Factors Influencing CBD Land Prices

by Bill Mundy, CRE, & John A. Kilpatrick

Pricing land in central business districts (CBD) offers a challenging paradox. During economic "boom" times, the conventional wisdom is that land values should soar with increasing demand and decreasing vacancies. Conversely, accurate forecasting of these values is problematic since comparable transactions are relatively infrequent and thus time factors are often erratic. As developable CBD land becomes increasingly short in supply, developing useful supply, demand, and pricing models for Counselors is more than an academic exercise.

Generally accepted appraisal methodology (*i.e.*—"First Generation" approaches)[1] leave much to be desired in this context. A straightforward sales comparison approach is deficient, since aggregate adjustments to sales – particularly for market conditions – can often exceed 100 percent of the unadjusted sales price due to rapidly changing markets. A land extraction method (extracting the depreciated value of the building from the sales price to arrive at land values) can be fraught with errors due to judgmental issues in determining depreciation and verifying data.[2] Other first-generation techniques (cost, income) are not even applicable.

As such, second generation techniques (*e.g.*—regression modeling, survey techniques) are increasingly appropriate for valuing CBD building sites. This manuscript reviews one application of time-series regression modeling and presents a recent case study from Seattle which illustrates when such modeling can be useful.

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REGRESSION ANALYSIS – AN OVERVIEW

Regression analysis has been a fixture of economic analysis for over a hundred years. Bruce and Sundell (1977) shows that regression analysis has apparently been used in real estate valuation since 1924[3] and more recently Colwell and Dilmore (1999) show that a 1922 monograph by G.C. Haas of the University of Minnesota's Division of Agricultural Economics utilized this methodology in the analysis of rural land prices.[4] The modern regression models to estimate land prices (often referred to as "hedonic models" when used to value real estate) owe their roots to the work of Colwell and Sirmans (1980),[5] Chicoine (1981),[6] Kowalski and Colwell (1986),[7] and others. Isakson (1997) recently extended these models to value urban land using sale date, distance from an interstate corridor, zoning, and buyer and seller characteristics as explanatory variables. His model was statistically significant and explained about 43 percent of the variance in prices on a set of 363 land sales in Denver between 1985 and 1992.

These regression models can be viewed as a variation of the sales adjustment grid, a long-standing mainstay of first-generation appraisal methodology. While appraisers would traditionally use two or more "paired sales" to estimate adjustments which then would be applied in an adjustment grid, the hedonic model collapses these two steps into one, and uses a richer data set coupled with a more advanced set of statistical tools.

Indeed, in this context, the rich set of analytical tools implicit in hedonic modeling may make it a preferred variant on the sales adjustment grid, when properly applied. Wolverton (1998) shows that normative paired-sales has an implicit linear relationship, and thus fails to account for diminishing marginal price effects.[8,9] Pace (1998a[10] and 1998b[11]) and Ramsland and Markham (1998)[12] show that using the hedonic model improves on the sales adjustment grid solution. Colwell, Cannady, and Wu (1983), in their review of the sales comparison approach, suggest that coefficients estimated from a regression equation should be used as factors in the adjustment grid.[13] Isakson (1998)[14] further applies the hedonic model to the appraisal review process.

REGRESSION MODELING USING ECONOMIC VARIABLES

Appraisal methodology derives from the general theory that, at equilibrium,[15] the value of real estate is a function of utility, scarcity, desire, and effective purchasing power.[16] Real estate pricing models are equilibrium models because they estimate market value as the interaction of supply and demand at equilibrium. Over the years, appraisal methodology has evolved as an explanatory model which uses the prices of similarly situated properties ("comps") to estimate the value of the property in question. However, it is clear that appraisal theory would accommodate other equilibrium pricing models, and indeed it appears that the currently popular first-generation approaches are simply special cases of a more generalized pricing model.

