Expectations of Land Value in Rural and Suburban Regions

by

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ABSTRACT

Timberland has become a new and emerging asset class among investors. Institutional investors have committed large amounts of capital through the private equity market. Timber real estate investment trusts (REITs) have also allowed smaller individual investors to participate in the ownership in timberland. Given that land supply is fixed, the demand for land is expected to increase as baby boomers near retirement. Owners of timberland are faced with making strategic decisions as to whether timberland remains the highest and best use.

Given these facts, this thesis examines over 300 predominately rural counties where timberland is harvested and attempts to create a model to identify where land has the highest value as an urban use, and secondly, where this urban land value is expected to experience the most appreciation.

Using house prices as a proxy for land value, models for both house price and house price appreciation were developed. The results indicated that two variables were significant factors in forecasting appreciation: 1) the percentage of developed land within a county and 2) the percentage of seasonal units. As a result, urban counties with a lower percentage of seasonal units appreciated less, whereas rural counties with a higher percentage of seasonal units appreciated more. The results are significant in that it shows how there is an option growth effect for rural land beyond the urban edge which can potentially yield higher appreciation rates for speculative landowners.

Thesis Supervisor: William C. Wheaton
Title: Professor of Economics

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CHAPTER 1 - INTRODUCTION

A. STATEMENT OF THE PROBLEM

There has been a growing interest and demand for rural land as baby boomers near retirement and more people are purchasing real estate for investment purposes. Timberlands represent a significant portion of rural land today. Owners of timberland are faced with making strategic decisions as population centers grow into rural areas and timberland gives way to urbanization pressures. Given that timber is becoming an increasingly popular asset class among institutional investors, timber investment management organizations need to reevaluate whether harvesting timber is still the "highest-and-best use" (HBU) or whether urban land use provides a better return. This thesis analyzes rural counties (on a macro level) where timber companies currently own land and attempts to determine which counties are prospects for converting timberland for development now and in the future. Making this determination can be a difficult process because land value, particularly raw land, is very speculative in nature. Land value is based on outcomes that are uncertain, such as the property's future growth expectations. Hence, developing a model that provides a better understanding as to which counties have higher growth expectations, or appreciation, could be very useful for an owner of timberland, especially for owners that have investment interests across the United States.

To help make an assessment of growth expectations, this thesis studies both house prices and appreciation. The theory being, if house prices appreciate, or are expected to appreciate, then this appreciation should also be reflected in the value of land. By looking at both house price and appreciation, several options are presented. First, if a county has higher than average

appreciation, then perhaps a development for some other purpose is expected. A rational landowner would then hold onto this land until the value of the land price is high enough to justify the cost of development. Alternatively, if counties have less than average appreciation, then a landowner is faced with two more choices. On one hand, a county with high house prices may indicate a selling opportunity; while on the other hand, a county with low house prices may indicate harvesting timber is the best use. By identifying which county falls into which category, a timber landowner can hopefully make wiser and more strategic decisions on any future development opportunities. Of course, such decisions should not be taken lightly since loss of timberland to urbanization is usually finite, or at the very least, prohibitively expensive to reverse. As such, any responsible landowner would have to analyze a county on a more micro level prior to changing its use. This study simply provides identification as to which areas one may want to examine further.

B. OVERVIEW OF TIMBERLANDS

Dating as far back to the Native Americans, timber has played a vital role in American history. It has been used for a variety of uses such as cooking, shelter, shipbuilding, and fuel to name just a few. Historically, when forests were cleared, it was converted to agricultural uses. If land did not support agricultural uses due to high elevations or steep terrain, then land was allowed to grow back naturally. Today, the management of timberland is much more scrutinized. Careful monitoring of growth and harvesting levels is performed and sustainable forestry practices implemented with the hope that the need for forest products balances the need to protect, preserve, and enhance the environment. Because of these efforts, the U.S. has approximately

the same amount of forestland today, as it did in 1920, despite a 165 percent increase in population.[1]

As of 2001, the American Forest & Paper Association approximated that one third of the U.S. is forestland, or 747 million acres. Forestland is defined as having at least 1 acre in size and contains 10 percent tree cover. Two-thirds of the U.S. forestlands, equating to approximately 504 million acres, are classified as "timberlands". Timberlands are forests capable of growing 20 cubic feet of commercial wood per year.[2]

As shown in Table 1 below, the majority of timberland (in acres) is generally recognized in three regions of the U.S. – the northeast (32%), southeast (40%), and northwest (28%). However, growing stock or timber inventory is slightly different. The northwest has the most at 44%, while the northeast has 25% and the southeast has 31%. Even though there are large timber inventories in the west, much of the land is comprised of national forests as a result of the national forest system established in the 1900's. In fact, 64% of the western timberland is in public ownership and public policy has restricted harvest levels there. Unlike the west, national forests in the east were not established prior to any conservation movement and thus only 20% of eastern timberland is under public ownership. This fact is reflected in regional harvest levels in that 64% of harvests come from the southeast, 17% from the northeast and only 19% from the west.[3]

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[1] Moore, W. Henson and John Kelly. U.S. Forest Facts and Figures. May 2001. p.6
[2] Ibid.
[3] Timberland as an Investment. 2003. American Forest Management, Inc. 25 July 2005 <www.americanforestmanagment.com>.

Table 1: Timberland Overview

	Northeast	Southeast	Northwest
Acreage:	32%	40%	28%
Growing Stock:	25%	31%	44%
Harvest Levels:	17%	64%	19%

Owners of timberland fall into three main categories – non-industrial private owners, forest product companies and the government. The majority of commercial timberlands, approximately 58% (291 million acres) are owned by non-industrial private owners, usually individual or small-lot owners, trusts or corporations. It is estimated that approximately 600,000 landowners have holdings larger than 100 acres, each managing their land for different purposes. The forest products industry is approximately 13% (67 million) and represents some of the healthiest and most productive commercial timberland in the U.S. Federal, state and local governments make up the remaining 29% (146 million).[4]

As observed by one timberland investment advisory firm, timberland ownership has changed significantly over the last 15 years stating, "Institutional investors, such as public and private pension funds, have purchased large tracts of timberlands from the forest products companies, and in turn, sell logs harvested from these lands back to the producers of forest products."[5] In doing so, there has been rapid consolidation among forest products companies. In essence, forests are fast becoming financial assets instead of product resources. Other trends in timberland ownership can be observed:

[4] Moore, p.11.

- Larger properties coming to the market: Transaction sizes ranging from $200 million to $2.0 billion
- Emerging market opportunities: Acquiring properties that are expected to generate attractive returns over the next several years
- Timberland gaining market presence as an asset class: An increasing number of institutional investors, the establishment of Timber Real Estate Investment Trusts (REITs), and debt markets positioned to accept timber-backed securitized notes at favorable rates/terms. [6]

As noted by another advisory firm, two 'watershed transactions' took place in 2004. One transaction resulted in the sale of 2.2 million-acres of timberland while the other resulted in the acquisition of 907,000 acres. "The active timberland transaction market in 2004 excited investors and unleashed an unprecedented level of capital directed toward timberland acquisitions."[7]

As a result, timberland has been recognized as an attractive investment opportunity. Globally over $12 billion is invested in timberland. It is viewed as a relatively low-risk investment with strong diversification attributes. It also is seen as being negatively correlated with other types of financial assets, including stocks and bonds, and little correlation with the real estate market. Furthermore, it is positively correlated with inflation.[8]

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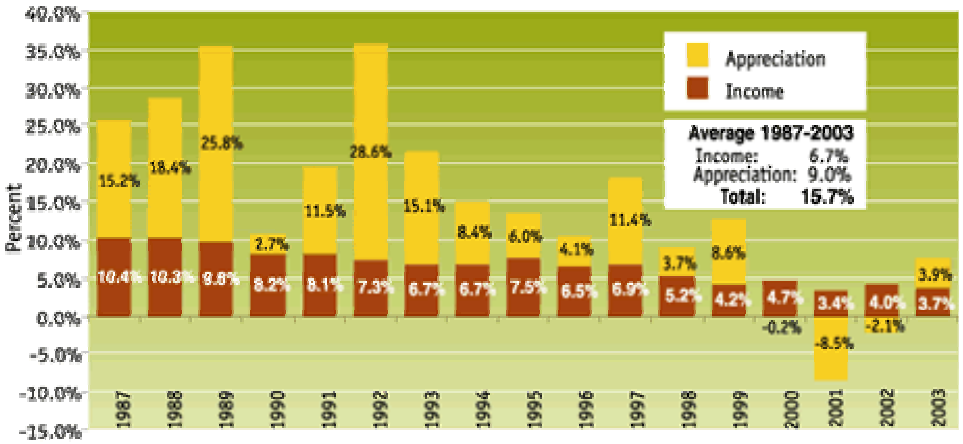
[5] Timberland as an Investment. 2004. The Campbell Group. 25 July 2005 <www.campbellgroup.com>.
[6] Ibid.
[7] Timberland Trends and Issues. Summer, 2005. Landvest. 25 July 2005 <www.landvest.com>
[8] American Forest Management, Inc.

