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Honors Thesis

The Real Estate Cycle

A Study of Booms, Busts, & Bubbles

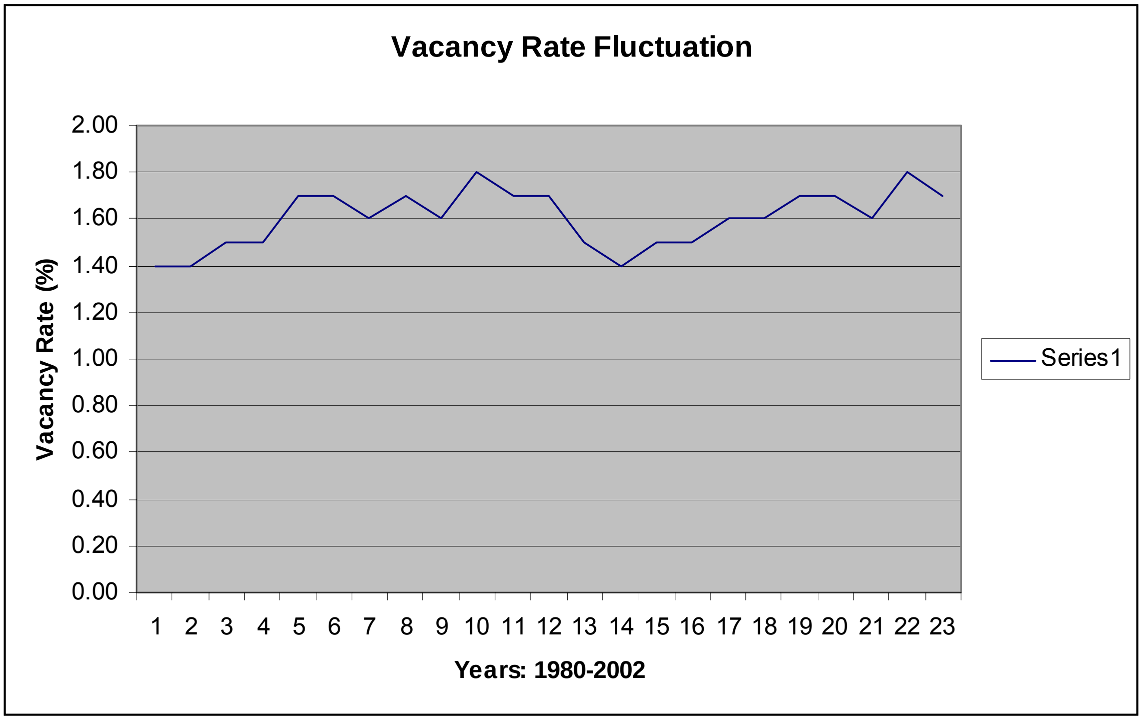
Introduction

Real Estate is defined as the national stock of buildings, the land on which they are built, and all vacant land. These buildings are used either by firms, governments, organizations, and households. Overall, the real estate market plays a large part in world economic arena, with the total value of real estate equaling one third of the value of all capital assets in the world, and equaling $10 trillion worth of assets in the United States alone. Further, the yearly value of new building construction in the United States remains the largest category of national investment, roughly totaling 7 percent of GDP per annum. Real estate represents the single greatest component of national wealth, and the greatest component of individual investment per annum.

In structure, the real estate market is quite complex, and acts as the equilibrium combination of two sub-markets, the property market and the capital market. It is the interaction of these two sub-markets that guides and determines the state and ensuing confidence in the general real estate market. Additionally, like other economic variables, real estate can both be measured as a flow and as a stock for analytical purposes; the flow of real estate is represented by new construction output, while the stock of real estate is measured as the total value of all existing buildings and land values. For the purposes of this study, real estate will be considered from each angle.

