | | 595.3 | | 597.5 | |
| Adj $R^2$ | 0.799 | | 0.878 | | 0.878 | |
| N | 2,395 | | 2,395 | | 2,395 | |

**Notes:** Significant at: *1, **5 and ***10 percent levels; dependent variable is Ln(Sales Price); reference categories: Marina (neighborhood) and Sale in Q3-2011; Box-Cox transformation estimations also performed; cannot reject the natural log specification at the 5 percent level, so natural log specification maintained and those results reported here

**Table III.** Semi-log regression estimation results

This is on par with other published results. Note that Model 2, which includes the (very significant) "floor" variable, explains approximately 8 percent more of the variation in the dependent variable than Model 1.

In Model 3, we drop the (insignificant) "penthouse" indicator and add a square of the floor level variable, "floor squared" to see if there are quadratic effects in floor level. Results for Model 3 indicate that the coefficient for "floor squared" is negative and significant, while the "floor" coefficient remains positive and significant. As such, the floor effect appears to be quadratic in price. As floor level increases, the price increases, albeit at a decreasing rate.

So far, the model specifications for estimating the impact of a floor level have only included "penthouse," "floor" or "floor squared." We wish to perform further tests in order to see if the floor effect is monotonically increasing. To do this, we create a piecewise linear spline on the independent variable, "floor," breaking the number of floors into five categories (1-4, 5-8, 9-12, 13-16 and 17-20 floors). These categories express the effect for the specific floor groupings compared to the reference category, namely, higher floors not explicitly controlled for in the model (Table IV).

Results presented in Model 4 indicate that the lowest category (1-4 floors) has a larger negative effect on sales price (−0.290) compared to the next category, 5-8 floors (−0.224). These negative effects are in reference to the omitted category, floors higher than the eighth floor[4]. Does this "lower-floor penalty" persist if we expand the model to include more categories? Results presented in Models 5 and 6 suggest that it does. In Model 6, the effect of a unit being located in the first four floors of a building is −0.461 (compared to units located above 20 floors). This lower-floor penalty declines monotonically in magnitude to a value of −0.146 for the units in floors 17-20. Comparing coefficients for each of the categories, the change in magnitude of the penalty seems to be largest going from "floors 5-8" to "floors 9-12" (the coefficient falls in magnitude from −0.395 to −0.270). Perhaps the ninth floor is just high enough to get a major shift in the trade-off between the negative travel effect and the positive ambience effect. The coefficients for floor categories are shown in Figure 2.

## Conclusion

This investigation has been an attempt to investigate the existence of a "higher-floor premium" in condominiums in San Diego, California. In particular, we have attempted to address two major shortcomings of prior investigations; namely that they have been rather narrow geographically (occurring largely in Southeast Asia) and methodologically (including "floor" or "story" as a control, rather than a focus of analysis and without considering a separate "penthouse premium").

Economic theory implies there may be two competing forces affecting the decision to live on higher levels of a condominium building. On one hand, higher-level floors are associated with longer travel times within a given building and hence higher implicit travel costs. However, there may also be positive amenities associated with living higher up such as less traffic noise, better views, etc.

Results presented here generally confirm those of prior investigations. Condominium units located on higher floors are associated with higher-sales prices, controlling for other relevant factors such as square footage, age, neighborhood and year sold. In other words, the positive ambience effect seems to dominate the higher travel costs associated with living on higher floors. With very significant and positive coefficients for "floor" in Models 2 and 3 (and their analogs in Models 4-6), our results support the existence of a higher-floor premium. Specifically, we find that increasing floor level by one (at the mean) is associated with about a 2.2 percent increase in sales price. The floor level effect appears to be quadratic, with the coefficient for floor-squared negative and significant. Thus, higher floors are associated with higher sales prices, though the increase occurs at a decreasing rate.

