Housing Price Models for the Walnut Station Redevelopment Area

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Abstract: This study examines the rent prices of apartments and sale prices of condominiums in Eugene, Oregon. In it, an hedonic pricing model is used to capture the value people place on specific characteristics of the residential units. Applications include the determination of potential rent or sale prices of redeveloped land in, and around, the Walnut Station area that covers several blocks along Franklin Boulevard, to the northeast side of University of Oregon campus.

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I. Introduction

Over the past year, the city of Eugene has recognized the inevitability of growth and change along the Franklin Boulevard corridor, especially in the Walnut Station area. The city planners, along with the University of Oregon, private business and property owners, and residents have recently been working together to plan for the redevelopment of this area; they hope to guide its changes in positive ways. Our goal in this study is to help provide these groups with information about residential land values so that they can plan the redevelopment of the area in ways that will be the most beneficial for the city and community. When determining residential land values, we identified several projects of interest involving the Walnut Station area that will have effects on our findings in one way or another. Some of the projects have already started, and some are on the way.

In December 2006 the Lane Transit District plans to open a new bus rapid transit system (EmX) which will connect downtown Eugene with downtown Springfield. The system, which is currently under construction, was influenced by the light-rail systems in cities like Portland and Denver. However it uses rubber-tire vehicles, bus-only lanes, and queue jumpers (devices that trigger traffic signals in order to give the busses priority at intersections) instead of rails and train cars. EmX is a more affordable solution than light-rail and will allow the traffic to flow more smoothly with more consistent travel times than normal buses. One of the major corridors of the EmX line is along Franklin Boulevard, specifically in the interest area of Walnut Station. The accessibility of the bus rapid transit system is potentially an attractive attribute to neighborhood residents and other community members that attend the University or are otherwise in the area often. Due to the impacts of EmX, this area has become even more attractive to city planners (and the other groups mentioned previously) for major redevelopment. Current plans for this redevelopment include mixed-used, pedestrian-friendly neighborhoods.

An additional reason for interest in the Walnut Station area is the recent sale of the Williams Bakery site to the University of Oregon. The University purchased this lot adjacent to campus with the ultimate goal of constructing a new sports arena; plans for the building are currently underway. Along with a new arena, the University has shown interest in other sites (like the car dealer lot they purchased) in the Walnut Station area to further expand University-related activities. This expansion could put more demand on nearby restaurants and other student and tourist goods and services. The University is most interested in several vacant lots, located east of the campus area, most of which have either already been sold for redevelopment, or are being actively considered for redevelopment. The city planners and the community want to make sure the redevelopment of these lots, and others in the area, will be guided in constructive ways in order to change the Walnut Station area for the better.

There is yet another a project which is currently under review that could make the Walnut Station area a major gateway to Eugene and the University of Oregon. The Oregon Department of Transportation, in conjunction with the cities of Eugene and Springfield, is examining the feasibility of constructing a new freeway interchange between I-5 and Franklin Boulevard. Such a project would substantially increase the traffic flow on Franklin Boulevard. The increased traffic would create a larger market for retailers and other tourist accommodations in the area. If the interchange is constructed, the Walnut Station area will provide many tourists and prospective students with a first impression of Eugene. However, the increased traffic would lower the residential values in the area. The importance of pleasing first impressions, along with many other reasons, is partially why the city of Eugene is interested in the architectural form, aesthetics, and potential mixed-use characteristics of the redevelopment within the interest area.

The city of Eugene is specifically interested in the Walnut Station area's potential for mixed-use buildings. They want to use the ideals of "new urbanism" to counter urban sprawl and its consequences. In the last decade, Eugeneans have experienced the consequences of growth first-hand through increased traffic congestion and loss of open space due to sprawl of neighborhoods and businesses. Community members have even expressed their concerns with the loss of community character in Eugene. The ideals of new urbanism and the City's Mixed-Use Development program particularly emphasize the importance of improving the relationship between transportation planning and land use. It encourages "growing up, not out" in higher-density, mixed-use buildings (including both retail and residences), improving the appearances of the buildings, and increasing a sense of community by allowing individuals to access many of their daily needs within walking distances. In a mixed-use development program, the reliance on automobiles can be transferred to more environmentally-friendly modes of transportation like walking, bicycling, and mass transit systems. This would not only improve air quality, but also traffic congestion and other local effects of transportation.

Eugene city planners are pursuing development plans that improve the traffic flow of vehicles and pedestrians all the while determined to create a pleasing environment in the Walnut Station area. In this study, we refer to previous articles written about similar areas to determine the effects of traffic and noise externalities from both the roads and railroads near the interest area. We also examine articles about how residential amenities, new urbanism features, and location-related attributes effect the prices of residences in areas similar to Eugene and the Walnut Station area.