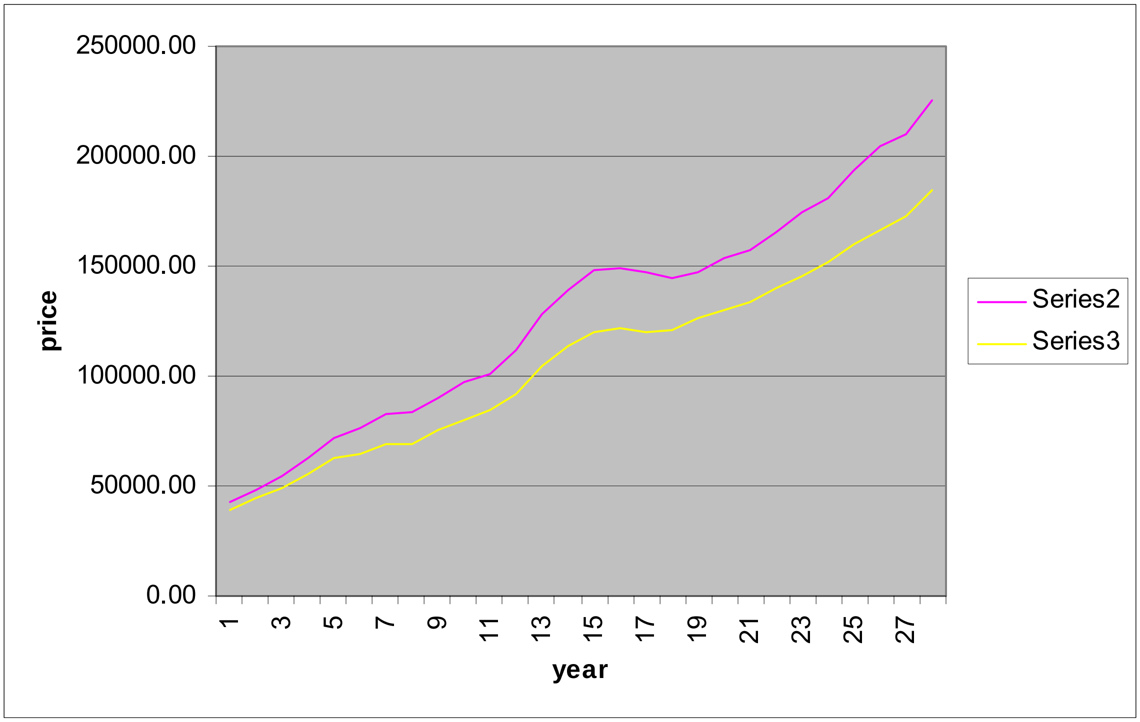
This paper intends to analyze the modern real estate residential and office markets from both macroeconomic and microeconomic perspectives, in a very structured format, and aims to analyze questions of general determination of prices, reasons for substantial price variances in many metropolitan markets, and ultimately to study reasons behind the historically observed cyclical nature of the real estate market. This study will explore whether real cycle phases are distinct and observable, where cycles actually exist, how they are caused, how long they last, how they differ from each other, and whether the appreciation phase of a cycle can be explained by a speculative bubble or other exogenous factors. Ultimately, this paper will substantiate that every real estate boom creates its own subsequent bust, how this actually occurs, why this occurs, can it be precluded, and the degree to which the supposed real estate cycles are correlated with the overall business cycle in general. This study will develop and analyze three distinct economic models, each of which begin to show the workings of the real estate market, and show, from a theoretical perspective, the cause of real estate bubbles. Initially, the four-quadrant model will be used to introduce the real estate market, show which factors may affect the system, show how a cycle can progress and run, provide a theoretical analysis of market interaction to see where prices are derived, and to see areas where the market is vulnerable. Next, the Stock - flow model, provides a further, more complex analysis to show how consumer expectations can create a cycle, based on their perception about future price inflation. The models will then be supplemented with historical data to substantiate many of the theories developed, and to provide answers to questions regarding turbulence in real estate prices. Specifically, the paper will conduct several econometric analyses in both the short term and the long term, to study the historical fluctuations in the real estate market to find the mechanisms that govern the interactions between real estate and other sectors of the economy, and to determine the ways that real estate influences and is influenced by the economy (especially with respect to business cycles). Further, this paper will study the correlation between real estate performance and selected economic variables, inclusive of both lags and leads. It is believed these findings will substantiate the theories presented in the aforementioned models with real world data analysis, and will enable forecasting of future trends and cycles of real estate pricing. These econometric analyses will come in the form of simple static regressions, various simultaneous equation system models, and LM tests. The paper will conclude with a general discussion of the historical and current state of the New York real estate market, and forecasts for future market trends.