To the extent that appropriate data is available, the first-generation approaches to value may suffice. However, when data is unavailable or when the Counselor wants to use multiple approaches, other general equilibrium models which rely on more readily available data may be useful. Critics would suggest that there is one and only one set of traditional methods that can be used to explain market prices and hence estimate or forecast market values. However, the realities of economic analysis are just the opposite.

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Hence, a model which uses, for example, general economic variables and which explains price variation would appear to be at least as good as one which uses comparable market prices to explain subject property prices. If the generalized economic model has a stronger fundamental basis in

economic reality, then it may be preferred even if it only does "as good" a job of explaining prices.

The use of general economic factors to explain asset prices is well steeped in economic literature. One economic model which was developed to explain stock prices was the Capital Asset Pricing Model (CAPM). It is analogous to first-generation appraisal methods (specifically the sales adjustment grid) in that the CAPM uses the prices of similar assets (in this case, the Markowitz[18] - type diversified market portfolio and a risk-free asset) to develop an explanatory model for any other asset within that market portfolio.[19] If real estate is included in a market portfolio (as increasingly it is due to the proliferation of REITs), then CAPM is a perfectly good general equilibrium model for pricing real estate, albeit one not frequently used for pricing non-securitized assets.[20] Ross (1976) developed the Arbitrage Pricing Theory (APT), a more generalized model which allows for numerous factors to be applied to explain the price of an asset.[21] While the extension of an APT-like model to real estate pricing at equilibrium seems intuitively obvious, it is even more so driven when one considers the arbitrage motivations of the classical real estate investor.

TIME-SERIES ECONOMIC DATA

If the sales adjustment grid can be viewed as a special case of a multiple regression methodology, then it is one which uses *cross sectional* data (sales that have occurred within a confined time span, *i.e.*—the last one or two years) versus *time-series* (also called *longitudinal*) data. The use of time-series data carries with it two important implications:

1. What are the factors which cause real estate prices to vary over a longer time-frame?
2. What sort of statistical implications are there in using time-series data?

The first question has been fairly well treated in the salient real estate literature. Rice (1992) developed and supported the long-term economic model which demonstrated that real estate prices were cyclically depressed by economic forces in the late 1980s and early 1990s, and that the trend back to long-term economic equilibrium would require a long-term transition. As of the time of his writing, the nation had approximately 5.7 billion square feet of office space, of which about one billion square feet were vacant. At an average factor of 250 square feet per worker, the nation's economy in 1992 – still in recession – needed to expand by four million workers to fill the then-existing vacant space. Thus, Rice foresaw the long-term stagnation of developable land prices in the downtowns of the U.S., and the price recovery the real estate economy is just now experiencing.[22] In the same vein, Dolde and Tirtiroglu (1997) use data over a 13-year period (1982-1994 inclusive) to measure property value changes in Connecticut and San Francisco.[23] Also, Meese and Wallace (1994) use data over 19 years (1970-1988) to model San Francisco real estate values.[24]

Second, the empirical questions associated with using time-series models and data to estimate real estate prices have been addressed thoroughly by Clapp (1990),[25] Isakson (1997),[26] and others.

SEATTLE DOWNTOWN LAND PRICES – A CASE STUDY

The link between employment and the health of the economy is widely known and generally appreciated by the lay person. However, the specific mechanism by which employment drives other sectors of the economy is not fully appreciated. Specifically, the channels by which employment drives land prices is not widely understood.

First, land prices are driven by the demand for raw land to build buildings. In Downtown Seattle, for example, the buildings are most often offices, which house workers. Simple logic suggests that as the number of workers increases then the demand for office space increases, and so does the demand and hence the price of land. However, the linkage is not so simple -- why does the number of office workers increase in the first place? How does the number of workers at, say, a Boeing plant in the suburban city of Everett influence the number of workers at a bank in Seattle?