The main point of this paper is to use an hedonic pricing model to obtain information about the prices of apartments and condominiums using data from Eugene. The results from the model can, in principle, be used to calculate any necessary subsidies to ensure the construction of specifically desired redevelopment projects. The city planners will be able to use our findings to determine what the best choice of redevelopment for the area will be. This paper does not suggest the "best" alternative for redevelopment, but only provides information for the city to use in their decisions if they choose.

Now that the foundation of our study has been set, we continue on to discuss the previous literature on our subject in section II and the methodology and data we used in section III. Then, in section IV, we discuss each model we used, report our results and analyze the effect of each variable. We conclude in section V with an explanation of our final results and hope they will be helpful to the city planners with the Walnut Station area redevelopment as well as other projects in the future.

II. Literature Review

The main goal in this study is to calculate the values of apartments and condominiums in Eugene based on several different architectural and location-related characteristics and then apply results to the Walnut Station area. Before we started collecting data for the regression calculations, we focused our attention on finding related studies. There are a myriad of studies and articles that discuss what kinds of architectural and location-based characteristics are likely to effect property prices in an urban housing market. There are also previous studies on how traffic externalities (such as road noise and train noises and vibrations) substantially lower market prices for housing. For clarification purposes, in this study, we associate the same meaning of property prices to apartment rent prices and condominium sale prices. We are able to draw the connection between property prices and rent prices of apartments or sale prices of condominiums because, as Cheshire and Sheppard (1993) observed, in urban economic theory, the price of land is the price of a specific space at a specific location. So we can apply the studies on housing prices to our study because each apartment unit and condominium unit is specific to its space and location. In addition, our hedonic price model has interactive variables of spatial variation (i.e. the distances from *each* residential unit to a number of other locations). Fik, Ling, and Mulligan (2003) show that this factor alone significantly increases the explanatory ability of a model.

This model will be especially helpful for identifying value difference between a typical apartment complex and a mixed-use building because it does measure a value attributed to proximity to goods and services. As previously stated, the ideas of new urbanism are widely accepted as neo-traditional planning ideas that move away from the conventional suburban developments. They implement mixed land and building uses which are intended for higher-density neighborhoods and more pedestrian-friendly transportation designs. This type of planning is favorable to many people because of the intentions to reduce urban sprawl and improve the environment. There are even ideas which are discussed in a study by Jennings (2004) that new urbanism revitalizes the neighborhoods as well as the community participation in the neighborhoods. Jennings describes in his study that when participatory new urbanism was applied to Boston, it gave lower income neighborhoods a chance to improve their conditions based on their needs. When applying new urbanism planning techniques to Eugene, the city will not be facing the same wealth-segregation issues that Boston did. However, other issues, such as the community participation, have already been implemented. The city planners working with community groups like the University of Oregon, business and property owners, and residents from the area is significant because, as Jennings (2004) suggests, participatory planning not only nurtures local democracy but has a social utilitarian value as well.

According to Jennings (2004), the community members of Eugene who have recently been concerned with the lost sense of community will regain this sense. On the other hand, in light of Dixon and DupuisAvaila's (2003) study in Aukland, New Zealand, there may be problems associated with continuations of new urbanism planning techniques. They found that the of "sense of community" within the mixed-use areas decreased over time because people stayed in their homes more often and traveled shorter distances for everyday needs. With the continuation of the mixed-use developments, people tended to keep to themselves instead of using the denser environment to network with others.

While the mixed-use development effects on "sense of community" are ambiguous, the effects on property prices are not ambiguous at all. Several studies conducted in Oregon, California, North Carolina, and Washington, D.C. found that people are definitely willing to pay for the features of a mixed-use neighborhood. We used the theories in these studies help us determine the effects of new urbanism features on prices for condominiums and apartments in Eugene. Tu and Eppli (1999, 2001) have written two different articles which both show that people will pay a higher price premium to live in new urbanism developments. Their first article (1999) focused on Kentlands in the Washington, D.C. metropolitan area and determined that the premium people are willing to pay for the features of a mixed-use neighborhood is about 12%, or $25,000. In their second study, Tu and Eppli (2001) focus again on Kentlands, but this time include Laguna West near Sacramento, California, and Southern Village in Chapel Hill, North Carolina. They again found that the value of new urbanism housing is greater than the value of similar housing in the surrounding areas, and people pay a price premium to reside in a mixed-use community. In both studies, Tu and Eppli (1999, 2001) used the sale price for their dependent variable and covered or enclosed parking spaces, square footage of living area, number of bedrooms and bathrooms, the age of the building, the quality of building supplies, and the number of stories of the building were independent variables. This tells us that the variables they used were significant factors in determining property values, and that people will probably be willing to pay to reside in a neighborhood with new urbanism features.