A real estate cycle is usually characterized in terms of vacancy fluctuations around a stable long - term equilibrium line:



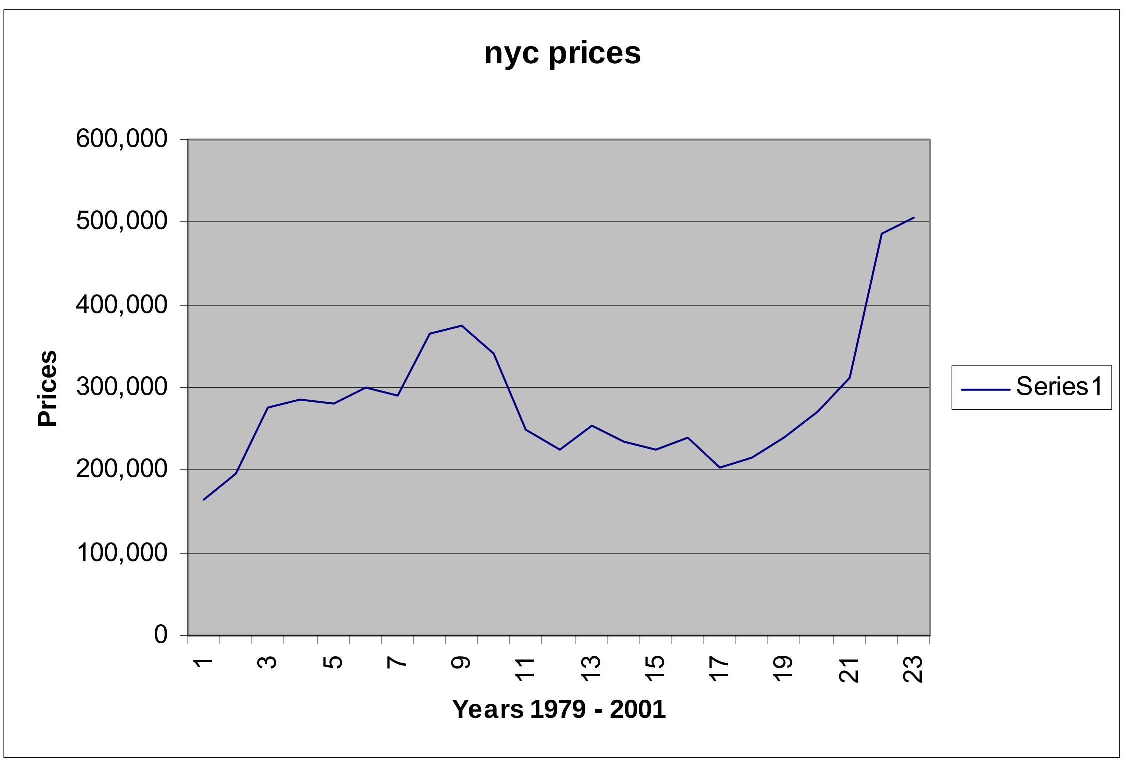
and is analyzed (by most enthusiasts) through a study of the elements that fuel increased construction levels, absorption of space, and inflated price levels. Over the past two decades, the real estate market has gone through significant changes, some of which were caused by cyclical effects, and some of which were more representative of longer - term of structure in the real estate market. These deviations have profoundly affected the occurrence, amplitude, and frequency of real estate market cycles.

