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SKI RESORT REAL ESTATE MARKETS: WHY NOT TO INVEST

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Abstract

This paper examines the behavior of ski resort property in a major New England market over the last 25 years. A property price series is constructed for the Loon Mountain resort, which is believed to be quite typical of New England Ski areas. This series reveals that *nominal* prices are no higher today than they were in 1980, and consequently *real* prices have eroded by close to 40%. The price series also exhibits considerable variation across time. We explore the causes of this fluctuation with a time series VAR model of the resort and learn three things. First, natural snowfall is crucial to the annual business (skier visits) in the broader New England area. Second, regional annual business is central to the price appreciation at particular resorts. And finally, resort supply responds so elastically to any movement in prices or business that it effectively curtails any long term property appreciation. Impulse responses with the model reveal that a wide range of (positive) demand shocks all fail to generate any long term (real) price appreciation because new development responds so elastically. This behavior is likely to be quite typical of many ski resorts.

I. Introduction

As the US economy continues to grow, an increasing number of Americans are purchasing and building second homes: by the ocean, near lakes, and in the mountains. According to Ski Magazine, in 1960 there were only a handful of ski areas that had any permanent housing, while by 1990, the country contained more than 40 major resorts with collectively over 100,000 housing units (excluding hotel rooms). The objective of this paper is to examine the investment performance and economic behavior of such second homes in one particular market, ski resorts, and in one part of the country, New England. To our knowledge, this is the first effort to study a market for "second" or resort homes. A number of authors have examined the cyclic movements of commercial property markets [Wheaton (1987), Voith and Crone (1988), King and McCue (1987), Grenadier (1994), Hendershott (1999)]. The hotel lodging industry has been studied [Coopers (1999), Wheaton and Rosoff (1996)], and of course the primary home and apartment markets have been well researched [Grebler and Burns (1982), DiPasquale and Wheaton (1992,1994), Blackley (1999)]. There is no published work, however, on 2^{nd} home resort housing.

To study this market, a property price series is first constructed for one particular resort, Loon Mountain. This resort is believed to be quite typical of New England Ski areas. This series reveals that *nominal* prices are no higher today than they were in 1980, and consequently *real* prices have eroded by 40%. In addition to showing little long term nominal appreciation, the series exhibit considerable variation across time. The series is stationary, however, and so can be examined with traditional econometrics. We explore the causes of these fluctuations with a time series model of the resort, a conditional VAR, and learn three things.

First, natural snowfall is probably more important than either long term economic growth or the business cycle in explaining the annual volume of the region’s business (New England skier visits). Secondly, annual regional business in comparison to Loon Mountain’ own stock of units closely explains price appreciation. Finally, new supply at Loon Mountain responds so elastically to any movement in prices or regional business that it effectively curtails any long term property appreciation.

To further reinforce these conclusions, we examine VAR impulse responses to both transitory and permanent demand shocks. The shocks are truly exogenous and are generated by either exceptional snowfall in one year, or by a permanent increase in annual snowfall. In both cases the initial increase in prices that results from the generated business is soon reversed from exuberant new development. In most situations, prices (in real terms) actually wind up permanently lower a number of years after the shock. This behavior is likely to be quite typical of many ski resorts and hence can limit long term investment performance for such property markets.

II. Data and Modeling Approach.

The New England ski market is composed primarily of 19 major resorts and 14 minor ski areas in the three northern states of Maine, New Hampshire and Vermont. Major resorts have a large number of trails as well as extensive lodging and condominium developments. Minor areas focus primarily on local day skiing. Most skiers in these markets live in the Northeast, and much of the skier traffic comes from automobile based weekend trips, between the months of December and March. These weekend and holiday trips generate most of the demand for resort real estate. The region’s snowfall is not as abundant as in the Western US, so all of the resorts over the years have installed full snowmaking capacity on virtually all of their terrain. The resorts compete extensively with each other for destination skiers that come predominantly from Boston and New York.