The articles that we have looked at so far are based on communities far away from our interest area. To try to determine the preferences of people in Oregon, we used another article which focused on Portland, Oregon. Song and Knapp (2003) examined how new urbanism planning in Portland effected property prices. They used Geographic Information Systems (GIS), and other information about every property in Portland. They included variables such as the types of buildings, distance to the nearest commercial use, bus stop, and park, the lot size, square feet of the building, age of the building, the school district the building is in, and distance to the major road. Song and Knapp (2003) found that all of these variables significantly effect the prices of the property. They concluded that the people place positive value on the improved pedestrian access to commercial uses and better transit access in neighborhoods based on new urbanism, so they are willing to pay for these characteristics. On the other hand they concluded that people place negative value on the higher densities, greater mixture of land uses, and smaller lots associated with new, so they may opt to pay for residency in a conventional neighborhood. Eugene is not as densely populated as Portland, so the denser mixed-use communities may be a big detractor when it comes to finding people to live there, especially if it is expensive. On the other hand, if the residences are not very expensive, the close proximity to commercial uses and transit accesses may be positive attributes and hold enough value to attract people to live there. The main question we will be able to answer with our model is whether people in Eugene are willing to pay for the same features in the interest area of Walnut Station as people in Portland, Kentlands, Laguna West, and Southern Village are willing and able to pay for.

One of the differences between our interest area and the areas included in Tu and Eppli's (1999, 2001) and Song and Knapp (2003) studies is the influence of traffic externalities from both automobiles and trains. There are several studies we used to help determine how automobile traffic and railroads effect the sale prices of condominiums and rent prices of apartments. The studies use house sale prices as dependent variables, but as we previously stated in this section, we can associate the same meaning of property prices to apartment rent prices and condominium sale prices due to the spatial differences of the locations of each unit. There are two articles in particular that describe how traffic noise externalities effect housing prices. In the first, Hughes and Sirmans (1992) show that traffic noise negatively effects the prices of houses in neighborhoods, so the more noise, the lower the price of the house. In the second, Theebe (2004) confirms and quantifies the result that traffic noise lowers the price of a house. The article shows that sound levels below 55 decibels (dB) do not harm property prices but for each additional decibel, the property loses 0.4 percent in value on average. The article also concludes that noise levels above 65 decibels are capitalized into the price of the specific property with a maximum discount premium of twelve percent (ignoring extremes). On the other hand property in a very quiet area might sell at a premium of up to 6.5 percent. Because the Walnut Station area is directly next to Franklin Boulevard, the sale prices for condominiums and the rent prices for apartments will be affected by the automobile noise externalities.

Another factor of traffic externalities in the Walnut Station area that will effect housing prices will be the Union Pacific railroad. The railroad runs along the river next to the Walnut Station area north of Franklin Boulevard. Strand and Vagnes (2001) show that railroad noise and vibrations negatively affect the prices of houses that are 100 meters or closer to a railroad. The closer the house is to the railroad, the lower the price for the house is. In the study, as Strand and Vagnes traveled from 100 meters away from the closest railroad to 20 meters away from the closest railroad, they observed a 23 percent discount in the property prices. With this information, we thought a large portion of the Walnut Station area would be effected by the railroad noise and vibration externalities, so when we determined the rent and sale prices of units in the area, we kept it in mind.

We did not include variables like distance to the railroad or noise from traffic measured in dB in our model because we did not have access to that data. Ultimately, we decided to use the findings from the related articles as supplements to the information we gathered and the results we obtained. The next section will discuss how we got the data sets for apartments and condominiums in Eugene and following that will be a section that discusses of our final models and results.

III. Methodology and Data

By using an hedonic price model, we can derive the values that people place on different residential and location-related amenities by including the specific characteristics as variables in our regression model. When we hold all the variables constant except for the one in question, we can explain the differences in property prices that are attributable to that amenity. The city planners were most interested in the mixed-use aspects of redevelopment in the Walnut Station area, so to determine the attributes of mixed-use development people would be willing to pay for in their housing, we gathered two different sets of data. The first one gave information about apartments, and the second gave information about condos in the Eugene housing market, both of which are alternative uses under consideration.

In the planning stages of our study, we had decided to use Geographic Information System (GIS) to obtain statistical information about apartment complexes in the Eugene area. However, it turned out that the GIS provided by the University of Oregon at the time did not provide apartment complex data with as much detail as we had wanted. So the apartment data was collected through a survey that we conducted. We selected a sample, as randomly as possible, of about one hundred apartment complexes in Eugene and called them to ask for information about the apartments' characteristics. In particular, we asked for information about studios, one bedroom, and two bedroom units. The survey included questions about the size of the unit, monthly rent, square footage, number of bathrooms, and other amenities. The full list of variables (and variable definitions) included in the survey can be seen in Section IV table 1.1.