The National Council of Real Estate Investment Fiduciaries ("NCREIF") is an association of institutional real estate professionals and started publishing a timberland index since 1987. This index serves as a benchmark for evaluating timberland investment performance. For the 10-year period ending in 2004, timberlands average annual rate of return was 7.7%.[9]

The total return for investors is comprised of two components – income and appreciation. Income, which accounts for just over one-third of the total return, is generated from the sale of harvested timber, sale of hunting and recreational leases, royalties generated from oil, gas and mineral extractor activities, and the sale of development rights and conservation easements. The balance is attributable to appreciation. Figure 1 provides a better depiction as to the components of the total return realized for timberland.[10]

Figure 1: NCREIF Timberland Property Index Disaggregation of Total Return (1987 - 2003)



Source: National Council of Real Estate Investment Fiduciaries

[9] NCREIF Total Timber Index

[10] Forestland Asset Class Overview. Forest Systems. 25 July 2005 <http://www.forestsystems.com>

C. THE DEMAND FOR TIMBERLANDS

There are many competing demands placed on forestlands today. These demands include timber harvesting, recreational uses, environmental protection, urbanization, and resort development. Owners of timberland, whether they are Timber Investment Management Organizations (TIMOs) representing institutional investors, Timber REITs or private individuals, will have to respond to these demands. This will become particularly important as baby boomers are nearing retirement and are expected to be the primary buyers of second homes in the next decade. The focus on baby boomers stems from the fact that 1) they are in their peak earning years and have the highest income levels of all age groups, 2) baby boomers represent the greatest percentage of households with high incomes, and 3) the largest number of affluent households is represented by baby boom households.[11]

Studies by the National Association of Realtors® (NAR) have also shown that the second home market surged in 2004 and that investment properties and vacation homes make up a significant portion of the overall housing market. "An examination of the 2003 data from the Census Bureau shows there are 43.8 million second homes in the United States, including 6.6 million vacation homes and 37.2 million investment units, compared with 72.1 million owner-occupied homes"[12]

What does this mean for timber companies? Owners of timberland as well as timber REITs are recognizing potential land development opportunities driven by the migration of baby boomers

[11] Rice, Jeanette I. "Second Homes". Urban Land. Feb.2005, p. 75.
[12] Molony, Walter, and Lucien Salvant. "Second-Home Market Surges". 1 Mar 2005. News Media. 25 July 2005 <http://www.realtor.org>.

into warmer climates, particularly the southeast. Some timberland holdings may have higher value for development, recreation or conservation than for growing timber.[13] Therefore, there is a growing interest among the investment community to better understand the value of land in both rural and suburban regions. Owners of timberland may have a competitive advantage and could capitalize in the second home market or other resort development opportunities.

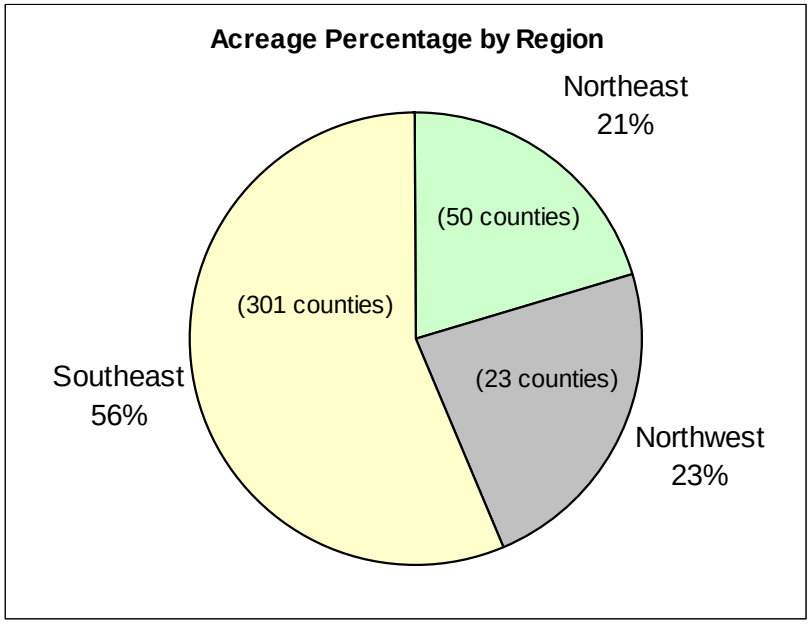
[13] Bremer, Darlene. "See the Forest through the Trees". NAREIT Features. July/August 2005. National Association of Real Estate Investment Trust. 25 July 2005 <www.nareit.com>

CHAPTER 2 - METHODOLOGY

A. GENERAL APPROACH

The first step in performing this analysis was to identify rural counties in which timber companies own and manage timberland. A total of 374 counties across the U.S. were selected totally approximately 7.5 million acres.[14] In total, 21 states were included in this analysis, with all three primary regions represented – the northwest, northeast and southeast. As shown in Figure 2 below, the majority of the counties selected were located in the southeast, which also happens to be where most timber is harvested.

Figure 2: Regional Breakdown of Rural Counties



[14] For confidentiality purposes, the name of the client providing the identification of the counties analyzed has been withheld.

The primary source for data was the U.S. Census Bureau for both the 1990 and 2000 time periods.[15] Data obtained for each county included population and household statistics, density, median house value and rent, employment, and income. Additional attributes collected include various amenity type variables. These include the presence of mountains, water (i.e. lakes, streams, etc.), average climate and precipitation (by state) and proximity to the nearest Metropolitan Statistical Area (MSA). GIS software was used to obtain this information.

The next step was to perform multi regressions across all counties to explain both house price levels and appreciation. Both are equally important. Price levels may indicate where land has a higher value as an urban use, whereas price appreciation would indicate potential development opportunities today and in the future. By looking at each, it helps answer the main question of this thesis: *Which counties (for this specific landowner of timberland) are appreciating faster – urban or rural?*

As a city is expanding out, there are two factors that will impact the value of rural land just beyond the urban edge. One is a growth premium, or the expectation that there will be a greater future growth in rents the closer a location is to the boundary of the city. The other factor is what Capozza and Helsley (1990) refer to as the irreversibility premium, i.e. the extra rent that landowners demand before they are willing to develop raw land and convert it to an urban use. This irreversibility premium is like an option effect, where the owner of a land parcel has the right without obligation to develop the land at any time. These two premiums represent what is

[15] Data was downloaded from www.census.gov from summary files SF 1 and SF 3 for 2000 and summary tape files STF 1 and STF 3 for 1990.

often called the speculative value of undeveloped land. Depending on how fast the urban boundary is expanding outward, these two premiums can cause undeveloped land values just beyond the city edge to grow at very high rates, making very high investment returns possible for speculative landowners.[16]

By using regression analysis, it is possible to create a model to see what variables in 1990 help explain 1990 to 2000 changes in terms of house price appreciation. Based on the coefficients produced by that regression, 2000 values can then be plugged into the equation in order to get a prediction of what the expected 2000 to 2010 changes in price appreciation should be, assuming that the next decade behaves the way the prior one did. Results for both 2000 Price Level Regressions and Forecasted Price Appreciation are discussed in further detail in Chapter 3 – Data Analysis.

B. COUNTY ATTRIBUTES

The counties selected for this analysis are predominately rural. As shown in Table 2, almost 50% of the population is 100% rural as defined by the U.S. Census Bureau, meaning that all of the population is located outside of urban clusters and urban areas. An urban cluster consists of densely settled territory that has at least 2,500 people but fewer than 50,000 people; whereas an urban area has 50,000 people or more.

[16] Geltner, David, and Norman Miller. Commercial Real Estate Analysis and Investments. 2001. p. 84 – 87.

Table 2: Percentage of Total Population is Rural

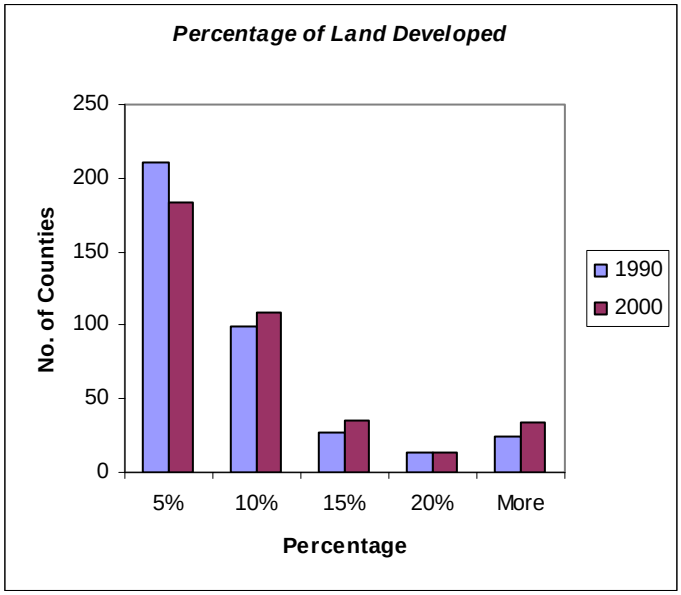
	1990		*2000*	
Rural Percentage:	*No. of Counties*	*% of Total*	*No. of Counties*	*% of Total*
0 - 25%	19	5%	23	6%
25 - 50%	51	14%	56	15%
50 - 75%	125	33%	133	36%
75 - 100%	179	48%	162	43%

For this analysis, a variable referred to as "Percent of Land Area Developed" was created in order to get a better idea as to portion of developed land for each county. In creating this variable, it was assumed that each housing unit was 2 acres. Therefore, a county with a housing unit density of 15 units per square mile would equate to 4% of the county land area as developed.[17]

For the counties analyzed, the average percentage of land developed is fairly low at roughly 8%. This would be expected given that these are counties where timberland is currently harvested. Figure 3 shows the number of counties by percentage of land developed for both 1990 and 2000.

[17] Calculated as: $\frac{15HU}{sq.mile} x \frac{sq.mile}{640acres} x \frac{2acres}{HU} = 4\%$

Figure 3: Histogram of Counties by Percent of Land Developed



The correlation between the rural population percentage and land developed percentage is fairly strong at -0.61 in 2000. Being negatively correlated indicates that as rural population increases, the percent developed decreases (or vice versa) as shown in the figure below.