We do find some evidence for a "penthouse" effect in a simple model without controlling for "floor," though the effect seems to disappear once we include "floor" in the model. In other words, the top-floor does not seem to confer any additional value over and above its advantage of being on a higher floor. When dividing the floors into

| Variable | Model 4 β | Model 4 t-stat. | Model 5 β | Model 5 t-stat. | Model 6 β | Model 6 t-stat. |
|---|---|---|---|---|---|---|
| Constant | 12.10[a] | 341.1 | 12.14[a] | 326.7 | 12.49[a] | 281.9 |
| Age | −0.0076* | −13.6 | −0.0064* | −11.3 | −0.0116* | −8.9 |
| Baths | 0.0019 | 0.10 | 0.0369* | 1.7 | −0.0191 | −0.7 |
| Bedrooms | 0.138* | 9.0 | 0.1221* | 6.9 | 0.1361* | 6.3 |
| Square footage | 0.0008* | 43.7 | 0.0008* | 40.9 | 0.0007* | 36.0 |
| Floors 1-4 | −0.282* | −20.4 | −0.350* | −22.6 | −0.453* | −22.5 |
| Floors 5-8 | −0.2155* | −16.5 | −0.2823* | −19.4 | −0.3901* | −21.0 |
| Floors 9-12 | – | – | −0.1713* | −10.4 | −0.2691* | −13.3 |
| Floors 13-16 | – | – | – | – | −0.2006* | −9.5 |
| Floors 17-20 | – | – | – | – | −0.1449* | −7.1 |
| Columbia | −0.1770* | −10.8 | −0.1662* | −10.3 | −0.1605* | −9.2 |
| Core | −0.3528* | −11.6 | −0.3210* | −10.8 | – | – |
| Cortez | −0.2501* | −12.7 | −0.2821* | −13.7 | −0.3092* | −13.4 |
| East village | −0.1060* | −5.7 | −0.0535* | −2.8 | −0.1044* | −4.7 |
| Sale in Q2-2006 | 0.0332 | 1.0 | 0.0415 | 1.2 | 0.0116 | 0.35 |
| Sale in Q3-2006 | 0.3217* | 8.1 | 0.3257* | 8.3 | 0.2717* | 5.5 |
| Sale in Q4-2006 | 0.2719* | 8.0 | 0.2731* | 6.7 | 0.2818* | 5.8 |
| Sale in Q1-2007 | 0.3030* | 10.1 | 0.2859* | 9.4 | 0.2326* | 7.0 |
| Sale in Q2-2007 | 0.3017* | 9.0 | 0.2877* | 8.2 | 0.2635* | 7.2 |
| Sale in Q3-2007 | 0.3553* | 10.1 | 0.3408* | 9.6 | 0.3562* | 8.6 |
| Sale in Q4-2007 | 0.3455* | 11.0 | 0.3062* | 8.9 | 0.3105* | 8.3 |
| Sale in Q1-2008 | 0.3644* | 12.2 | 0.3534* | 11.6 | 0.3047* | 10.0 |
| Sale in Q2-2008 | 0.2377* | 7.2 | 0.2132* | 6.2 | 0.2620* | 7.2 |
| Sale in Q3-2008 | 0.2222* | 6.3 | 0.2325* | 6.3 | 0.2134* | 5.3 |
| Sale in Q4-2008 | 0.1052* | 3.1 | 0.1076* | 3.0 | 0.1703* | 4.3 |
| Sale in Q1-2009 | 0.1312* | 3.8 | 0.1330* | 3.6 | 0.1372* | 3.6 |
| Sale in Q4-2009 | 0.0995* | 3.0 | 0.1002* | 3.0 | 0.0906* | 2.6 |
| Sale in Q1-2010 | 0.0004 | 0.01 | 0.0027 | 0.08 | 0.0154 | 0.42 |
| Sale in Q2-2010 | −0.0163 | −0.56 | −0.0122 | −0.41 | 0.0084 | 0.25 |
| Sale in Q3-2010 | 0.0165 | 0.56 | 0.0135 | 0.45 | 0.0137 | 0.40 |
| Sale in Q4-2010 | 0.0208 | 0.66 | 0.0254 | 0.79 | 0.0024 | 0.07 |
| Sale in Q1-2011 | −0.0190 | −0.66 | −0.0223 | −0.75 | −0.0285 | −0.91 |
| Sale in Q2-2011 | −0.0076 | −0.27 | −0.0007 | −0.03 | −0.0158 | −0.54 |
| *F* stat. | 332.08 | | 316.54 | | 215.09 | |
| Adj. $R^2$ | 0.8493 | | 0.8636 | | 0.8646 | |
| n | 1,704 | | 1,496 | | 1,040 | |