Gathering a sample of apartment complexes that was large enough and reliable was quite tricky because the apartment complexes had to be contacted by telephone. Not all owners and property managers were willing to share the information we needed and others could not be contacted within our limited time frame. Another setback in the data collection process was the fact that about one third of all apartment complexes in Eugene are owned by the company "Bell Real Estate" and during the time that we were collecting data, its leasing agents were not able to give us information about their properties because many students were signing leases for the upcoming school year. Despite all of our difficulties, our sample size was only reduced by about twenty complexes, which left us with 115 observations. That number does not imply 115 complexes, since each complex offers different types of units (studios, one bedrooms, and two bedrooms). Instead, we took the information of what kinds of units each complex offered and found the sum of all the different types which gave us 115 total observations. A positive part about the apartment data collection process was the fact that, through calling each complex, we gathered very detailed information about the apartments' characteristics. To our knowledge, it is also the most comprehensive data set available.

We obtained the condominium data using a completely different process than we used for the apartment data. We used 2004 data from the Regional Land Information Database of Lane County (RLID). The University of Oregon had purchased this information for other students' projects prior to ours. RLID is the most comprehensive information database available for the Eugene area and contains extensive statistical data on all properties in Lane County. The database has been maintained for over thirty years by the cities of Eugene and Springfield, the Eugene Water and Electric Board (EWEB), and the Lane Council of Governments. The data gave information about many different property characteristics, latitude and longitude values, land area, property tax value, and geographic characteristics for all properties. Some of the properties' information even includes the most recent sale price of the property.

The data from RLID originally included extra variables that we did not want to use in our analysis. So the first step to specifying the data set we wanted was to drop all of the observations that did not have "condominium" as its building type. When we looked at the descriptive statistics of the condominiums there was a range from $1,600 to $3,000,000 for the sales prices. It was obvious that something in the data set was not normal and would, at the very least, skew our results significantly. We contacted the Lane Council of Governments to ask if they could help us understand the range of the data. They informed us that the data set included a variable called "analysis code" which separates the sales prices into several categories. This variable controls for the condominiums being sold among family members for extremely low prices or by public institutions for very high prices. With the large range explained, we then needed to eliminate the extreme outliers in the data set to obtain a sample that only contains reasonable market value transactions (also called arms length transactions). We did this by only keeping observations that had the analysis code P,0,V, or Y which all represented market value condominium sales prices.

After we dropped the outlier observations, the data set was still quite extensive. The apartment regression data we used was a cross-section data set in the time period of the year 2006. However, the condominium data on sales was a time-series data set in the time periods of 1977 to 2004. Using this data set would have been not only hard to analyze, but also hard to compare with a cross-section data set of apartments. Also, because we wanted to estimate condominium sale prices in today's Eugene housing market, we decided to take only the sale price data between 2002 and 2004, and expressed the values in 2005 dollars. We then treated the data for condominiums as somewhat of an extreme cross-section data set. Certainly, each of those three years of condominium sales prices were influenced by different market factors, but we did not want to just use 2004 data because there were not very many observations for that year alone. Even though we are using more than one year of data, we transformed all of the sales prices to 2005 dollars so were able to treat the condominium data as a cross-section set. Our final condominium data set included 387 observations and the variables we included were the number of bedrooms, the square footage, number of full baths and half baths, fireplaces, the sale price (which we expressed in 2005 dollars) and the sale year. A full list of the variables (and variable descriptions) can be seen in Section IV table 2.1.

It was clear to us that it is always desirable to keep as many observations as possible, but for the purposes of our study, a cross section analysis of the apartment rent prices and condominium sale prices with most recent data of these values was more useful than using all of the observations of condominium sale prices. Unfortunately the RLID statistical data did not include as many characteristic variables of the condominiums as we obtained for the apartments, but it did still include the most important variables. Our final models and results that we used to analyze the data is in the next section, then we briefly present our conclusions in section V.

IV. Models and Empirical Results

The descriptions of our models and results from the data obtained are separated into to two sections. In the first one, Section A, we examine the apartment complexes' data, introduce the variables of interest, present multiple regressions, and explain the results. Then, in Section B, we follow the same process for condominiums.

Section A Part 1

Based on the apartments in the Eugene housing market, we thought the following variables would be important when determining the prices of rent. As previously stated, the data for apartments was collected through a telephone survey that we conducted on randomly selected apartment complexes. Table 1.1 lists the variables we used, descriptions of the variables, and the expected signs that we predicted to observe when we regressed them on rent prices.