Figure 4: Correlation between Rural Population and Percentage of Land Developed

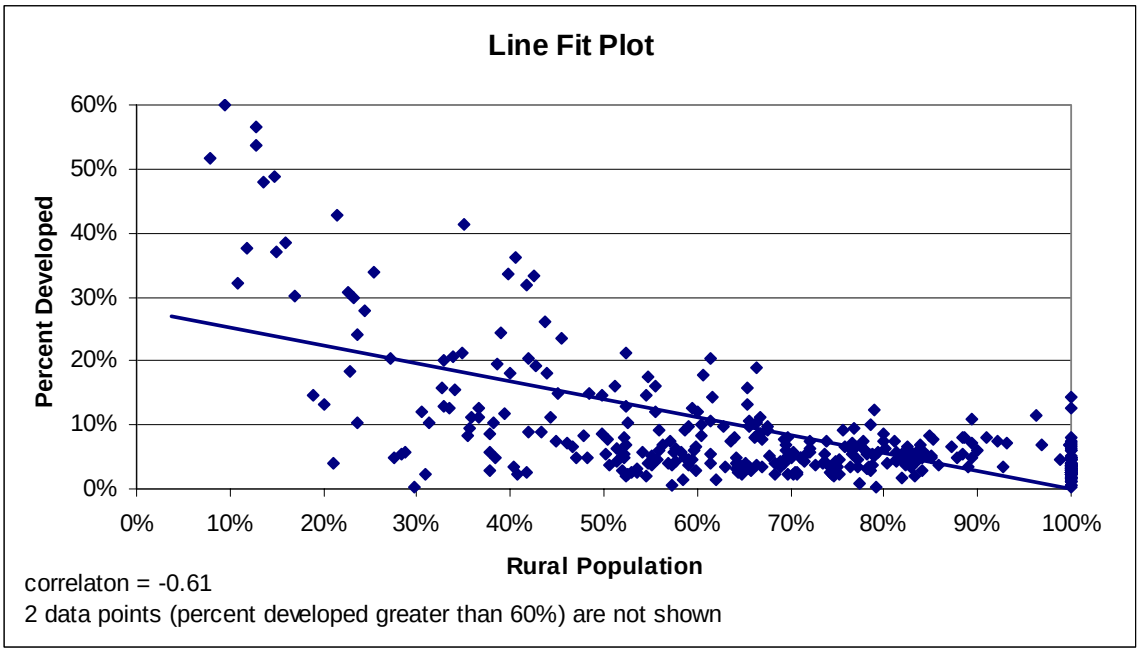


Table 3 provides the summary statistics of selected variables used in this analysis for both 1990 and 2000. The averages for each variable indicate a percentage increase from 1990 to 2000 except for employment within a county. This actually decreases on average from 68% to 63%.

Table 3: Descriptive Statistics on Selected Variables for 1990 and 2000

	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
	Mean		Median		Standard Deviation		Range		Minimum		Maximum	
Population	41,209	46,634	20,467	22,702	93,379	107,884	1,505,404	1,734,957	1,915	2,077	1,507,319	1,737,034
Housing Units	17,516	20,561	8,841	10,389	39,726	46,117	646,457	741,152	886	1,085	647,343	742,237
Seasonal Units (%)	6.04%	6.55%	1.89%	2.70%	9.82%	9.33%	57.37%	55.98%	0.14%	0.22%	57.51%	56.20%
Median Rent	194	296	177	275	68	90	358	567	99	129	457	696
Median House Price	46,039	72,955	42,600	67,450	13,491	24,336	124,300	214,300	15,800	22,600	140,100	236,900
Emp. w/in County (%)	68.23%	63.08%	70.22%	63.89%	17.95%	18.28%	80.91%	83.01%	16.11%	13.79%	97.02%	96.80%
Median Income	20,759	30,981	20,220	30,006	4,202	6,053	25,912	36,511	10,267	16,646	36,179	53,157
Per Capita Income	9,759	15,714	9,519	15,193	1,716	2,583	13,238	19,812	5,349	9,709	18,587	29,521
Pop. Density (per sq. mile)	56.96	64.45	33.34	37.90	74.97	85.15	707.50	815.40	1.48	1.60	708.98	817.00
HU Density (per sq. mile)	23.72	28.01	14.24	16.60	30.88	36.15	303.74	348.20	0.75	0.90	304.48	349.10
Land Area Dev. (%) *	7.41%	8.75%	4.45%	5.19%	9.65%	11.30%	94.92%	108.81%	0.23%	0.28%	95.15%	109.09%

Other Attributes (unchanged between 1990 and 2000)						
County Area (Sq. Mile)	821.69	632.86	781.35	8358.03	144.45	8502.48
Water Area (per sq. mile)	37.35	6.96	95.93	1249.91	0.00	1249.91
Temp (Fº)	59.72	63.40	7.96	29.70	41.00	70.70
Precip. (inches)	48.30	50.66	10.52	44.80	15.34	60.14
Mountains **	0.190	0	0.393	1	0	1
Distance to MSA (meters)	22,165	17,194	23,120	138,773	0	138,773

* Assumes each housing unit equals 2 acres
** Indicates a dummy variable. 0 for no, 1 for yes

Since this analysis focuses on rural counties, it was interesting to look at the percentage of seasonal units. Figure 5 shows the number of counties by percentage of seasonal units and Figure 6 shows how the percentage of seasonal units compares to house prices. It appears that there is a slight increase in house price as the percentage of seasonal units increase.

Figure 5: Histogram of Counties by Percentage of Seasonal Units

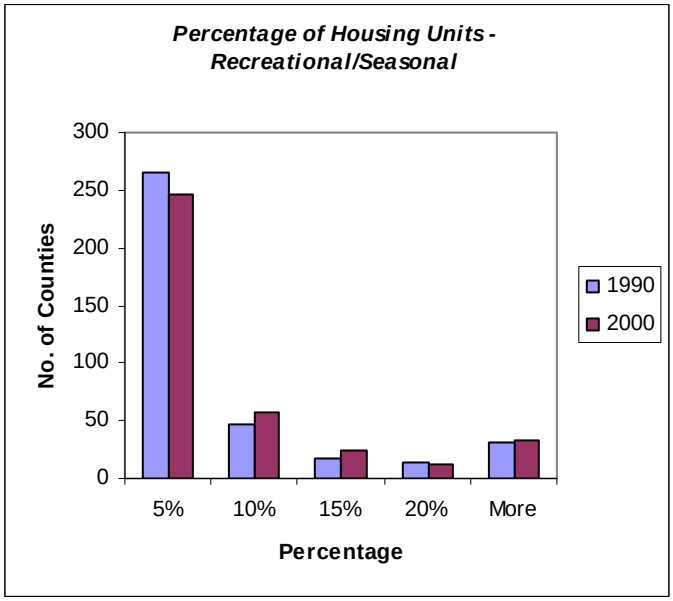
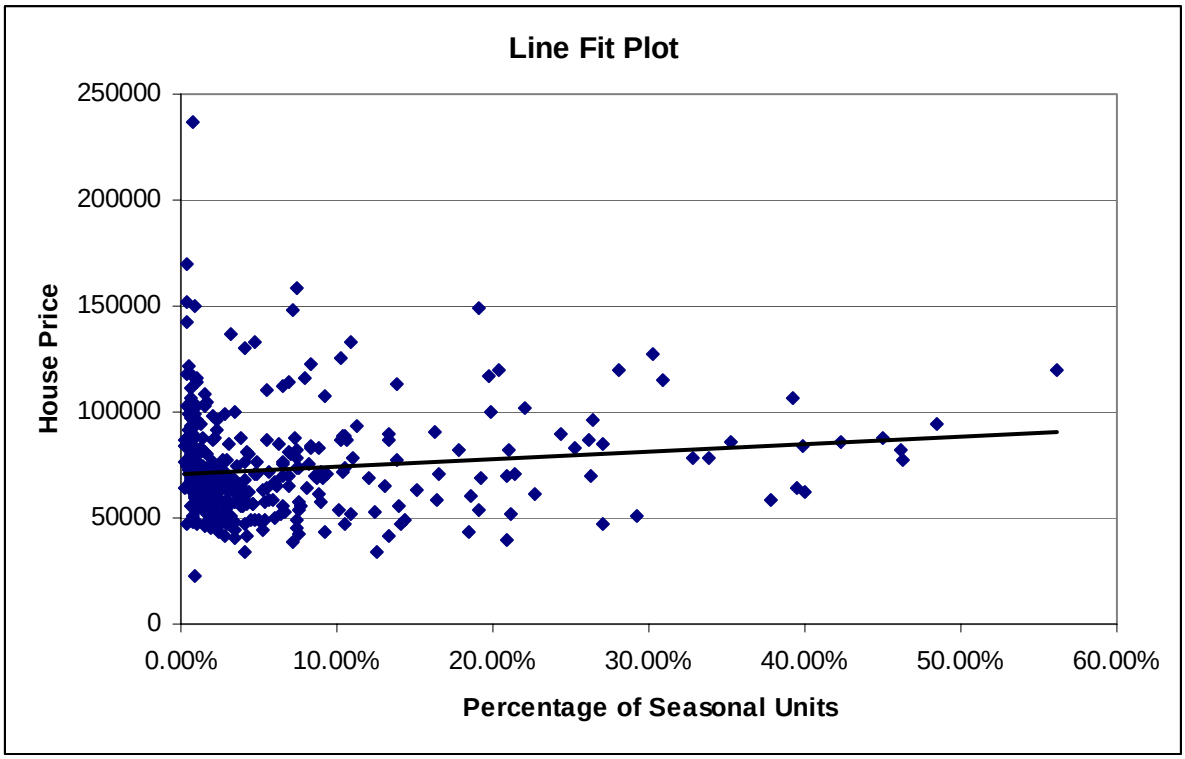


Figure 6: Relationship between Percentage of Seasonal Units and House Price



Prior to doing any regression analyses, it was also beneficial to determine whether any of the variables were heavily correlated since this could lead to odd results. For instance, population and number of housing units are heavily correlated at 0.997. Other highly correlated variables include rent and house price at 0.842, and of course income and per capita income at 0.843. A correlation matrix of selected variables is shown in table below.