Loon Mountain lies in the Center of northern states, in the White Mountains of New Hampshire. Being located directly off the State's largest interstate highway (I93) it is very accessible and has grown in popularity. The first ski trails were cut in the mountain in the early 1960s, and a hotel was built at that time. Condominium developments were begun in 1975, and today more than 2100 units sprawl along the access road that leads from Interstate I93 to Loon.

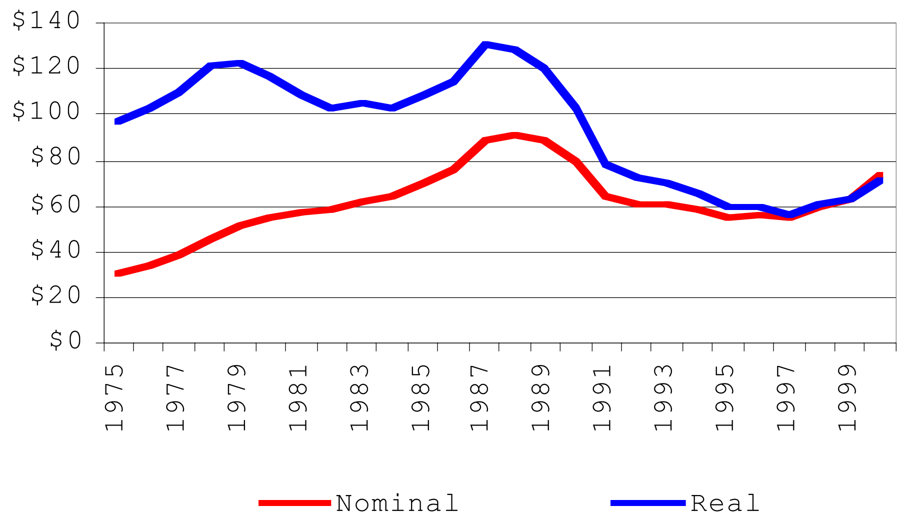
The condominium market at Loon divides itself into two parts. Those that were developed directly adjacent to the resort, the Village at Loon Mountain, contain a total of 555 units and are considered to be more desirable because of their direct access. Over the same time a host of smaller developments were undertaken that lie along the 3 miles of access road, and together contain roughly 1600 units. The real estate market for all of these condominiums is quite active, and sales of units occur in all seasons, with slightly higher transactions in October through December.

Since the objective of a price index is to identify a time pattern in the price of identical assets. We chose to focus on transactions at just the Loon Mountain Village. We obtained a listing of Sales of these units from several sources: tax records, brokers, and most recently an online service. All together we obtained a sample of 616 transactions since 1975. The developments at Loon Mountain Village fall into one of four complexes, and each individual unit is configured in one of 24 "types", in terms of square feet, bedrooms, baths, and style. Thus rather than try to measure every unit attribute, we developed a hedonic equation that simply had 3 complex and 23 unit "fixed effects". In Appendix A, the results of this equation are presented including the year (of sales transaction) coefficients.[1]

The results of this analysis were quite startling, and are displayed in Figure 1. Since the earliest recorded sale, in 1977, the price index (per square foot) has risen only 70% in nominal terms and has fallen 40% in real terms – as of January 2000. Furthermore, there was a significant price "bubble" in the 1980s that saw nominal prices more than double (from 1977 values) and real prices increase 25%. Since that peak, nominal prices have fallen 30% and real prices have declined almost 50%. Thus over the 24 years studied, not only have condominium prices failed to keep pace fully with inflation, but there has been considerable risk associated with their ownership. Those purchasing in the mid to late 1980s could have actually lost considerable value in nominal terms. These series then raise two questions to be addressed: why has long term appreciation been so little, and what accounts for the sharp decline of prices since the late 1980s.