The cycle is something that is difficult to study on an aggregate sector level, as shown by this per annum graph of average real estate sales price in the US, from 1975 to 2002:

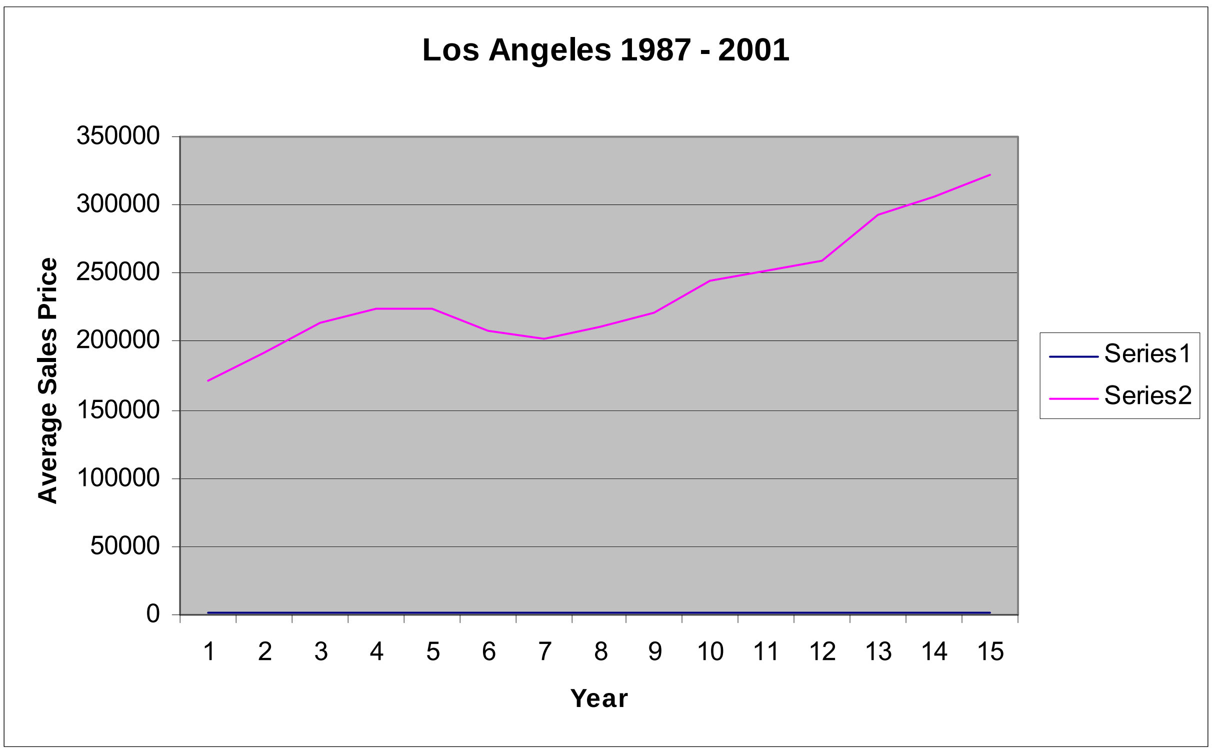


At a glance, this graph does not provide strong evidence in favor of a real estate cycle, as would be characterized by a more "patterned" fluctuation in price levels. The slight price dip around 1990-1992 indicates a general economic recession, yet this graph does not capture a true representation of a substantial cycle. However, this graph does indicate that cycles mostly take place on sub-sector levels, such as regional real estate markets, and they occur at various points depending on their specific phase, thus, the aggregate sales price graph will never capture the cyclical nature of a true real estate market.