People work and pay taxes. The income left after paying taxes (plus or minus a few adjustments) is disposable income. Spending patterns may or may not equal current disposable income. For example, if a household thinks that its job prospects are pretty good for the near future, and that income is expected to rise, then they may be willing to go into debt to purchase additional things, such as cars, homes, and appliances. Conversely, if a household is worried about employment in the near future, then they will tend to save or invest more, and defer purchases of big-ticket items.

Hence, the economy is not just a function of employment, but of the expectation of employment

and income in the near term. Low unemployment rates, coupled with increasing salaries, generally translates into a booming economy where people buy well beyond their current income dictates.

Office space demand (and hence, office land price) is a direct result of this economic reality. Robust employment and income causes households to spend money, and this money is multiplied several times in the economy.[27] Bankers, attorneys, accountants, and investment houses – among other office functions – are all secondary recipients of the increased spending which results from these positive expectations. The following sections briefly outline some of the linkages by which the economy in Seattle, as an example, is manifested in increased land prices.

Unemployment Impacts on Land Prices

The principal driving force behind raw land prices in downtown Seattle is the record low unemployment rate presently felt throughout the Puget Sound region. The robust employment picture generates four principal secondary effects that are linked to downtown land prices:

Retail — The healthy economy – particularly the stability of employment and the relative shortage of skilled workers – has driven up wages in the area, resulting in record levels of per-capita and aggregate disposable income. This, coupled with the stability of employment – signified by the persistence of low unemployment – stimulates record levels of retail spending. This, in turn, stimulates increases in retail space absorption in Downtown Seattle, at record per-square-foot prices (both rents as well as space prices).

Professional Offices — A significant portion of the employment base is white-collar office employment. Recent economic analyses of the Puget Sound economy indicate that transportation manufacturing (*e.g.* – Boeing) plays a much less significant role in the local economy than at any time in second half of the 20th century. The basic (exportive) economy of the Puget Sound region today stands on three legs: transportation, high-technology, and agriculture (including forest products). Much of the downtown Seattle demand for office space is to house the increasing numbers of individuals employed in the rapidly growing sectors which directly support this basic economy (*e.g.* – accountants, bankers, attorneys, and the investment sector) as well as headquarters for businesses directly involved in the exportive field.

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Tourism – In simple terms, conventions = hotels. As businesses profit, they are increasingly able to participate in conventions, trade shows, training sessions, and other hotel uses. Hotels have proliferated in downtown Seattle in the past few years, with healthy occupancy rates and increasing room rates. Tourism and hotel occupancy generate substantial secondary effects, including bars and restaurants, entertainment, and taxis and limousine services. All of these require real estate.

Government – Government growth has a component which is sensitive to the economy as well. As citizens' confidence grows, new bonding is allowed. As taxpayers' incomes grow, increased taxes are paid. This provides money for government to expand, and downtown Seattle has seen a new Federal building, new transit facilities, and new city buildings.

In summary, the unemployment rate is a proxy for a healthy and robust economy, and is a direct measure of the stimulation in downtown land prices currently being felt. *Table 1* shows the recent end-of-year unemployment statistics, as well as consensus projections for end-of-year unemployment for the coming years. *Table 1* (Puget Sound Unemployment Rate) illustrates the collapse in the unemployment rate since 1996.

Office Space Impacts on Land Prices

Demand for office space is directly measured in terms of office absorption. It is important to note that, as with any demand function, it is also necessary to measure contemporaneous supply (generally measured in terms of the vacancy rate).

Tables 1 - 4

Table 1

Puget Sound Unemployment Rate

Year	*Unemployment Rate*
1991	5.3
1992	6.7
1993	6.7
1994	5.8
1995	5.6
1996	5.3
1997	3.7
1998	3.1
1999	3.0

Table 2

Downtown Seattle Office Absorption

Year	*Square Feet Absorbed*
1991	208,254
1992	-617,791
1993	350,392
1994	846,221
1995	1,550,616
1996	850,672
1997	1,237,363