Before proceeding with any kind of analysis it is important to check the stationarity of a series, since variables that are true random walks can generate misleading statistical inferences with standard econometrics. Using the real price series, we tested the Null of a random walk with drift against a stationary time trend with a Dickey-Fuller F-Test. There is sufficient autocorrelation in the series so the augmented test is warranted. We can reject the null at the 10% level, but not 5%. This test is widely thought not to have much power, particularly for a sample with only 24 observations, but it is the best that can be done.[2]

Figure 1: Real and Nominal Condominium Prices ($/sqft)



To study the determinants of the movement in the price series, we began with data on the number of skier visits: a good ex post measure of demand. Each individual resort keeps these figures quite private, and the few resorts that are public companies, report only visits for an aggregate of all resorts owned. Trade associations at the state and regional level, however, do report aggregate statistics, as authorized by the resorts. The longest standing statistical series is for the 3-state northern New England region, which goes back to 1976. While it might have been possible to pry loose visit data for just Loon Mountain, such a series would be hopelessly endogenous in any analysis of prices. The advantage of the aggregate New England visit data is that it is a fine exogenous *instrument* for Loon Mountain demand. A rough guess would place Loon business at about 3% of New England's. Thus real estate activity at Loon is unlikely to have any impact on region-wide ski business.

While we could simply stop here and use New England visits to identify our models, we were interested in the determinants of skier demand and so obtained some standard economic series for the region: employment and income per worker. In addition it is widely felt that the level of natural snowfall in the region plays a strong role in generating skier business. Some feel that this results from a directly improved skiing experience, while others argue that artificial snowmaking is perfectly sufficient, and natural snowfall just "awakens skier interest". In either case, national weather service data was obtained for a site in the middle of the region.

Finally, we undertook a direct count of all condominium developments along the three mile access road. From records we were able to obtain the permit date of each development and create a series for the total stock of units at the resort - based on the time of construction. This covered the full period since the first development in 1975. All these data series are defined in Table 1.

Table 1: New England Ski Data

Variable	Definition
S_t:	Stock of Condominium Permits at Loon Mountain Resort.
NEV_t:	New England skier visits (lift tickets).
NES_t:	New England Average Snowfall (Plymouth NH).
P_t:	Price index for Loon Mountain Resort (constant $).
C_t:	Construction starts of units at Loon Mountain.
NEE_t:	New England Employment
NEY_t:	New England average income per worker.
R_t:	Interest rate {real, nominal}.

Conspicuously absent from this list is any information about condominium rental rates, either daily or seasonal. This information is kept by the resort management agency, and the current agent had been there a limited number of years. The records from previous agents are the property of the agent (not the resort) and simply could not be obtained. Prices were all that was available.

To study how resort prices are related to these variables, we develop a 2-equation "conditional" Vector Auto Regressive model (VAR). Like a traditional VAR model, a conditional VAR jointly predicts the endogenous variables (in this case prices in constant dollars and the stock of condominium units) as a function of lagged values of these variables. Conditional VARs, however, also include contemporaneous variables that are exogenous and not influenced by price or stock. Since we know a priori that New England Skier visits are exogenous to the Loon resort, we add it to the VAR and allow it and national interest rates to "condition" the price and stock equations, as in (1)-(2) below. As an aside interest, we estimate a third equation for New England skier visits (3) that includes other exogenous variables: snowfall and regional economic performance.