Table 1.1

VARIABLES	**DESCRIPTION**	**EXPECTED SIGN**
COMUNITS	number of units in the complex	+
TYPE	type of apt. takes on the value either studio, one bedroom, or two bedroom	+
UNITS	number of studios, etc. in the complex	+/-
RENT	monthly rent	x
SQFT	square footage of the apartment	+
HWF	takes on value 1 if hardwood floors, 0 otherwise	+
VCL	takes on value 1 if vaulted ceilings, 0 otherwise	+
WD	takes on value 1 if there is a washer/ dryer in unit, 0 otherwise	+
BATH	number of bathrooms	+
FIRE	takes on value 1 if there is a fireplace, 0 otherwise	+
ENTRY	takes on value 1 if entry is outside, 0 else	+/-
YEAR_BLT	year built	+
YEAR_REN	takes on value 1 if apt was renovated, 0 otherwise	+
PETS	takes on value 1 if all pets are allowed, 0 otherwise	+
CLEANING	dollar amount of non-refundable cleaning fee	+/-
DEPOSITS	dollar amount of deposits required to rent	+/-
GYM	takes on value 1 if complex has gym, 0 otherwise	+
POOL	takes on value 1 if complex has pool, 0 otherwise	+
BASK/VOL	takes on value 1 if complex has basket ball or volley ball court, 0 otherwise	+
CLB_HOUSE	takes on value 1 if complex has club house, 0 otherwise	+
BIKE_STG	takes on value 1 if complex has covered bike storage, 0 otherwise	+
WSH_DRY_COMP	takes on value 1 if complex has a washer/dryer in the complex, 0 otherwise	+
SEC_8	takes on value 1 if complex accepts section 8, 0 otherwise	+/-
UOTIME	travel time from apt. to University of Oregon campus	-
UODIST	travel distance from apt. to University of Oregon campus	-
DTTIME	travel time from apt. to downtown	-
DTDIST	travel distance from apt. to downtown	-
VRCTIME	travel time from apt. to VRC	+/-

VRCDIST	travel distance from apt. to VRC	+/-

For the apartment regression analysis, we started with a simple base model that included the variables that we thought were the most important in predicting the prices of rent. That model included rent as the dependent variable and sqft, bath, deposits, and uotime as the independent variables. The following table shows the effects of adding eight additional variables to the base model using a stepwise process.

Table 1.2

	(1)	(4)
	base model	add cleaning
sqft	0.360	0.345
	(8.08)***	(9.61)***
bath	81.438	56.243
	(2.94)***	(2.46)**
deposits	-0.308	-0.205
	(5.11)***	(3.71)***
uotime	-4.160	-9.119
	(1.64)*	(3.84)***
dwdunit		88.872
		(5.85)***
dpets		41.160
		(2.60)**
cleaning		0.188
		(2.46)**
dbikestorage		
Constant	368.511	362.189
	(9.19)***	(9.82)***
Observations	110	110
R-squared	0.60	0.75

	(9)
	add dgym
sqft	0.348
	(9.34)***
bath	46.363
	(1.89)*
deposits	-0.193
	(3.22)***
uotime	-10.603
	(3.87)***
dwdunit	78.945
	(4.39)***
dpets	42.536
	(2.64)***
cleaning	0.158
	(1.94)*
dbikestorage	21.230

	(1.37)
dclubhouse	19.163
	(0.98)
dpool	-3.546
	(0.21)
dgym	-9.955
	(0.55)
dfire	13.787
	(0.70)
Constant	371.876
	(9.59)***
Observations	110
R-squared	0.76

We began our analysis on the different models by interpreting base model results. As we had predicted, the coefficient on sqft is positive and significant. This mean that when all else is constant, and sqft is increased by 1 sqft we should expect a $0.36 increase in the price of rent on average. A more practical interpretation for the real world would be the following: if there is an increase of 100 sqft to an apartment, we should expect a $36 increase in the price of rent for that apartment. The coefficient on bath (the number of bathrooms) is also positive and significant. This tells us that for each additional bathroom we should expect monthly rent to increase by $81.44 on average. Although we predicted the sign on deposits to be ambiguous, we found that the coefficient on deposits is, in fact, negative and significant. So, for each dollar increase in deposits, we should expect the rent to decrease by $0.30 on average. Finally, as we had predicted, the coefficient on uotime is also negative and significant. This means that for each additional minute in travel time to the University of Oregon campus we should expect the monthly rent to decrease $4.16 on average.

To continue our analysis, we looked at the models with additional variables of interest. First we added to the model dwdunit, which takes a value of 1 if there is a washer and dryer in the unit and a value of 0 otherwise. We found that the coefficient for dwdunit is positive and significant. Included in the model next was dpets, which takes the value 1 if all pets are allowed and a value of 0 otherwise. The coefficient for this is also positive and significant. Then we added cleaning, which captures the effect of non-refundable cleaning fees on the price of rent. The coefficient, again, is positive and significant. Next, we added dbikestorage, which takes a value of 1 if the complex offers covered bike storage and a value of 0 otherwise. The coefficient for this is positive and significant. Although we also looked at the effects of dclubhouse, dpool, dgym, and dfire on monthly rents, we decided not to include them in our final model because they did not add predictive power to the model (as captured by R^2). Additionally, most of the excluded variables were not significant and also altered the significance levels on other variables. The final model we chose to use for Regression 1 was:

$$Rent_i = \beta_0 + \beta_1 sqft_i + \beta_2 bath_i + \beta_3 deposit_i + \beta_4 uotime_i + \beta_5 dwdunit_i + \beta_6 dpets_i + \beta_7 cleaning_i + \beta_8 dbikestorage_i$$