Table 3

Downtown Seattle Office Vacancy Rates

Year	*Office Vacancy Rate*
1991	13.7%
1992	15.3%
1993	13.0%
1994	10.9%
1995	7.6%
1996	6.3%
1997	5.0%
1998	4.8%
1999	4.1%

Table 4

Puget Sound Annual % Change in Household Income

Year	*Annual % Change*
1990	8.05%
1991	4.32%
1992	5.11%
1993	1.43%
1994	2.90%
1995	4.57%
1996	7.19%
1997	6.13%

In the case of the Seattle market, absorption statistics indicate a substantial increase in demand during the most recent years, as indicated in *Table 2*.[28] Note that annual absorption was well under 1,000,000 square feet in each year from 1991 through 1994, and was even negative (indicating loss in tenants) in 1992. Overall, the average absorption (demand) for office space during the four-year period 1991-1994 was 196,769 square feet annually. However, in 1995, this jumped to over 1.5 million, and the average annual absorption in the three-year period 1995-1997 was 1.2 million square feet – about six times the earlier average. If coupled with decreasing supply, this would indicate impending upward price pressure on both office space and the principal factor of production for new office space– the raw land.

Again, the other important factor – the supply measure — is the office vacancy rate for Downtown Seattle. While unemployment is a more powerful predictor (statistically), its effects are secondary and tertiary. Decreased unemployment means people will spend more of their income on products and services which will have an indirect yet powerful impact on the demand for downtown space.. Vacancy, on the other hand, has a more direct and fairly obvious bearing on land prices. While the relationship between vacancy rates and land prices is not necessarily linear, it is clearly causal. For example, a relatively high (greater than 10 percent) vacancy rate would have little predictive power for land prices, nor would a change from, say, 15 percent to 10 percent. However, below 10 percent or thereabouts, vacancy rates have powerful predictive power, since vacancy rates at very low levels trigger office construction and anticipatory land speculation. *Table 3* (Downtown Seattle Office Vacancy Rates) illustrates the recent trends in vacancy rates.

A simple visual inspection of the data suggests that office vacancy rates may have a lagged predictive element to land prices. In other words, the sharp decline of vacancy rates, from 10.9 percent in 1994 to 7.6 percent in 1995 did not begin to be felt until 1996 transactions were negotiated. This is reasonable and logical, since land prices tend to be set after data such as this is known in the marketplace. Sellers who find out about declines in vacancy rates (often six to 18 months after the fact) will then offer land for sale at prices influenced by those vacancy rates. Similarly, buyers will react to announcements of vacancy rates (again, six to 18 months after the fact) and will enter the market with bids on those parcels.

Household Income

As mentioned earlier, household income is a driving force in the economy, both directly (more income translates into more spending) as well as indirectly (anticipated stability and increase in income has a multiplicative impact). In the Puget Sound market, annual percentage increases in household income were on a decidedly downward trend from 1989 through 1993, suggesting a destimulus in spending and reductions in the multiplicative impact through the economy. *Table 4* (Puget Sound Annual percent Change in Household Income) illustrates these trends.

The average annual increase in household earnings fell to a low of 1.43 percent by 1993, and the average from 1991 through 1995 was only 3.7 percent. However, after the bottoming in 1993, the trend turned decidedly upward, and in 1996 and 1997 rose above 7 percent and 6 percent respectively. These annual increases – and the acceleration in annual increases – translates into a powerful force for increased consumer spending, consumer borrowing, and multiplicative impacts throughout the Seattle economy.

Retail Sector Impacts

Ultimately, increases in household earnings, low and decreasing unemployment, and other economic factors translate into increased retail spending. The retail linkage is important in Downtown Seattle for two reasons. First, retail headquarters operations are directly impacted, resulting in increased demand for office space. More significantly, however, is the substitution price impacts in the Downtown Seattle market. The area can roughly be divided into three sectors – government, financial (office), and retail. Statistical analysis of land prices in the three sectors indicates that the government market is separate unto itself, and has no direct impact on financial sector prices.