**Notes:** Significant at: *1, **5 and ***10 percent levels; dependent variable is Ln(Sales Price); reference categories: all floors higher than the highest spline specification in each model, e.g. for Model 4, all floors higher than eighth floor are reference category; Marina (neighborhood); and Sale in Q3-2011; Box-Cox transformation estimations also performed; cannot reject the natural log specification at the 5 percent significance level for Model 4; however, no coefficients changed signs or relative magnitude and only one (Bathrooms) changed significance levels (increased in significance to 5 percent level); cannot reject the natural log specification at the 5 percent significance level for Models 5 or 6 so natural log specification reported here

**Table IV.** Semi-log regression estimation results with floor dummies

categories, we find the coefficients for lower floor categories to be more negative than the floors in higher categories. Thus, the higher-floor premium appears to increase monotonically from lower to higher floors. In addition, there appears to be a slightly larger increase in the higher-floor premium moving from the 5-8 floors category to the

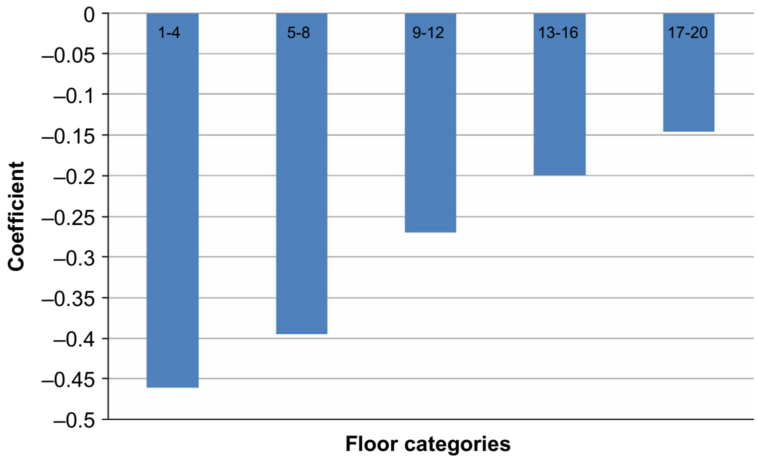


**Figure 2.**
Coefficient for floor categories, 1-4 through 17-20

9-12 floors category. We speculate that this could be a transition point where the positive ambience effect dominates much more than the negative travel cost effect (moving up from the 5-8 floors to the 9-12 floors category).

While we control for a number of factors affecting sales price and our adjusted $R^2$ values are in line with other published reports in this area, data limitations prevented us from considering other factors such as noise level (Brandt and Maennig, 2011), average elevator speeds and ocean views (Rodriguez and Sirmans, 1994; Benson *et al.*, 1998). An additional limitation of this study is that San Diego's high-rise condominium market may be lower on average than some other large cities, which could limit the generalizability of this study. We leave these and other issues for future research.

## Notes

1. Due to data limitations, we were unable to obtain data for the third and fourth quarters of 2009, though we do not expect those omissions to affect our results. While there were 2,580 condominium sales in the data set, missing values for some of the observations resulted in 2,395 observations used in the regression estimations.
2. However, our mean number of floors is similar to the mean reported for the two Singapore studies referenced above.
3. We interpret the coefficients from the semi-log estimations following Thornton and Innes (1989, p. 444), who suggest that "to calculate the true proportional change in Y resulting from a non-infinitesimal change in X, one would have to calculate: $g = \exp(b\Delta X) - 1$." See also, Halvorsen and Palmquist (1980) for a related discussion on interpretation of dummy variables.
4. Only observations for which there were more than eight floors were included in this estimation, which is why the number of observations has fallen to 898.

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## Corresponding author

Andrew Narwold can be contacted at: drew@sandiego.edu