$$P_t = f_1(S_{t-1}, P_{t-1}, NEV_t, R_t) \quad (1)$$

$$S_t = f_2(P_{t-1}, S_{t-1}, NEV_t, R_t) \quad (2)$$

$$NEV_t = f_3(NEE_t, NEY_t, NES_t, NEV_{t-1}) \quad (3)$$

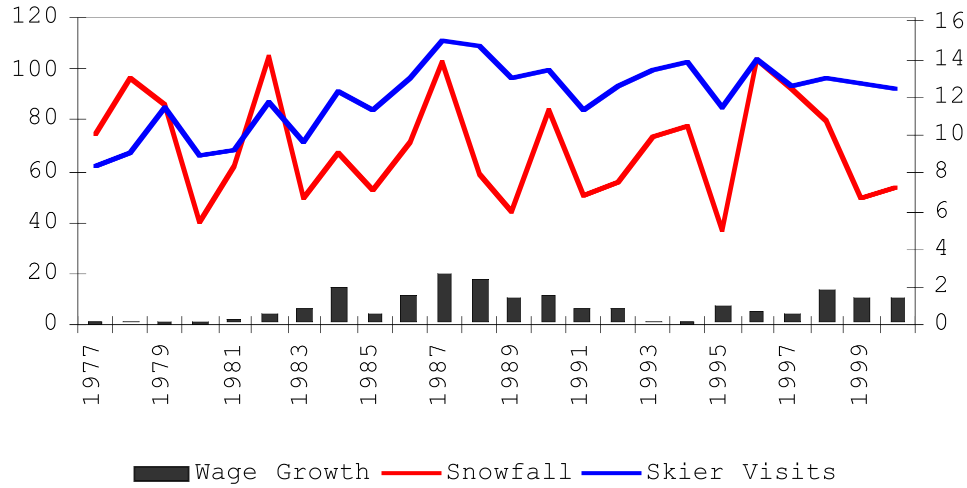
The advantage of the "conditional" VAR system is that we can examine two kinds of reactions. The first is the impact that a transitory shock to demand (NEV) has on prices and stock through a traditional impulse response analysis. Secondly, because the demand instrument is exogenous we can also examine the effect of a permanent change to demand. To do this we manually set NEV higher over some period of time, then forecast prices and stock, and finally compare the consequent changes to the price-stock forecast. The advantage of examining a permanent as opposed to transitory demand stock is that we can use the subsequent changes in prices and stock to estimate an implied supply elasticity for units at Loon Mountain – as determined over different time intervals.[3] To make the analysis "interesting" the magnitude of the shock to NEV is set equal to that which results from having regional snowfall jump up to historic levels – as determined from equation (3).

III. New England Skier Demand

Figure 2 tracks the total skier visits (day tickets sold[4]) to all resorts in the northern New England States. From 1977 to 1987, there was a pronounced 50% rise in the volume of regional ski business. Since then, however, there has been a slow gradual downward trend, with business falling cumulatively about 15%. These patterns in many respects mirror the industry nationwide, and there have been many explanations offered. Some see the growth in the 70s and 80s as being powered by a strong economy, but the surging economy of the 1990s has failed to turn around the industry. Others explain the trend in terms of demographic shifts: aging baby boomers are less interested in cold weather outside activity. In the case of New England, however, there is also the issue of natural snowfall, which has both trended and exhibited much fluctuation over the sample period.[5]

Figure 2 compares visits to both natural snowfall, and the growth in regional income per worker from 1977 through 2000. Wage growth was low (and even negative) during the 1970s and then rose until peaking in 1988. During this period, prosperity and skier visits seem to match each other. During the recession of 1990 and subsequent strong recovery, however, the two do not match well. In terms of snowfall, the annual movements in skier visits do seem remarkably related to the variation in snowfall. Plentiful accumulation during the winters of 1978, 1982, 1987 and 1996 all correspond to local peaks in skier visits.

Figure 2: Annual Snowfall, New England Skier Visits and Wage Growth



An initial equation predicting New England skier visits, uses NEE, NEY and NES as contemporaneous exogenous variables, and produced the results in equation (3′). Snowfall is clearly important in generating skier visits, in the year it occurs, but the region's economic variables are surprisingly weak: [6]

$$NEV_t = -4.6 + .003NEE_t + 1.87NEY_t + .042NES_t + .41NEV_{t-1} \qquad (3')$$

$$(-1.6) \quad (1.9) \quad (0.1) \quad (3.8) \quad (2.2)$$

R^2 = .71, N = 24 (1977-2000), DW = 1.77

In any VAR type analysis it is important to try different lags for right hand side variable and let the significance of each lag be the guiding principle for how far back to go. Further experimenting with equation (3′) revealed that including right hand side variables with a lag – as well as contemporaneously - was quite important and produced coefficients of almost identical magnitude and opposite sign. Thus, effectively, it is the change in the economic variables which impacts skiing – not their level. With snowfall, however, adding a lagged value produced no gain, implying that the level of snowfall has permanent impacts. The endogenous variable NEV also never needed a second lag.[7] Thus, when visits equation uses lagged as well as current values for the economic variables the results are:

$$NEV_t = 1.4 + .0042NEE_t - .0041NEE_{t-1} + 945.NEY_t - 886.NEY_{t-1} + .042NES_t + .26NEV_{t-1}$$