However, that same statistical analysis shows a high degree of correlation between retail sector land prices and office sector land prices. In other words, over time the two sectors tend to be price substitutes for one another, and the price trends are statistically identical. Thus, factors that cause retail sales (and hence demand for retail space) in Downtown Seattle also positively impact office sector land prices.

While retail sales have been on a general upward trend throughout the 1990s, the trend actually slowed during the early years of the decade,

Tables 5 - 8

Table 5

Downtown Seattle
Retail Spending Patterns

Year	*Sales ($ millions)*	*% change from previous*
1991	$ 35,604.93	2.57%
1992	$ 36,209.36	1.70%
1993	$ 37,422.02	3.35%
1994	$ 38,418.33	2.66%
1995	$ 39,364.96	2.46%
1996	$ 41,590.58	5.65%
1997	$ 43,987.00	5.76%

Table 6

Downtown Seattle
Traffic Counts

Year	*# of Cars Daily*	*% change from previous*
1991	431,412	2.09%
1992	432,786	0.32%
1993	436,682	0.90%
1994	444,779	1.85%
1995	449,592	1.08%
1996	460,435	2.41%
1997	466,421	1.30%

Table 7

Parking Revenues --
Representative Facility

Year	*Average Daily Revenue*[29]	*% change from previous*
1991	921.38	3.15%
1992	954.76	3.62%
1993	1072.96	12.38%
1994	1083.68	1.00%
1995	1143.09	5.48%
1996	1358.69	18.86%
1997	1495.79	10.09%

Table 8

Downtown Seattle
Land Prices

Year	*Unemployment Rate (contemporaneous)*	*Vacancy Rate (lagged)*	*Land Prices*
1985	6.80%	14.50%	238.14
1986	6.79%	14.97%	363.76
1987	6.38%	15.23%	265.49
1988	5.12%	11.60%	226.70
1989	4.93%	14.20%	255.19
1990	3.77%	14.00%	298.30
1991	5.29%	13.50%	197.14
1992	6.66%	13.70%	140.97
1993	6.74%	15.30%	125.45
1994	5.85%	13.00%	196.46
1995	5.57%	10.90%	175.95
1996	5.31%	7.60%	179.45
1997	3.66%	6.30%	249.15
1998	3.10%	5.00%	325.62

reaching an annualized increase bottom of 1.7 percent in 1992. However, after several years of sluggishness, annual increases jumped from 2.46 percent in 1995 to well above 5 percent in both 1996 and 1997. This change in retail sales patterns (contemporaneous with other predictive variables) predict sharp increases in demand for retail space, as well as sharp increases in retail and office sector land prices. *Table 5* illustrates the specifics (Downtown Seattle Retail Spending Patterns) showing both the early 1990's stagnation and the later-years jump in spending.

In thin but rapidly moving markets, traditional appraisal methods may fail to provide adequate accurate value estimates or forecasts. Given the magnitude of the potential errors, these are not trivial issues, and are matters of significant importance in the real estate profession.

Downtown Traffic Patterns

A collateral predictor of downtown retail demand, and hence downtown office space demand and land prices, is downtown traffic. While traffic counts downtown have increased each year in the 1990s, closer examination shows the same stagnation in the early part of the decade, followed by accelerated upward trends in the latter part of the decade. *Table 6* (Downtown Seattle Traffic Counts) illustrates the details.

Downtown Parking Revenues

Additional evidence of downtown economic trends can be examined from parking revenues. Since these are difficult to aggregate, we chose to analyze a representative parking facility over time. *Table 7* shows the results.

The average annual increase for the period 1991-1995 was 5.1 percent, principally skewed upward by changes from 1992 to 1993. As shown, in three out of the five years, annual revenue increases were below 4 percent. However, in 1996 and 1997, annual increase percentages were substantially higher, averaging 14.5 percent those two years.