Table 4: Correlation Matrix on Selected Variables

	2000 POP	*2000 HU*	*2000 REC*	*2000 DEN POP*	*2000 DEN HU*	*2000 DEV*	*2000 RENT*	*2000 HOUSE PRICE*	*2000 EMP*	*2000 INCOME*	*2000 PER CAPITA*
2000_POP	1.000										
2000_HU	0.997	1.000									
2000_REC	-0.111	-0.069	1.000								
2000_DEN_POP	0.793	0.786	-0.223	1.000							
2000_DEN_HU	0.796	0.798	-0.160	0.992	1.000						
2000_DEV	0.796	0.798	-0.160	0.992	1.000	1.000					
2000_RENT	0.490	0.498	0.063	0.554	0.560	0.560	1.000				
2000_HOUSE PRICE	0.513	0.521	0.134	0.486	0.497	0.497	0.842	1.000			
2000_EMP	0.261	0.275	0.034	0.243	0.264	0.264	0.230	0.133	1.000		
2000_INCOME	0.369	0.365	0.031	0.475	0.462	0.462	0.787	0.755	-0.075	1.000	
2000_PCAPITA	0.473	0.486	0.168	0.539	0.561	0.561	0.785	0.783	0.135	0.843	1.000

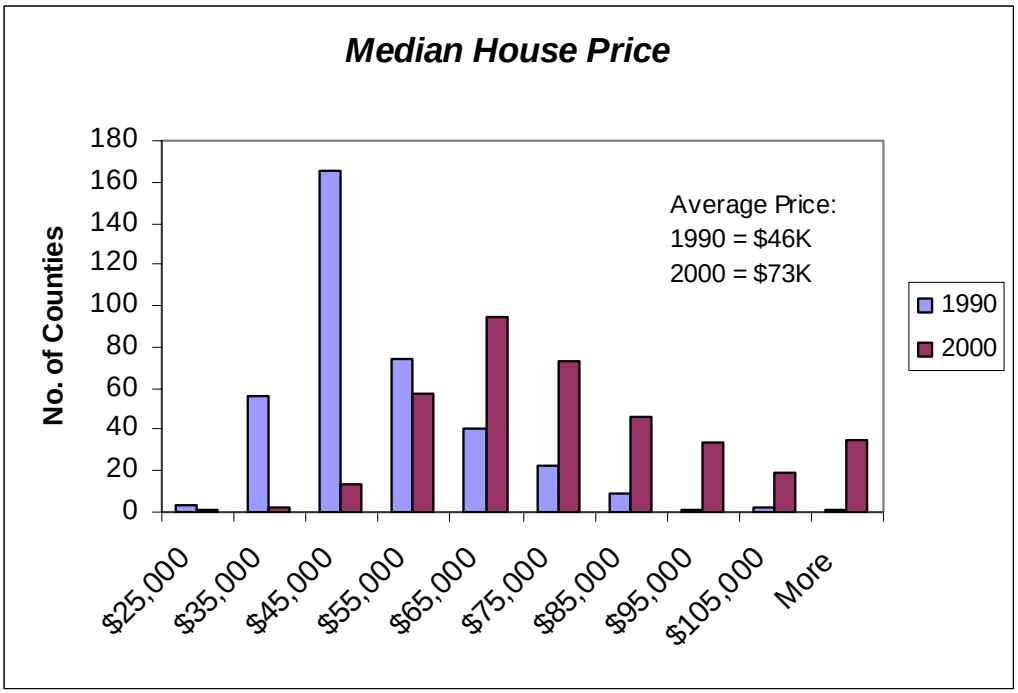
The next step is to identify which variables are significant predictors of house prices. This is where Census data can be very useful, especially when analyzing counties at the macro level. Utilizing the variables above (or some altered form of them) will help explain both house price levels in 2000 as well as facilitate in the development of a model for future house price appreciation.

CHAPTER 3 – DATA ANALYSIS

A. PRICE LEVELS

Land value is probably one of the most fundamental topics in all of real estate. But knowing the value of land can be difficult to ascertain, especially when it comes to rural land. One good proxy of land value is house prices. Given that land value is the residual of development value over development cost, land will be worth more as house prices increase. The figure below provides a breakdown of the median house value within the counties analyzed.

Figure 7: Median House Price Levels for 1990 and 2000



Land derives its value from demand. Since land is fixed in supply, economics states that as more land is demanded by people, the rent will increase proportionally. This is why it is important to

look at population growth in each county. Increase in population, hence demand, may indicate if a county is experiencing urbanization pressures.

Another factor that can influence house prices is location, such as the proximity to a major city. This is where urban land derives its value. People will pay more for land located at more advantageous sites and less for inferior sites. Typically, advantageous sites are located in the city center and rents fall as one moves towards the urban fringe. The reason why can be explained when considering the two components of urban land rent. The first component is the rent per acre for its alternative use, in this case timberland (i.e. the rent necessary to convert timberland into urban land.) This rent is constant across all locations. The second component is the savings in commuting cost per acre that result when housing is placed on the land. In other words, one can pay more for land located near the city center because one is paying less in commuting costs.[18] For this reason, distance to the closest MSA was also used as a predictor variable for house price.

Other useful predictors of house price levels are 1) relative income – the ability for people to pay for housing, 2) employment – the number of people working within the county of residence and perhaps an indicator of the number of people commuting to work, and 3) the percentage of units considered seasonal – an indication of whether the county has amenities or uses other than urban land. Amenity type variables, such as presence of water, mountains, average temperature and precipitation were also included as predictor variables.

[18] DiPasquale, Denise, and William C. Wheaton. Urban Economics and Real Estate Markets. Upper Saddle River, NJ: Prentice-Hall. Inc., 1996, p. 36-39

Using 2000 house prices as the dependent variable, the results of the regression are shown in Table 5. Generally speaking, the results are very satisfactory with an adjusted R square of 0.68, which means that the model can explain 68% of the variation in 2000 house prices. A review of the t-stats indicates that all the independent variables, except for temperature, are useful predictors of house price and are statistically significant. House prices predicted using this model will differ, on average, by $13,610 (i.e. the standard error) from actual house prices. The regression results shown below:

Table 5: 2000 Price Level Regression Results

SUMMARY OUTPUT - 2000 Price Levels

Regression Statistics	
Multiple R	0.834
R Square	0.696
Adjusted R Square	0.687
Standard Error	13610.52
Observations	374

Predictor Variables:

2000_REC	Percentage of Seasonal Units
2000_REL_INC	Relevant Income
2000_POP/EMP	Population over Employment
2000_POP/HU	Population per Housing Unit
2000_DEV	Percent of Land Developed
WATER	Water Area per County (sq. mile)
MNTS	Presence of Mountains (dummy variable)
TEMP	Average Temperature (F)
PRECIP	Average Precipitation (inches)
DIST	Distance (meters) to closest MSA

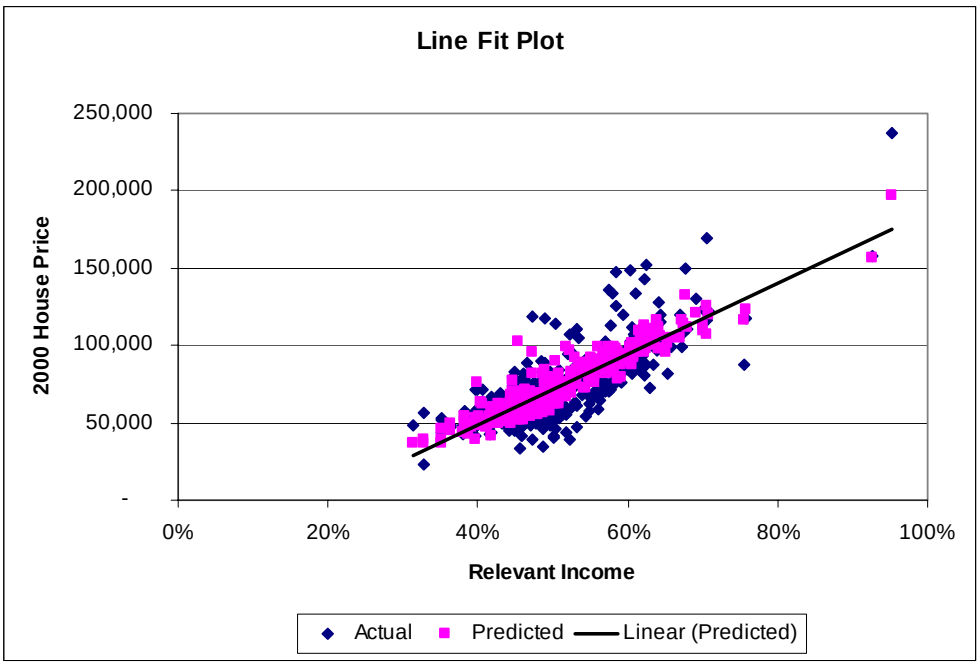
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	1.53656E+11	1.5E+10	82.94681	1.99792E-87
Residual	363	67244389125	1.9E+08		
Total	373	2.209E+11			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-69800.386	16116.565	-4.331	1.92E-05	-101493.944	-38106.829	-101493.944	-38106.829
2000_REC	47187.705	13973.580	3.377	0.000812	19708.371	74667.038	19708.371	74667.038
2000_REL_INC	190387.410	11716.669	16.249	5.27E-45	167346.340	213428.481	167346.340	213428.481
2000_POP/EMP	781.019	374.769	2.084	0.037859	44.027	1518.010	44.027	1518.010
2000_POP/HU	21002.331	3482.516	6.031	4.02E-09	14153.892	27850.771	14153.892	27850.771
2000_DEV	28226.140	8497.477	3.322	0.000986	11515.677	44936.602	11515.677	44936.602
WATER	16.707	8.260	2.023	0.043836	0.464	32.950	0.464	32.950
MNTS	9548.107	3164.206	3.018	0.002728	3325.631	15770.583	3325.631	15770.583
TEMP	-2.370	186.419	-0.013	0.989862	-368.968	364.227	-368.968	364.227
PRECIP	-230.378	106.401	-2.165	0.031024	-439.617	-21.138	-439.617	-21.138
DIST	-0.061	0.037	-1.633	0.103274	-0.135	0.012	-0.135	0.012

Some general observations can be made after interpreting these results. As expected, the coefficient for distance is negative, indicating that the further away a county is from a major city, the lower the house prices will tend to be. However, this independent variable is not as strong as some of the others. Specifically, relevant income is the strongest predictor. Figure 8 below shows the strong relationship between relevant income and house prices.