Where:

β_0: 361.667
β_1: 0.343
β_2: 55.627
β_3: -0.206
β_4: -9.877
β_5: 80.149
β_6: 41.135
β_7: 0.155
β_8: 24.603

One of the goals of our study was to develop a predictive model, through regression analysis, which could estimate monthly rents for apartments in Eugene based on several amenities. The city would then be able to use this model to predict the rent prices that they can expect to charge for new complexes in the Walnut Station redevelopment area. For example, consider a unit for rent in the Walnut Station redevelopment area. Assume the characteristics that the unit has are the following: 1

bedroom, 1 bath, 750 sqft, 200 dollars in deposit fees, 3 minutes from UO, washer and dryer in the unit, does not allow pets, has a 75 dollar cleaning fee, and has covered bike storage. Using our final model, the monthly rent that the city can expect to charge for such a unit is $693.00.

Section A Part 2

In this regression we performed a logarithmic transformation on all of the quantitative variables from our apartment data set. We then examined the price of rent elasticities. In particular, when keeping all other variables constant, the model predicts the expected percentage change of the price of rent given a one percent change of any one of the quantitative variables on average. Once again, we started with a base model and added more variables one by one. The following table shows the effects of adding variables to the base model.

Table 1.3

Log regression			
	(1)	(2)	(3)
	base model	add dwdunit	add dpets
lsqft	0.451	0.433	0.439
	(9.31)***	(10.89)***	(11.55)***
lbath	0.167	0.085	0.084
	(2.79)***	(1.68)*	(1.74)*
ldeposits	-0.149	-0.163	-0.162
	(4.39)***	(5.88)***	(6.10)***
luotime	-0.054	-0.081	-0.114
	(1.95)*	(3.51)***	(4.69)***
dwdunit		0.178	0.164
		(7.05)***	(6.68)***
dpets			0.074
			(3.25)***
lcleaning			
dbikestorage			
Constant	4.345	4.568	4.562
	(12.77)***	(16.29)***	(17.04)***
Observations	104	104	104
R-squared	0.64	0.76	0.78

Table 1.3 continued

	(7)
	add dpool
lsqft	0.563
	(11.51)***
lbath	0.054
	(0.93)
ldeposits	-0.045
	(1.11)
luotime	-0.099
	(3.48)***
dwdunit	0.164
	(3.39)***
dpets	0.024
	(0.69)
lcleaning	0.064
	(2.11)**
dbikestorage	0.031
	(1.13)
dclubhouse	0.086
	(1.92)*
dpool	-0.093
	(2.99)***
Constant	2.826
	(6.81)***
Observations	57
R-squared	0.87

In this base model we chose to use the same variables as the ones used in the base model in Table 1.2 with the exception that we performed logarithmic transformations on them. We assumed the same signs for the coefficients as in Table 1.1 since everything should still have the same effect. For this base model, we found that all of the coefficients are significant and have the expected signs. According to our results, the coefficient on lsqft means that with a one percent increase in an apartment's square footage we should expect an increase of 0.451 percent on the apartment's rent price on average. As we kept adding variables, just as we did in Table 1.2, there were improvements in the predicting power of the model up until we included the variable lcleaning. After its inclusion, important variables of the base model became insignificant, which was not desirable. Because of our analysis of Table 1.3 we chose to use the following log-model for our final Regression 2:

$$lRent_i = \beta_0 + \beta_1 l\,sqft_i + \beta_2 lbath_i + \beta_3 ldeposit_i + \beta_4 luotime_i + \beta_5 dwdunit_i + \beta_6 dpets_i$$

Where:

β_0 : 4.562
β_1 : 0.439
β_2 : 0.084
β_3 : -0.162
β_4 : -0.114
β_5 : 0.164
β_6 : 0.074

Notice that compared to the final model in our regression without logarithmic transformations we were able to include two more variables, cleaning and dbikestorage, whose inclusion here only worsened the predicting power. Consequently, we have two models, one predicting an actual rental price, and one estimating percentage change in rental price. Regression 2 predicts a percentage change of the price of rent of an apartment determined by a 1 percentage change of another characteristic, when holding all else constant. For example, with a 1% increase in square footage, we should expect a 0.43% change in the rent price; with a 1% increase in travel time to UO, we should expect a 0.11% decrease in the rent price; and if there is no washer or dryer in the unit, then we should expect the rent price to increase by about 0.16% on average.