(0.4) (1.8) (-1.7) (3.4) (-5.1) (4.4) (1.5)

$R^2 = .82$, N = 24 (1977-2000), DW = 1.93 (3'')

In (3'') a permanent, increase in the level of regional personal income (NEY) will impact visits strongly in that year, but the impact quickly vanishes as the coefficient for the lagged value takes effect. Eventually the impact almost vanishes. In this sense, regional wealth has only transitory impacts on skier visits, not permanent impacts. The same is true for increases in regional employment (NEE).

Since we will use snowfall to determine the magnitude of our demand shock we should examine its impact in more detail. With only a single significant coefficient, a *permanent* increase in snowfall will generate a concomitant permanent shift in skier demand. If every year, there were 50 inches of extra snowfall (roughly the sample range, or 4 standard deviations) this would boost visits by 18% in the first year (50x.042/12.2), while after several years, the impact on visits would be 1/.74 times this or a 25% increase. In terms of transitory impacts, if the same 50 extra inches occurred only in one year, the 18% impact in that initial year would drop to 4.5% the year after and only 1% two years later.

IV. Loon Mountain Price-Stock VAR

The 2-variable VAR model predicts Loon Mountain condo stock and prices as a function of these variables lagged and the two conditioning variables, interest rates, and region-wide skier visits. The equation for condo prices is shown in (1′) and that for condo stock in (2′). Both equations look quite like a structural model would. In the price equation, skier visits has a strong positive impact while interest rates and condo stock are negative. Experiments with real (as opposed to nominal) interest rates yielded a worse fit, and in no case was a second order lag significant on the price or stock variables.[8]

$$P_t = 19.9 + 2.51NEV_t - 1.48R_t - .014S_{t-1} + .79P_{t-1} \quad (1')$$

(1.7) (2.7) (-2.8) (-5.1) (10.3)

$R^2 = .96$, N = 24 (1976-2000), DW = 1.54

The equation for the condo stock also closely resembles a supply (stock adjustment) model. Prices have a significant positive effect on new development, and interest rates depress construction. The strong direct impact of visits on development can be explained in one of two ways. First, visits could well be a close instrument for the unobserved condominium rental rate. Second, visits is a direct measure of potential buyers, and in a market with frictions, buyer traffic is an important determinant of prices [Wheaton (1990)] . As with the price equation, the coefficients for second order lags on the stock and price variables were insignificant and a first order VAR seems sufficient.

$$S_t = -498. + 2.19P_{t-1} + 44.7VNE_t - 6.14R_t + .93S_{t-1} \quad (2')$$

(-3.3) (2.4) (3.6) (-.9) (27.5)

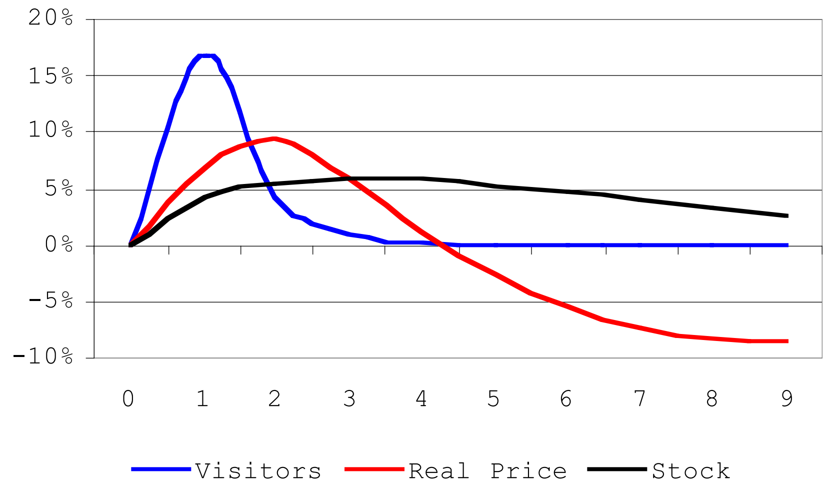
$R^2 = .994$, N = 24 (1977-2000), DW = 1.68