Land Prices

From 1970 through 1977, downtown Seattle land prices were sluggish, rising less than 4.5 percent per year. However, from 1977 through 1983, land prices rose dramatically, with average annual land price increases of nearly 43 percent over that period. Land prices rose in response to a rapidly expanding Seattle economy, with the two key factors being relatively low unemployment (6.4 percent in 1980) and low office vacancy rates (reaching a trough of 2.3 percent in 1979).

However, land prices soon began to fall, and from 1983 to 1993 dropped an average of 10.5 percent annually. Two factors coincided to stimulate this long-term systemic drop in prices – a sluggish economy in the early 1980s coupled with overbuilding of office space. For example, unemployment in the Puget Sound area reached peaks of 10.3 percent in 1982 and 9.9 percent in 1983, coincidental with the cyclical "top" of the land price market. Additionally, office vacancies soared at the beginning of the 1980s, with the vacancy rate increasing from 2.3 percent to 15 percent in just six years (1979-1985).

Land prices again reached a bottom in 1993, but the principal indicators which signaled the regime shift in 1983, again signaled a change in direction for land prices. Unemployment in the region, which held above 5 percent since 1991, fell precipitously in 1996 and dropped to 3.3 percent by 1997. Year-end unemployment for 1999 reached approximately 3 percent, and was projected to hold at or below these levels for several years into the future. Additionally, the double-digit office vacancies of the 1980s and early 1990s were fully absorbed by 1998, with the year-end vacancy rate below 5 percent — one-third the level experienced in the overbuild 1980s. Vacancy rates, unemployment, and land prices for the period 1985 through 1998 are shown in *Table 8*.

MODEL DEVELOPMENT

A basic hedonic pricing model, in the absence of a supply constraint, would take the form:

$$Land\ Value = f\,(x_1, x_2, \ldots x_n)$$

where x_1 through x_n are various characteristics, and $f(\ )$ describes a pricing function, usually estimated from a linear regression model. Parsimony dictates the use of the most simple model which will accommodate known and expected characteristics of the data.

Data and Analytical Methodology

To estimate the functional form of the model, it was first necessary to gather a broad sample of

downtown land sales and cross-sectional pricing variables. Eighty-two separate transactions were analyzed, spanning 14 years (1985-1998), and these parcels were described by 26 separate characteristics.

Transaction prices in three different forms (raw price, price per square foot, and price per square foot of FAR) were regressed on individual and groups of variables. In all, over 100 separate regression analyses were performed. Additionally, variables were regressed in linear form, in semi-log form, and log-log form (commonly known as a "Box-Cox" transformation). This last form was chosen due to the expected non-linearity in the data.

The decision rule was to maximize both the adjusted R^2 of the regression model as well as the statistical F-test. In short, these two measures, which tend to move in tandem, measure the ability of the statistical model to account for variation in the data.

It is also important to carefully analyze models for other specification errors. It is possible to have a model with a very high R^2, but very fragile in terms of predictive power due to poor specification. Parsimony in selection of explanatory variables is key, and thus it is typically considered appropriate to "optimize" R^2 while at the same time minimizing the number of variables used in the model. In the final analysis of this model, only two explanatory variables were needed to adequately explain land values. Earlier models tested included as many as 16 variables simultaneously.

Additional tests were performed both before and after construction of the models to determine the quality of the data. For example, statistical t-tests of price means were conducted on logical groups of data (*i.e.* – government area transactions versus financial area transactions) to determine if all of the data came from uniform underlying populations. Time series tests were performed to determine if there were temporal characteristics which were otherwise unexplained by the other variables. Corner lots were tested against non-corner lots, and zoning characteristics and FAR assignments were tested.

Findings

The final functional form determined by the regression analyses was:

$$\ln(prices) = a + b\ln(unemployment + c\ln(vacancy\ rates) + e$$

where a, b, and c are standard regression output coefficients, and e is an error term, assumed (after the Box-Cox transformation) to be normally distributed with a mean of zero and a standard deviation of one. These are the typical constraints of a best, linear, unbiased estimator of land prices.