Section B Part 1

We obtained the following variables from the RLID data base and thought that all of them would be important for determining sales prices of condominiums in the Eugene housing market. The table lists the variables, descriptions of the variables, and the expected signs of the coefficients for each variable.

Table 2.1

VARIABLES	DESCRIPTION
SALE_PRICE_IN_2005_DOLLARS	Sale Price of condominium in 2005 dollars (x)
NO_BEDROOMS	Number of bedrooms in condominium (+)
NO_FULLBATHS	number of full bathrooms (+)
NO_HALFBATHS	Number of half bathrooms (+)
TOTAL_FINISH_SQFT	square footage of the condominium (+)
DFIREPLACES	takes on value 1 if fireplaces, 0 otherwise (+)

As with the apartments, we started with a base model which included variables that we thought were the most important for predicting the sales prices of condominiums. In the base model, we included the variables: sale price (as the dependent variable), total_finish_sqft, and no_fullbaths (as the independent variables). We did not include no_bedrooms in the base model even though it is a characteristic which future condominium buyers probably value. The following table shows the effects of adding variables to the base model (that we did not use) where sale_price is the dependent variable and no_bedrooms the independent variable.

Table 2.2

regression			
	(1)	(2)	(3)
	only with no_bedrooms	add total_finish_sqft	add total_finish_sqft
no_bedrooms	20168.677	-338.208	5229.054
	(5.35)***	(0.09)	(1.46)
total_finish_sqft		52.028	

		(11.39)***	
no_fullbaths			25242.683
			(10.88)***
Constant	29326.827	22134.424	26558.179
	(3.77)***	(3.27)***	(3.90)***
Observations	387	387	387
R-squared	0.07	0.30	0.29

We found that whenever we added either total_finish_sqft or no_fullbaths to the model, immediately the coefficient for no_bedrooms became insignificant. This is most likely because of high collinearity between the number of bedrooms and a condominiums' size or its number of full bathrooms. We also observed an extremly low R-squared value if only no_bedrooms is in the model. Because of this analysis, we decided to exclude no_bedrooms from our base model. However, we thought that the variable total_finish_sqft would take account for the number of bedrooms. Once we decided on a base model for the condominium data set, we made the following table, which shows the effects of adding variables to the base model that we defined earlier.

Table 2.3

	(1)	(2)	(3)
	base model	add no_halfbaths	add dfireplaces
total_finish_sqft	33.459	12.941	12.952
	(6.69)***	(1.60)*	(1.61)*
no_fullbaths	15183.984	22570.897	17993.065
	(5.73)***	(6.47)***	(4.49)***
no_halfbaths		11489.988	7772.392
		(3.20)***	(1.98)**
dfireplaces			6772.985
			(2.29)**
Constant	18941.802	26117.774	29182.443
	(5.02)***	(6.01)***	(6.45)***
Observations	387	387	387
R-squared	0.36	0.38	0.38

For our analysis of the condominium regression models, we began by interpreting the base model. As we had predicted, the coefficient of total_finish_sqft was positive and significant. In particular, this coefficient means that with one additional square foot the expected sale price should increase by \$33.46 on average. The same is true for the coefficient of no_fullbaths, it is significant and positive. The coefficient means that with another full bath in the condominium the expected sale price should increase \$15,183.99 on average.

After the interpretation of our base model we looked at how the addition of other variables of interest effected the sales prices of condominiums. The first variable we added was no_halfbaths. As we had assumed, its coefficient was positive and significant. It means that another half bath should make the expected sale price of the condominium increase. The last variable we included was the variable dfireplaces, which takes the value 1 if the condominium has a fireplace and 0 otherwise. Once more, as we had assumed, its sign is positive and it is significant. From the results of our analysis, we decided that our final model for Regression 3 is:

$$Sale\_price_i=\beta_0+\beta_1 total\_finish\_sqft_i+\beta_2 no\_fullbaths_i+\beta_3 no\_halfbaths_i+\beta_4 dfireplaces_i$$

Where β_0= 29182.443
β_1= 12.952
β_2= 17993.065
β_3= 7772.392
β_4= 6772.985

One of the goals of our study was to develop a predictive model, through regression analysis, that would estimate the sales prices for condominiums in the Eugene housing market. The city would then be able to use the model to predict how much a condominium with specific characteristics could sell in the Walnut Station redevelopment area. For example, consider a condominium with the following characteristics: 1000 square feet, 2 full baths , 1 half bath and a fireplace. According to our final model the expected sales price would be $92,665.95 on average. This price seems a little bit low, but can probably be explained by the odd price data of the condominiums. We also did not include all of the variables that we wanted due to the lack of information on those variables.