If one was to attempt to interpret these equations as demand and supply structural equations, the long term elasticity of price with respect to stock is about -2.5 in (1') when evaluated at current (year 2000) values. Inverting, demand would have an elasticity of about -.4. In equation (2') the long term elasticity of stock with respect to price is larger – about 1.0 – again when evaluated at year 2000 values. This exercise, however, runs contrary to the VAR approach which is to examine the dynamic properties of the *full system* of equations and make general inferences about elasticity therefrom.

V. VAR Impulse Responses

Since VARs are linear systems, the matrix of coefficients is sufficient to determine the impact of any shock on all future values of the variables in the VAR. In other words initial conditions do not matter. The traditional impulse response analysis is to trace out the yearly *changes* in the forecast values (stock and price) that result from a temporary 1-period shock to any variable in the system – or in this case the exogenous variable that is outside of the system. In our analysis, we will examine how the forecast of prices and stock would differ if *in one year* snowfall was 50 inches greater, and hence skier visits were 18% higher. Figure 3 traces out the change in the predicted values of condo prices and stock that result from this shock – over a 10 year horizon.

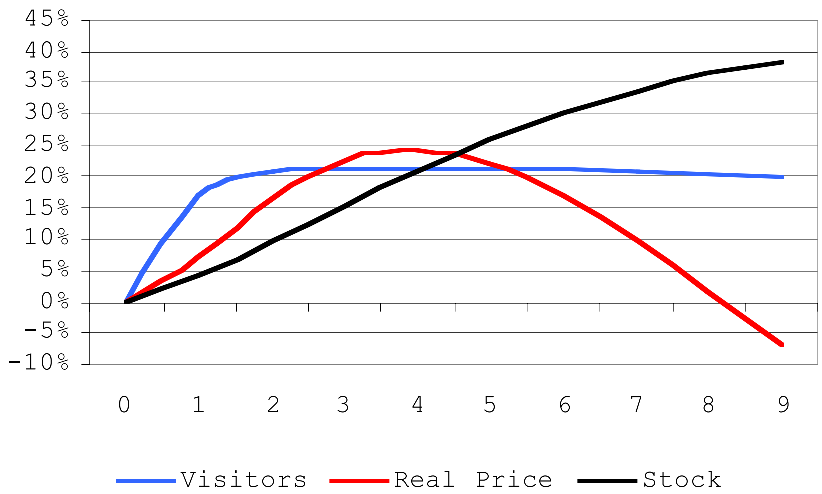
Figure 3: VAR Impulse Response, Temporary Increase in Snowfall in period one: % change in forecast values



Since region wide skier visits is an important conditioning variable in both VAR equations, the shock's impact is immediately felt in terms of generating higher prices and more new development. The positive effect on prices carries forward a few periods, and thus even though skier visits returns to normal in subsequent years, the price impact continues to propel a growth in the stock. Since the additions to the stock are long lived while the shock to demand vanishes, prices soon start to fall from their non-shock path. Eventually, by year 9, there is a greater stock, visits are back where they were originally, and hence prices are *lower!*

We now ask what happens if there is a permanent shift in weather and there is 50 more inches of snowfall each year in the forecast horizon. Of course the impulse response functions in Figure 4 will start out as in the transitory shock case, but now demand (skier visits) continues to be higher each year in the forecast. With demand now permanently higher, prices rise much further and longer than in the transitory snowfall case. This in turn sets off a much more pronounced growth of the stock (development boom). By the 5th year, this development boom begins to fulfill demand and prices turn downward. The boom is slow to correct, however, and by year 9 prices are again *lower* than they were without the permanent shock. Prices bottom out in year 14 at about 13% lower than in the non-shock case, again in constant dollars.