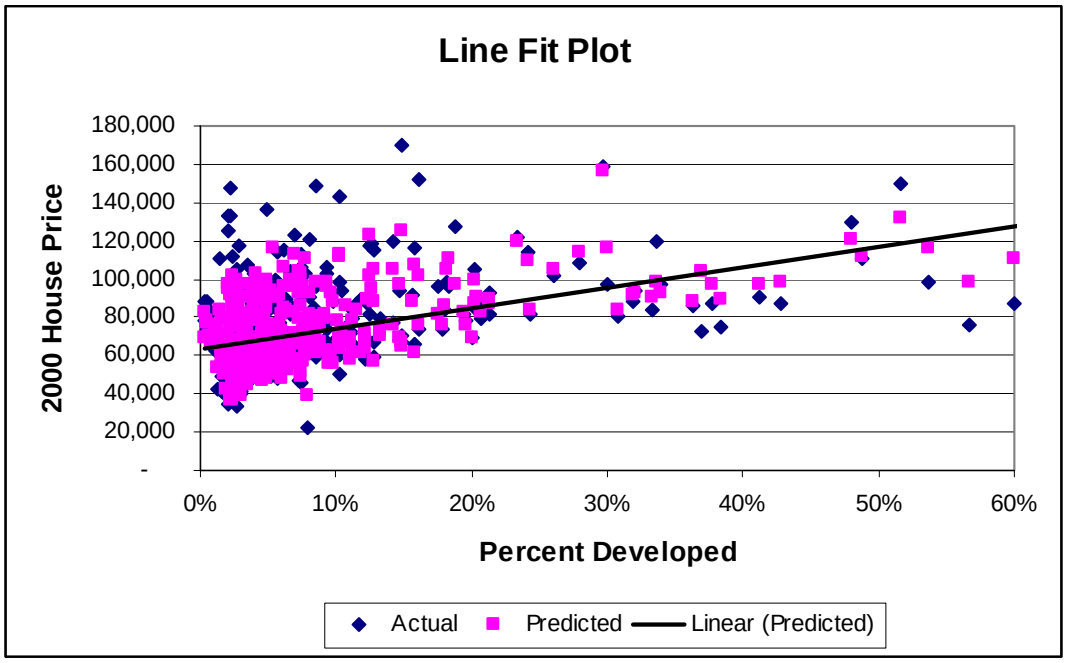
Figure 8: Regression Output - Relevant Income and House Price



Other variables that have a positive impact on pricing are population per housing unit and population over employment. This seems very logical given that increased population is a strong driver of house prices as discussed above.

Another strong indicator of house price is the percent of land developed. This positive relationship shows that house prices will increase as more of the county is developed. See Figure 9.

Figure 9: Regression Output - Percent of Land Developed and House Price



One of the more interesting results is the positive effect the presence of mountains and water has on house prices. Recall that the mountain variable is a dummy variable where a 1 indicates that mountains are present and a 0 indicates that mountains are not present within the county. Therefore, the regression results indicate that for a county with mountains, there is a $9,548 premium on house prices, i.e the coefficient of this variable. Water is also positive, which suggests that counties with large areas of lakes and streams have higher house prices. As a side

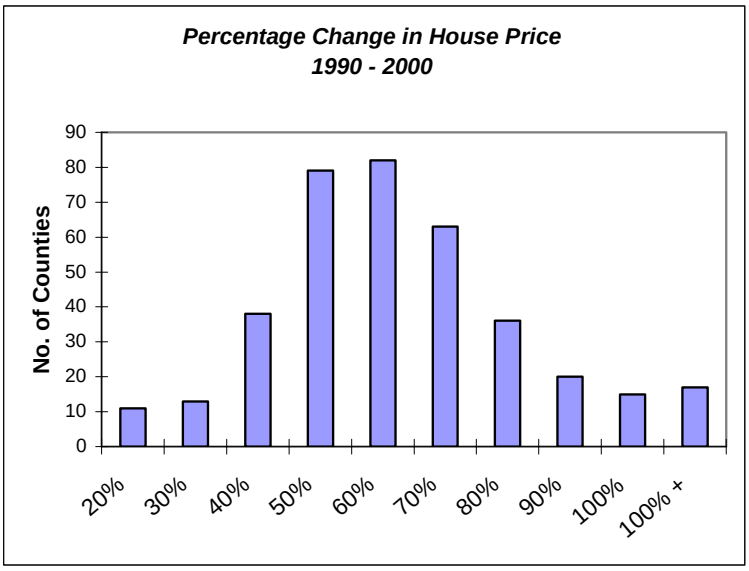
note, the average percentage of land area that is water for all counties is almost 4%, with a few counties nearing 50%.

Lastly, the coefficient for percentage of seasonal units is also instructive. This seems to indicate that counties with more second homes tend to have higher house prices. Given that these are rural counties, it is possible there are other potential uses for these counties beside urban development such as resort or recreational uses.

B. PRICE APPRECIATION (1990 – 2000)

After looking at house price levels, the next step was to create a model that would predict which counties are experiencing higher rates of house price appreciation than other counties. First, the percent change in median house price between 1990 and 2000 was calculated for each county. This new variable, expressed as a percentage, would be used as the dependent variable in the regression. Below are the summary statistics for this new variable.

Figure 10: Descriptive Statistics on Percent Change in House Price



Summary Statistics:	
Mean	0.581562487
Standard Error	0.01080963
Median	0.552199378
Mode	0.420918367
Standard Deviation	0.2090483
Sample Variance	0.043701192
Kurtosis	0.871928395
Skewness	0.634703147
Range	1.344581235
Minimum	-0.015363128
Maximum	1.329218107
Sum	217.5043701
Count	374

The independent variables, or predictor variables, are the same variables used in the price level regression, but from the 1990 data set. By doing this, a model was developed which helped explain the variation in house price appreciation between 1990 and 2000. The regression result for price appreciation between 1990 and 2000 is shown Table 6.

Table 6: 1990 – 2000 House Price Appreciation Regression

SUMMARY OUTPUT - PRICE APPRECIATION

Regression Statistics	
Multiple R	0.532
R Square	0.283
Adjusted R Square	0.261
Standard Error	0.180
Observations	374

Predictor Variables:

1990_REC	Percentage of Seasonal Units
1990_REL_INC	Relevant Income
1990_POP/EMP	Population over Employment
1990_POP/HU	Population per Housing Unit
1990_DEV	Percent of Land Developed
1990_REL PRICE	Relative House Price
WATER	Water Area per County (sq. mile)
MNTS	Presence of Mountains (dummy variable)
TEMP	Average Temperature (F)
PRECIP	Average Precipitation (inches)
DIST	Distance (meters) to closest MSA

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	11	4.614044261	0.41946	12.99311	7.4739E-21
Residual	362	11.68650033	0.03228		
Total	373	16.30054459			