The analysis revealed six key findings in addition to the model:

1. Land prices in the financial district were statistically equal to those in the retail district, but not equal to those in the government district.
2. Corner lots and non-corner lots do not have statistically different prices.
3. Zoning characteristics (for commercially zoned parcels) were not statistically significant.
4. Selling price per square foot was not a function of parcel size.
5. The impact of unemployment appears to be contemporaneous, consistent with a hypothesis that developers (buyers of land) react to leading economic variables.
6. The impact of vacancy rates appears to be lagged by one year, consistent with a hypothesis that developers rationally react after key supply variables are revealed.

The regression model yielded the following coefficients:

$$a = 7.7425$$

$$b = -1.4681$$

$$c = 0.1057$$

It was additionally necessary to deal with the issue of a supply constraint. Model adjustments were found useful to proxy for the pricing problems associated with this supply constraint. Specifically, land prices were adjusted to the third quartile rather than the means. This was accomplished by analyzing the distributions around the means in sample data to determine the approximate average relationship between the third quartile and the mean. It was found that the third quartile is approximately 1.24 times the mean, on average.

Mid-1999 land values, on a per-square-foot basis, are thus estimated as follows:

$$Land\ Value = 1.24[e^{7.4725-1.4681\ln(unemployment)+0.1057\ln(vacancy\ rate)}]$$

Final regression results included an adjusted R^2 of 83.38 percent, and an F-test statistic of 21.0728, which indicates that the model has a statistical reliability of approximately 99.8 percent.

Predictive Results

Using this model, downtown Seattle land prices would be predicted at $513 at mid-year 1999. At the same time, appraisers in Seattle were forecasting 1998 and 1999 land prices no greater than $425 per square foot.[30]

While there were a limited number of actual transactions consummated in Seattle during this period, the transactions which were consummated were well predicted by the model. Indeed, traditional appraisal methods failed to account for transactions above $500 per square foot. However, the lowest price we recorded for a developmental commercial parcel in the downtown Seattle study area during the months following the conclusion of this study was $543 per square foot.

SUMMARY & CONCLUSIONS

In thin but rapidly moving markets, traditional appraisal methods may fail to provide adequate accurate value estimates or forecasts. Given the magnitude of the potential errors, these are not trivial issues, and are matters of significant importance in the real estate profession. This study shows the usefulness of a time-series regression model which uses economic data to provide more accurate forecasts of prices in rapidly moving markets.

Clearly, the model developed herein should not be viewed as static, either in coefficient value or in functional form. Rather, this study demonstrates the usefulness of time series regression methodology. REI25

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20. Subsequent versions of the CAPM have examined multiple effects, such as month of the transaction and size of the subject firm. These subsequent variations on the CAPM increasingly resemble the Sales Adjustment Grid.
21. Ross, S., "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory*, 1976, pp.343-362. Copeland and Weston (1988) show that CAPM is simply a special case of the APT. See Copeland, T., and J. Weston, *Financial Theory and Corporate Policy* (Reading, MA: Addison-Wesley, 1988), pg.193.
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25. Clapp, J., "A Methodology for Constructing Vacant Land Price Indices," *The AREUEA Journal*, 1990, pp.275-293.
26. Isakson, Hans R., "An Empirical Analysis of the Determinants of the Value of Vacant Land," *Journal of Real Estate Research* 13, 1997, pp.103-114.
27. Current consensus estimates would put multiplier factors for Seattle at 2.4 – 2.7 times. In simple terms, an additional dollar of earnings in Seattle actually results in about $2.40 to $2.70 in extra spending.

28. Table 2 and several subsequent tables were developed two years ago for an early version of this model, and hence does not include data after 1997.
29. This is an index number designed to shield the parking operator's identity but accurately reflect the revenue changes.
30. Indeed, appraisers engaged by the State of Washington in a major downtown land condemnation case during the Spring of 1998 forecasted prices much lower than these.

ABOUT THE AUTHORS

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