Figure 4: VAR Impulse Response, Permanent Increase in Snowfall from period one:
% change in forecast values



It is possible to calculate an implied supply elasticity from the permanent shock impulse response function - for each year. This is one advantage of the VAR methodology over structural models. For example, in the second year of the shock, the stock has increased by only 10% while prices are 17% higher - an elasticity of .57. By year 6 the same calculation gives an elasticity of 2.0. As prices approach zero and then turn negative, the implied elasticity is effectively infinite.

It is this long run infinitely elastic supply (with respect to real prices) that largely explains the absence of much long term price appreciation in the Loon Mountain resort. Positive shocks to skier demand, whether generated from weather, economic growth, or purely unpredictable changes in recreational preferences, quickly lead to increased real estate development. If the demand shocks are permanent, then supply eventually outstrips demand and prices fall. If the shocks are transitory, then whatever supply increases occur are permanent, and this of course will depress prices as demand returns to its lower normal pattern.

VI. Discussion

The data at Loon Mountain strongly suggests that the historical movement in condominium prices and stock behave as if supply were perfectly elastic and prone to overbuild every time positive demand shocks occur. There can be little doubt about these short run market dynamics. They also are consistent with the evidence that most New England resorts continue to expand their trails and lifts – even in the face of stagnating and declining overall demand. What is still a question, however, is why this behavior occurs. What is it about the operation of the local land market and construction industry that generates such behavior? A number of hypothesis exist, but further micro economic analysis is required.

First off, it could be the case that the opportunity value for land in Northern New England, mostly forestry and agriculture, has been declining in real terms. This might explain the over-willingness of owners to develop land into resorts. Secondly, we know little about the construction industry in rural areas. Conceivably, real incomes and wages have not increased in Northern New England, and so structure replacement costs might not risen much (if any) beyond inflation in the last 25 years. Finally, the access to capital of ski resorts has changed dramatically in recent years. In the 1960s and 1970s most resorts were owned by families or small corporations. In the 1980s and 90s, several large national corporations began consolidating the industry, bringing public market capital into the industry. Separating out these various hypotheses must remain the objective of future research.

References

Blackly, D. "The Long Run Elasticity of New Housing Supply in the US", *Journal of Real Estate Finance and Economics*,18,1 (1999) 25-42.

Coopers and Lybrand, "Econometric Forecasting: Understanding the U.S. Lodging Industry",(Report prepared for the 17th annual Hospitality Industry Investment Conference), June, 1995.

DiPasquale, D. and W. Wheaton, "Housing Market Dynamics and the Future of Housing Prices", *Journal of Urban Economics*,35,1, (1994);1-27.

DiPasquale, D. and W. Wheaton, "The Cost of Capital, tax Reform and the Future of Rental Housing", *Journal of Urban Economics*,31,3, (1992);337-359.

Grebler, and Burns, "Construction cycles in the U.S.", *AREUEA Journal*,(summer,1982).

Grenadier, S. "Local and National Determinants of Office Vacancies", *Journal of Urban Economics*, 37,1, (1995) 57-72

Grenadier, S. "The Persistence of Real Estate Cycles", *Journal of Real Estate Finance and Economics*, 10,2, (1995) 95-121.

Hamilton, James D. *Time Series Analysis,* Princeton University Press (1994).

Hendershott, P, C. Lizieri, G. Matysiak, "The Workings of the London Office Market", *Real Estate Economics*, 27,2, (1999)pp.365-387.

King, John L., and Thomas E. McCue. "Office Building Investment and the Macroeconomy: Empirical Evidence 1973-85." *AREUEA Journal* 15, 3 (1987): 234-255.

Voith, Richard and Theodore Crone. "National Vacancy Rates and the Persistence of Shocks in U.S. Office Markets." *AREUEA Journal* 16, 4 (1988): 437-458.