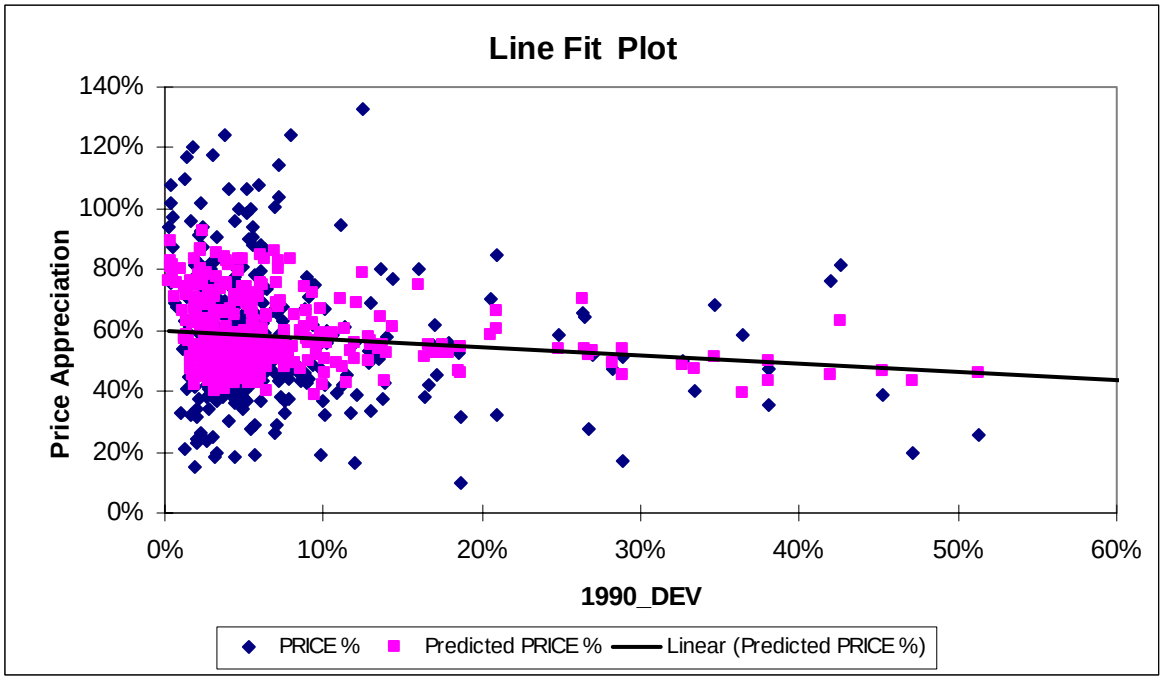
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.0544265	0.2198752	0.2475	0.8046	-0.377967	0.4868196	-0.377967	0.4868196
1990_REL_INC	0.7721381	0.2237818	3.4504	0.0006	0.332063	1.2122136	0.332063	1.2122136
1990_DEV	-0.3179124	0.1362526	-2.3333	0.0202	-0.585858	-0.0499664	-0.585858	-0.0499664
1990_REC	0.6090448	0.1794614	3.3937	0.0008	0.256127	0.9619625	0.256127	0.9619625
1990_POP/EMP	0.0122094	0.0059388	2.0559	0.0405	0.000530	0.0238883	0.000530	0.0238883
1990_POP/HU	0.0802552	0.0429038	1.8706	0.0622	-0.004117	0.1646272	-0.004117	0.1646272
1990_REL PRICE	-0.1448828	0.0620063	-2.3366	0.0200	-0.266821	-0.0229449	-0.266821	-0.0229449
WATER	-0.0000249	0.0001098	-0.2271	0.8205	-0.000241	0.0001911	-0.000241	0.0001911
MNTS	0.1853148	0.0418596	4.4271	0.0000	0.102996	0.2676334	0.102996	0.2676334
TEMP	0.0043154	0.0025342	1.7028	0.0895	-0.000668	0.0092990	-0.000668	0.0092990
PRECIP	-0.0043985	0.0014462	-3.0413	0.0025	-0.007243	-0.0015544	-0.007243	-0.0015544
DIST	-0.0000011	0.0000005	-2.2594	0.0245	-0.000002	-0.0000001	-0.000002	-0.0000001

The adjusted R square in this regression is not as strong as the house price regression, but almost all the t-stats are statistically significant. This time, the independent variable 'water' is not a useful predictor of appreciation as compared to the prior regression on house prices. Temperature remains a weak predictor as well.

Nonetheless, the results are still meaningful. Most notably is the negative coefficient for the '1990_DEV' variable. The results of this regression are suggesting that counties with a high amount of developed land are appreciating less than those counties where the portion of

developed land is low. See Figure 11 below. In other words, counties experiencing suburbanization pressures are appreciating less than counties that are more rural in nature. This seems a bit counter intuitive since one may tend to believe that urban areas have experienced higher appreciation in the past decade. Moreover, the results for the house price regression indicated the opposite effect. Recall that house prices increased as the percent developed increased. (Refer to Figure 9)

Figure 11: Regression Output - Percent Developed and Appreciation (1990-2000)

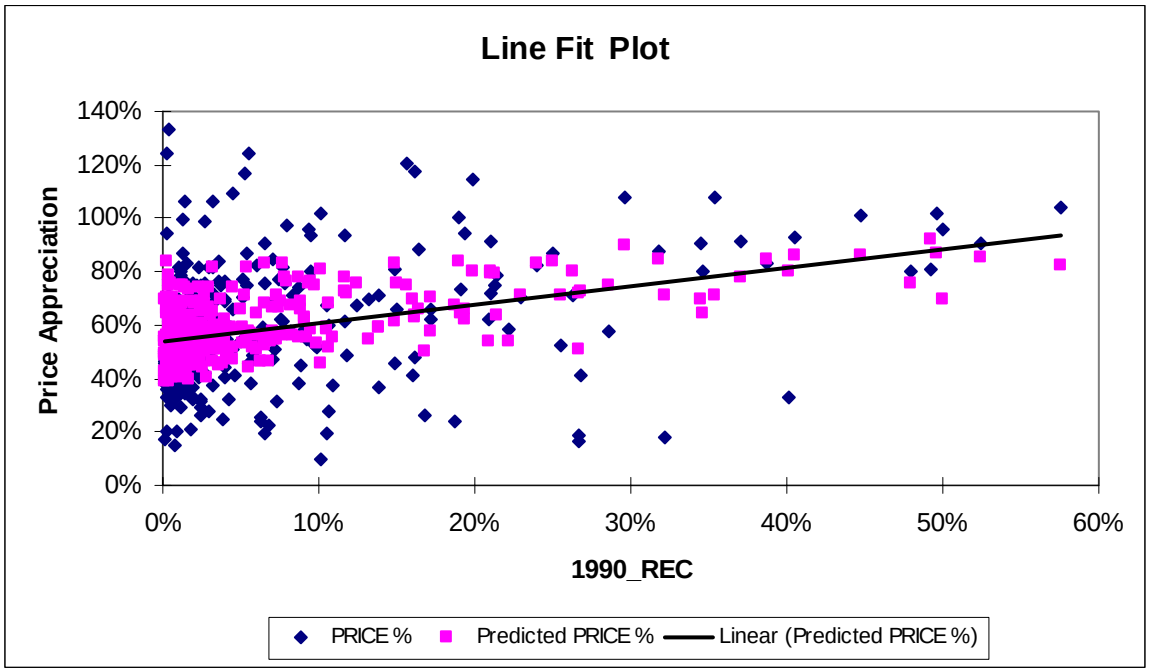


Other predictor variables that have a negative coefficient include relative house price (noted as '1990_REL_ PRICE') and distance. The fact that relative house price has a negative coefficient is instructive. This states that counties with higher relative house prices will experience less appreciation. However, when you look at the line fit plot, the trend line slopes upward. The reason why is that the regression equation is controlling for everything else. Therefore, when

controlling for the percent developed, higher house prices have lower appreciation. When one does not control for percent developed, higher prices have higher appreciation. As for distance being negative, the coefficient is so close to zero that this variable will have very little impact on appreciation.

Surprisingly, the regression results indicate that some of the stronger predictor variables are associated with recreational amenities. In fact, the strongest predictor variable is the mountain variable. According to this model, counties with mountains are estimated to appreciate 18% in comparison to counties without mountains. The percentage of seasonal units is also strong and indicates that an increase in second homes may be slowly growing in appreciating markets. See Figure 12 below.

Figure 12: Regression Output -Percentage of Seasonal Units and Appreciation (1990 – 2000)

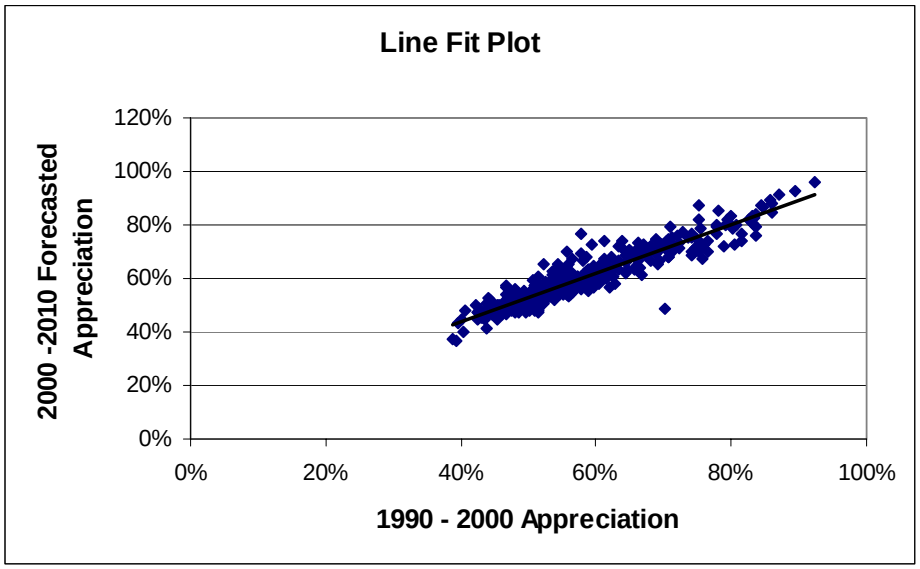


The other predictor variables have similar positive and negative coefficients as compared to the house price level regression. Relevant income is still one of the strongest predictor variables with a positive relationship with house price appreciation. Population per housing unit and population over employment are each positive, but not as statistically significant. Hence, an increase in population may not be as good of an indicator when it comes to appreciation as compared to some of the other amenity type variables, such as percentage of seasonal units and the mountainous counties.