Section B Part 2

Just like we did with the variables in the apartment regression, we also performed a logarithmic transformation of all the quantitative variables for the condominium data. This allowed us to examine sale price elasticities for condominiums in the Eugene housing market. In particular, we used the model to estimate the percentage change in the sale price as one of the quantitative variables changes by a certain percentage, keeping all other variables constant. We did not explain again why lno_bedrooms (log(no_bedrooms)) is not part of the base model, because in this model it, again, becomes insignificant whenever we add another quantitative variable. The following table shows the effects on sales prices as we added variables to the base model.

Table 2.4

regression			
	(1)	(2)	(3)
	base model	add lno_halfbaths	add dfireplaces
ltotal_finish_sqft	0.610	-0.104	-0.104
	(7.66)***	(0.27)	(0.27)
lno_fullbaths	0.250	0.325	0.325
	(4.36)***	(1.30)	(1.30)
lno_halfbaths		-0.171	-0.171
		(0.88)	(0.88)
dfireplaces			0.000
			(.)

Constant	6.893	11.982	11.982
	(12.89)***	(4.48)***	(4.48)***
Observations	387	79	79
R-squared	0.36	0.14	0.14

Again, we began our analysis of Table 2.4 by interpreting the base model. All of the coefficients are positive and significant, which means that the base model suggests that a 1% increase in square footage should increase the expected sale price of the condominium by about 0.61%. As soon as we added more variables, all of the coefficients became insignificant. Their signs also became opposite of what we had predicted. This really contradicted our assumptions because it is unlikely that a percentage increase in square footage would lower the sale price by a certain percentage. We also noticed that the R-squared was very low, which means that this model does not have very much predictive power. So, in this case we used the following base model as the final model for predicting sale price elasticities, or Regression 4:

$$lSale\_price_i = \beta_0 + \beta_1 ltotal\_finish\_sqft_i + \beta_2 lno\_fullbaths_i$$

Where:

β_0 = 6.893
β_1 = 0.61
β_2 = 0.25

In contrast to Regression 3, the model above is used to estimate the percentage change of the sale price of a condominium when one of its characteristics changes by 1 percent and all else is held constant. For example, with a 1% increase in square footage, we should expect the price of the condominium to increase by 0.61% according to our final model, Regression 4. Even though the explaining power of this model is relatively low, the problems can probably be explained by multicollinearity between variables and, again, by the sale price data of the condominiums.

V. Conclusion

Although we trust the results for the apartments substantially more than we do the condominium data, we did not exclude the condominium results. Both condominiums and apartments are alternatives that are under consideration for the Walnut Station area, so both are equally as important. Even though the findings for condominium sales prices are suspect and seem to be biased downward, we still learned something from them. When comparing the condominium results with the apartment results, we found that the same types of variables effected the prices the same way. The apartment results can also serve as a possible supplement to the condominium results because we would expect that variables such as the time it takes to get to the University of Oregon would effect the prices similarly in both cases. In each case of Sections A and B, we tried many different models to predict the prices. All of the final models we decided to use for this study, especially the apartment models, have very robust coefficients which made us confident that they were the best possible models available.

As we previously explained, we will be integrating the results from our models with the results from some of the other related studies that we examined. We found that Eugene is similar to Kentlands, Laguna West, Southern Village, and Portland because people in each of these cities will pay to reside in neighborhoods that include specific features. In our study, the value of a feature such as less travel time to the University of Oregon can be combined with the results that people place positive value on improved pedestrian access to mass transit (Song and Knapp 2003). The new bus rapid transit—a form of mass transit—will lower the travel time from the Walnut Station area to the University, so we could expect the rent of apartments in the area to be higher relative to other areas in Eugene. On the other hand, quite a bit of the Walnut Station area is very near the Union Pacific Railroad line that runs along the river, and the Franklin Boulevard corridor, both of which could lower the value of property due to high noise levels.

An example of an apartment unit in the Walnut Station area near the railroad could be the following: 2 bedrooms, 1 bathroom, 800 sqft, $300 in deposits, 4 minutes from the University, no washer or dryer in the unit, does not allow pets, has $100 cleaning fee, and has bike storage. According to our model, we should expect the monthly rent to be $630.49. However, when we apply the effects of the train noise, the price could be discounted up to 23%, making the rent $485.47 if it is within 20 meters of the railroad. On the other hand, if the unit was very near Franklin Boulevard, the rent price could be discounted up to 12%, making it $554.83.

To reiterate, the same kinds of variables would effect both apartments and condominiums in similar ways, we just chose to illustrate examples using the apartment information because we are more confident in the coefficients for that model. We were pleased to have such robust coefficients and very significant results. We hope that by using our models and other information, the Eugene city planners, along with the other interested community groups, will be able to continue the with the planning in the Walnut Station redevelopment area with the most efficient processes, and end up with a design that is the most beneficial to the neighborhood and the city.

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