Wheaton, William. "The Cyclic Behavior of the National Office Market." *AREUEA Journal* 15, 4 (1987): 281-299.

Wheaton, William and Lawrence Rossof, "The Cyclic Behavior of the US Lodging Industry", *Real Estate Economics* 26,1(1996): 67-82.

Wheaton, William “Vacancy, Search and Prices in a Housing Market Matching Model”, *Journal of Political Economy,* 44,2 (1990) pp 222-333.

APPENDIX A: CONDOMINIUM PRICE EQUATION

Variable Description	Coefficient
Clearbrook I	4.7
Clearbrook II**	1.7
Coolidge	11.8
Cannon	-
Aspen	(6.8)
Burke	(7.1)
Aspen or Burke	(6.5)
Dartmouth	(14.8)
Dartmouth Deluxe	(10.1)
Columbia II**	(7.2)
Columbia II Deluxe	(9.0)
Cannon Deluxe	5.3
Columbia	(13.1)
Pedestal**	(10.0)
Super Dartmouth	(23.7)
Super Cannon**	(5.0)
1500 Deluxe**	(2.2)
1700 Deluxe	(22.1)
2300 Deluxe	(14.0)
1800 Standard	(17.2)
1600 Deluxe**	3.0
1800 Deluxe	(10.6)
2200 Standard	(7.6)
2200 Deluxe**	(3.6)
1600 Standard**	(0.5)
Special Design**	1.2
1500 Standard	-
1978	6.8
1979	11.5
1980	16.2
1981	18.6
1982	20.0
1983	23.5
1984	25.2
1985	30.6
1986	36.9
1987	49.3
1988	51.7
1989	49.5
1990	41.3
1991	25.1
1992	21.8
1993	21.8
1994	19.7
1995	15.6
1996	17.2
1997	15.6
1998	20.5
1999	23.7

Usable Observations 616
Degrees of Freedom 567
Centered R^2 0.6841
Un-centered R^2 0.9824
Mean of Dep. Variable 59.4724
Std. Error Dep. Variable 14.4176
Std. Error of Estimate 8.4391

[All coefficients significant at the 5% level *except* those with **]

Footnotes

[1] The hedonic equation was estimated both in linear and log form, with the latter reflecting a slightly better fit using a Box-Cox test. The R2 of .68 is quite high for an equation predicting sales price per square foot (rather than total sales price).

[2] The null hypothesis is that the series in differences is related only to its lagged differences. The alternative adds in lagged levels and a time trend. The coefficient for lagged levels is -.12, the time trend is statistically significant (negative) and the residual sum for this unconstrained equation is 1193. That for the constrained equation is 803. The suggested F value is 5.9 which is significant at the 10% using the test values suggested by Dickey-Fuller [see Hamilton, pp 227-228].

[3] In a structural model, it is possible to trace out how the stock changes over time as a function of a price change, but the time pattern of the elasticity is completely determined by the equation's functional form: the long run elasticity is a simple extrapolation of the short run value. In a 2-variable VAR, the full matrix of coefficients determines the implied elasticity, that is, the ratio of: change-in-stock/change-in-price. This allows for a much less restrictive pattern of elasticity over time.

[4] Season ticket sales have an assumed value for total daily usage that is made by each resort.

[5] The snowfall series has a mean of 76 inches, with a standard deviation of 13. Over time it is a random walk with a slight downward drift. The trend is hard to see, and the variance in the random walk is very large.

[6] The significant lagged visits coefficient suggests that a transitory shock to a RHS variable carries on for a year or two. Alternatively, a permanent shock takes a few periods to reach its full impact.

[7] Second order lags were never significant, and the reduced value of the lagged visits coefficient suggests that (3'') has much less autocorrelation than (3').

[8] The VAR equations were estimated with OLS, and no effort was made to insure orthogonality of the errors. The latter is necessary if a historical variance decomposition is undertaken, but is not needed to achieve unbiased coefficient estimates and impulse responses.