C. FORECASTED APPRECIATION (2000 – 2010)

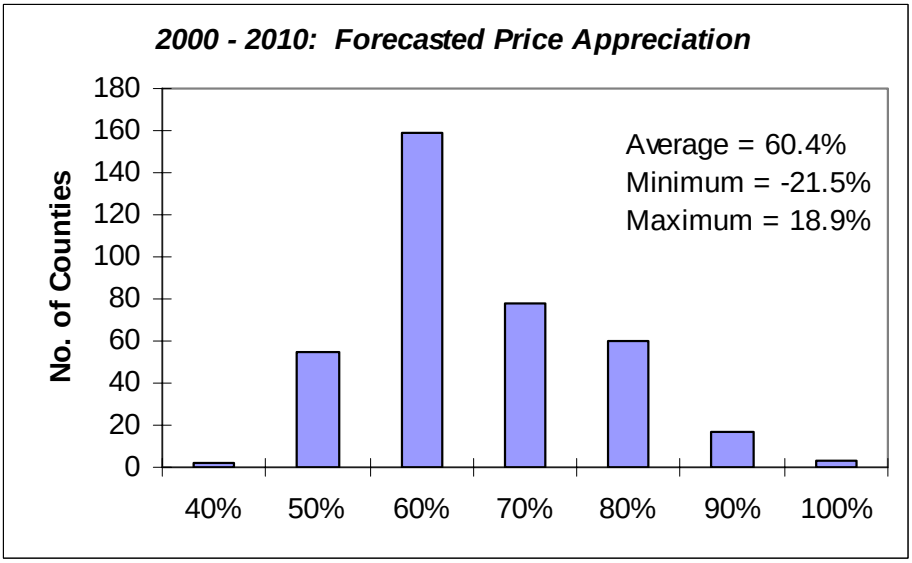
Using the appreciation regression equation, it is now possible to forecast house price appreciation from 2000 to 2010. This of course assumes that the next decade behaves similarly to the one prior. By doing this, it will give owners of timberland (for these counties) an idea as to which counties may be more advantageous to develop now (i.e. at their peak development as an urban use) versus those holdings in which an owner would want to hold onto its land if larger appreciation is forecasted. After plugging the corresponding 2000 values into the regression equation above, the forecasted price appreciation for the next decade is determined. The scatter plot below show how the 2000 – 2010 price appreciation forecast is highly correlated to the decade prior. In fact, the correlation is 0.94. See Figure 13.

Figure 13: Appreciation (1990-2000) v. Forecasted Appreciation (2000-2010)



On average, the forecasted appreciation is 60.4%. This is 2.2% higher than the appreciation from 1990 to 2000 at 58.2%. A distribution as to how the forecasted price appreciation is spread among all counties is shown in Figure 14.

Figure 14: Distribution of 2000 – 2010 Price Appreciation



Further analysis as to where development opportunities for urban land (now and in the future) are discussed in further detail in Chapter 4.

CHAPTER 4 - RESULTS AND FINDINGS

The regression results in Chapter 3 points toward a wide range across all the counties in price appreciation, ranging from a minimum change in appreciation of -21.5% to a maximum change in appreciation of 18.9%. Thus analyzing the data one step helps gain a better understanding of these results. Recall that the objective for this thesis was to determine whether urban counties appreciate at higher rates than rural counties. Looking at a subset of the data set helps answer this question.

Counties were selected based on urban and rural attributes and then compared. The criterion in making this determination was based on population density, percent of land developed, and the percentage of rural population. The results for this analysis were very informative. The 'top' urban counties averaged a forecasted appreciation of only 47.3%, well below the average appreciation of 60.4% for all counties, whereas the 'top' rural counties averaged a forecasted appreciation of 73.4%. See Table 7.

Note that the percent of developed land is also shown to see if any price appreciation for a particular county will have any impact on the surrounding land, in this case timberland. In theory, the lower the percent developed within the county, the less likely any price appreciation will have on the surrounding land. The relationship between land developed and forecasted appreciation is shown in Figure 15. This figure clearly shows how the forecasted appreciation increases as the percent of developed land decreases.

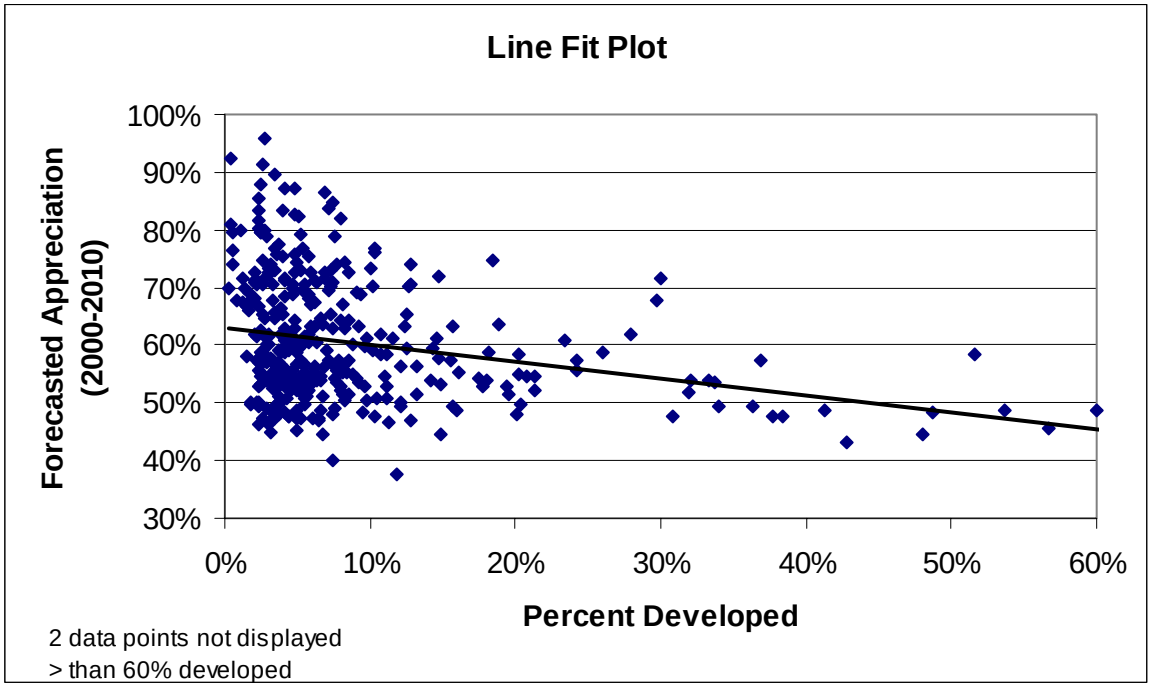
Table 7: Comparison between 'Top' Ten Urban and Rural Counties

County*	State	2000 Price Level	Percent Developed**	Seasonal Percentage	2000-2010 Price Appreciation
TOP URBAN AREAS:					
U1	WA	197,084	109.1%	0.71%	41.0%
U2	WA	132,159	51.6%	0.93%	58.3%
U3	FL	110,473	60.0%	7.35%	48.6%
U4	FL	92,745	32.1%	11.23%	54.0%
U5	AL	97,691	37.8%	0.35%	47.7%
U6	NC	98,611	56.7%	0.25%	45.5%
U7	SC	115,809	53.6%	0.46%	48.8%
U8	SC	120,936	48.0%	4.16%	44.7%
U9	FL	111,338	48.7%	0.68%	48.2%
U10	GA	109,734	84.0%	0.26%	36.6%
	Min	92,745	32.1%	0.3%	36.6%
	Max	197,084	109.1%	11.2%	58.3%
	Average	118,658	58.2%	2.6%	47.3%
TOP RURAL AREAS:					
R1	MT	83,043	0.38%	32.88%	92.4%
R2	MT	77,319	0.50%	10.35%	79.7%
R3	MT	70,411	0.59%	8.39%	74.1%
R4	ME	71,133	1.09%	39.99%	80.0%
R5	FL	76,268	1.19%	3.77%	67.5%
R6	OK	54,179	1.28%	7.56%	71.6%
R7	AR	63,568	1.50%	13.35%	66.6%
R8	GA	70,284	1.59%	5.31%	67.3%
R9	GA	79,204	1.59%	1.78%	69.1%
R10	GA	63,010	1.66%	7.44%	66.2%
	Min	54,179	0.4%	1.8%	66.2%
	Max	83,043	1.7%	40.0%	92.4%
	Average	70,842	1.1%	13.1%	73.4%
FOR ALL COUNTIES:					
	Min	36,495	0.3%	0.2%	36.6%
	Max	197,084	109.1%	56.2%	95.8%
	Average	72,955	8.8%	6.6%	60.4%

* For confidentiality purposes, the name of the counties have been withheld.

** Based on the assumption that each housing unit equals 2 acres.

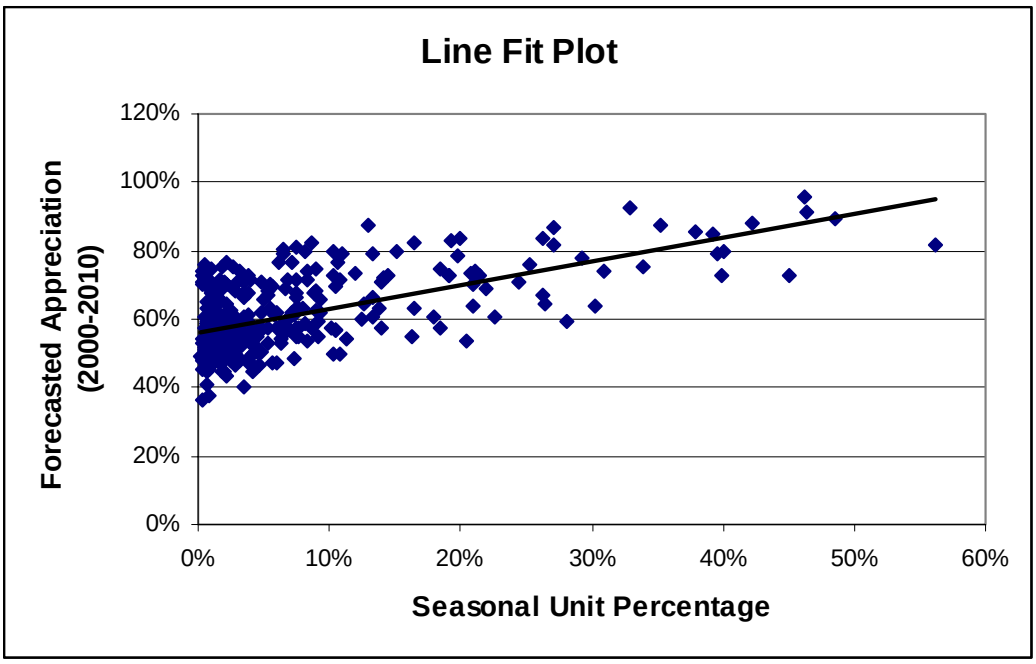
Figure 15: Relationship between Percent of Land Developed and Forecasted Appreciation



As shown in Table 7, the average percent of land developed is very low for the rural counties. Hence, the likelihood that the surrounding land will experience any price appreciation will be low as well. Furthermore, the rural counties also have lower than average house prices. As an owner of timberland, this indicates that these counties, with higher than average appreciation, may be well-suited as its current use of growing timber versus some other alternative use. Thus a landowner should hold onto these parcels, or in other words speculate. On the other hand, the average amount of land developed for the top urban counties is much higher. Thus, there is a higher chance that the surrounding timberland will also experience similar appreciation. Since these counties have higher than average house prices (i.e. more expensive) and low forecasted appreciation as compared to all other counties, then these counties may be better off being sold.

Table 7 also shows is the percentage of seasonal units for each county. As seen in the price appreciation regression results, this variable has a positive effect on price appreciation. See Figure 16. As expected, the counties that were more rural also had a higher percentage of seasonal units.

Figure 16: Percentage of Seasonal Units and Forecasted Appreciation



To better understand the effect the percentage of seasonal units has on price appreciation, another table similar to Table 7 was created. This time the 'top seasonal' and 'top non-seasonal' counties were selected. The results are shown in Table 8. The benefit of looking at the data this way is the ability to see what other variables the counties may have in common.

Table 8: Comparison between 'Top' Ten Seasonal and Non-Seasonal Counties

County*	State	2000 Price Level	Percent Developed**	Seasonal Percentage	2000-2010 Price Appreciation
TOP SEASONAL UNITS					
S1	WI	102,978	7.4%	39.2%	84.6%
S2	WV	60,866	2.5%	39.5%	79.4%
S3	WI	82,899	6.8%	39.9%	72.5%
S4	ME	71,133	1.1%	40.0%	80.0%
S5	WI	91,650	2.5%	42.3%	87.9%
S6	WI	81,854	4.8%	45.0%	72.8%
S7	WI	94,047	2.7%	46.2%	95.8%
S8	WI	82,264	2.6%	46.3%	91.3%
S9	WI	90,181	3.4%	48.5%	89.6%
S10	WI	92,397	8.0%	56.2%	82.0%
	Min	60,866	1.1%	39.2%	72.5%
	Max	102,978	8.0%	56.2%	95.8%
	Average	85,027	4.2%	44.3%	83.6%
TOP NON-SEASONAL UNITS					
N1	GA	88,614	36.3%	0.2%	49%
N2	NC	98,611	56.7%	0.3%	46%
N3	GA	109,734	84.0%	0.3%	37%
N4	GA	102,447	4.2%	0.3%	71%
N5	VA	95,487	12.6%	0.3%	70%
N6	GA	111,122	7.8%	0.3%	74%
N7	AL	97,691	37.8%	0.3%	48%
N8	GA	101,365	16.0%	0.3%	49%
N9	SC	75,862	17.8%	0.4%	53%
N10	SC	76,512	14.2%	0.4%	54%
	Min	75,862	4.2%	0.2%	36.6%
	Max	111,122	84.0%	0.4%	74.1%
	Average	95,745	28.7%	0.3%	55.0%
FOR ALL COUNTIES:					
	Min	36,495	0.3%	0.2%	36.6%
	Max	197,084	109.1%	56.2%	95.8%
	Average	72,955	8.8%	6.6%	60.4%

* For confidentiality purposes, the name of the counties have been withheld.

** Based on the assumption that each housing unit equals 2 acres.

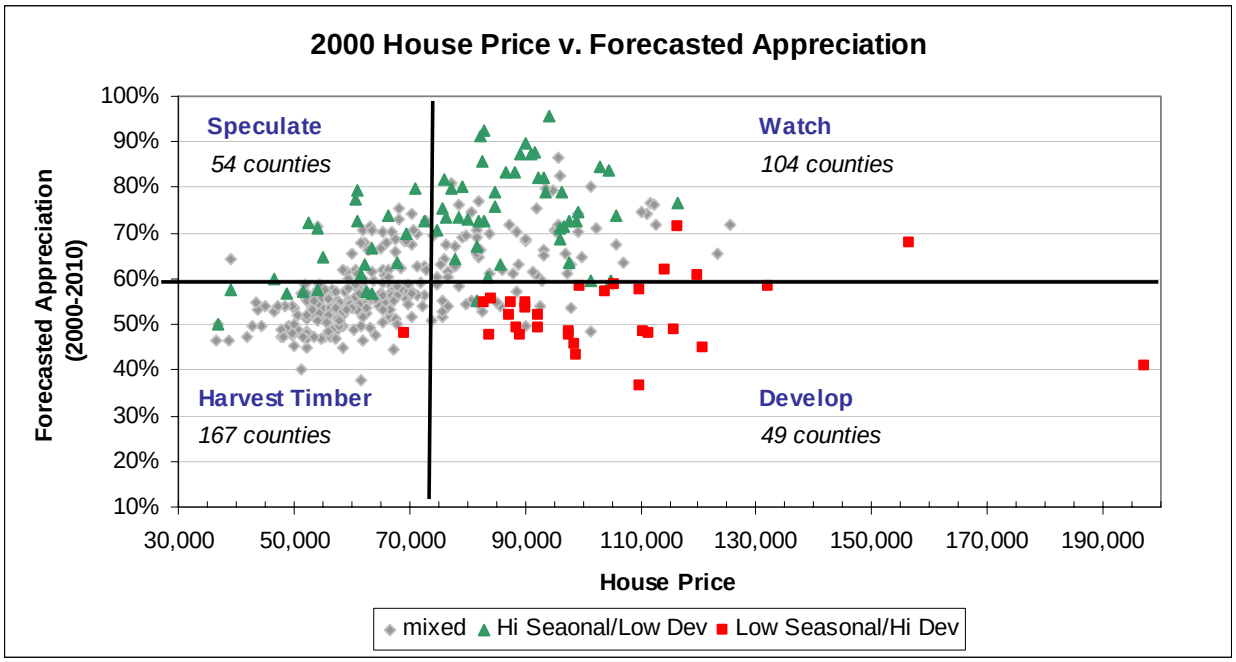
In sum, counties with a high percentage of seasonal units had a forecasted appreciation of 83.6%, well above the average appreciation of 60.4%. Counties with a low percentage of seasonal units had appreciation rates below average, i.e. 55.0%. Some other observations can be made by looking at Table 8, specifically regarding house prices. Both seasonal and non-seasonal counties have higher than average house prices, with the non seasonal counties being slightly higher. Also, the seasonal counties had a lower than average percent developed, reinforcing the findings in Table 7.

CHAPTER 5 – CONCLUSIONS

The goal of this study was to provide an owner of timberland a macro level analysis of its current land holdings and to gauge where potential land development opportunities exist versus where it is optimal to hold land. Counties with low price levels and high appreciation is where land should be held; whereas high price levels and low appreciation is where land development is more attractive, assuming development is feasible. Within the counties studied, the results of the regressions found that price appreciation was less in urban areas with higher price levels. Similarly, counties that were more rural with lower house prices experienced higher appreciation. Furthermore, the percentage of recreational units played an important role as well. The results indicated that counties with a high percentage of seasonal units had higher appreciation, whereas counties with a low percentage of seasonal units had lower appreciation.

Looking at the percentage of seasonal units and the amount of land developed for each county provides additional insight as to how these counties compare. Figure 17 provides a breakdown as to which counties fall into which category. The quadrant is divided based on the average 2000 house price, approximately $73,000, and the average forecasted appreciation at 60%. Any county that falls in the upper left portion of the graph are good candidates to hold, whereas those in the lower right are good opportunities to sell. The two remaining quadrants are mixed – the lower left quadrant (low house prices and low appreciation) indicates harvesting timber as the best use, whereas the upper right quadrant (high house prices and high appreciation) is where landowners may want to keep a watchful eye.

Figure 17: Strategy Chart



As shown in the table above, counties were also color-coded to make some additional observations. Counties that have a high percentage of seasonal units (greater than 10%) and low percent development (less than 20%) were shaded green. These counties, 67 in all, primarily fall into the 'Watch' and 'Speculate' category. Counties shaded red have a low percentage of seasonal units and high percent developed. Almost all the counties, 31 in total, fall into the 'Develop' category. The remaining 267 counties, shaded grey, don't match these criteria and primarily fall in the 'Harvest Timber' quadrant.

The figure above can provide an owner of timber very useful information. A landowner would want to consider developing in urban areas that are more expensive and hold onto rural less expensive areas. In essence, these rural areas are given an option growth effect and will tend to

experience higher rates of appreciation due to the speculative nature of land. In summary, 54 counties fall into the 'speculate' category, whereas 49 counties fit into the 'develop' category. However, one also must keep in mind that if house prices are high and density in that county remains low (or close to zero) then the impact on surrounding land value will be minimized. Such places may indicate a resort use, or some small enclave within the county, versus a county undergoing suburbanization pressures. As such, more analysis at the micro level may be warranted

FUTURE DIRECTIONS

Doing this macro level analysis will hopefully provide owners of timberland a new perspective on price appreciation in rural and suburban counties. However, it also only studies those counties in which a timber company already owns land. It does not address what other factors may influence the purchase price of timberland. Given that timberland transactions have increased significantly in the last 15 years, it may be possible to obtain transaction data (perhaps from NCREIF) and develop a model on a micro level. In doing so, perhaps other attributes, or price triggers, can be identified when trying to price the value of timberland.

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