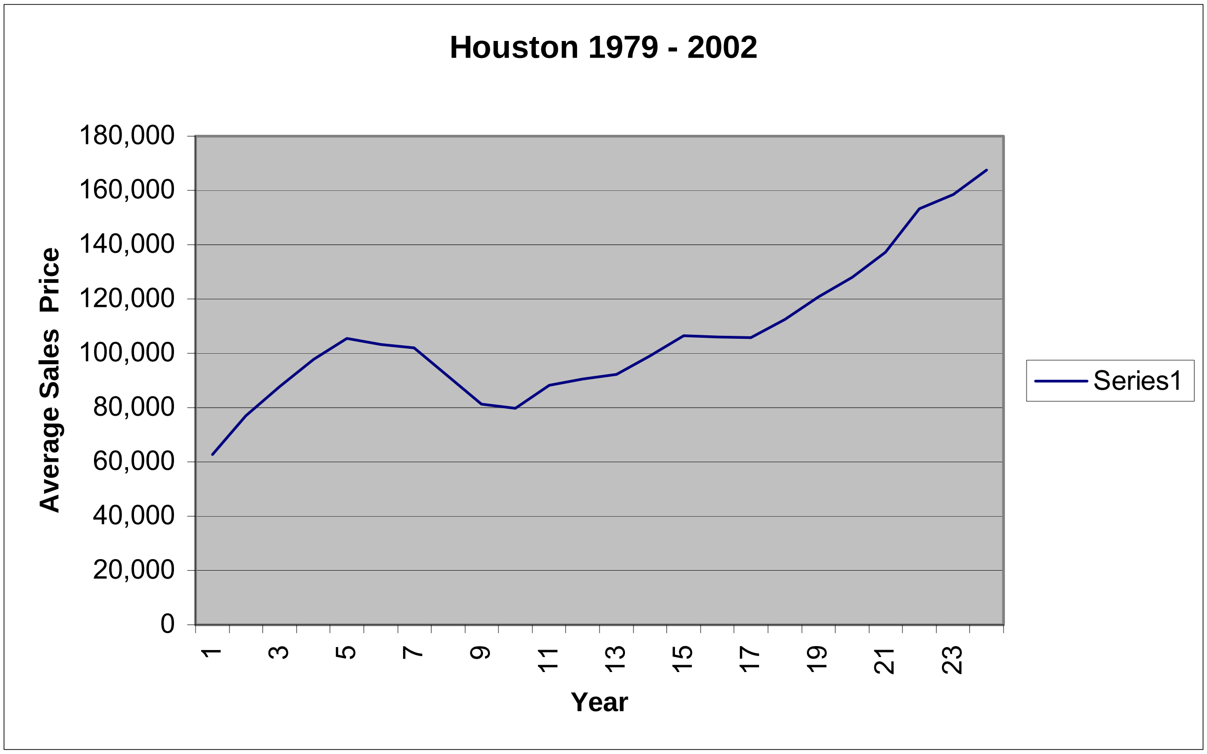
Considering this, the models to be explored in later sections of this study will be applied to analyze regional real estate markets, such as those in New York, Los Angeles, and Houston, where the following graphs substantiate the cyclical nature of each of these regional real estate markets. The following 3 graphs each show a price boom followed by a significant depression in prices. Further, each of these graphs set the basis for the forthcoming models, which will begin to analyze how these pricing cycles originate, and whether they create each other in a perpetual succession. As can be seen from this initial graphical representation, in the Manhattan market, the market reached lows around 1990 and 1995, hit a high around 1988, reached another low around 1993, and has been on a generally upward climb ever since. This market represents a very interesting example because of the strong price fluctuation. The successive boom and bust periods lead to further inquiry, such as whether this is one large fluctuating cycle, whether these are successive cycles caused by one another, whether these cycles are caused by exogenous variables and the succession is a coincidence, or whether these consumers create these cycles by having myopic expectations, or "irrational exuberance" a phrase coined by Alan Greenspan to describe the consumers who took part in the recent stock market boom. Further, the fact that this market is marred with tremendous fluctuation, introduces the possibility that space density in the real estate model is mutually exclusive with the degree of market cycles, a theory presented by the well-known monocentric city model.



The graph of the Los Angeles real estate market provides a stark contrast to that of the seemingly unstable price fluctuation in the Manhattan market. The Los Angeles market shows a more subtle cyclical nature, with milder boom and bust cycle from 1987 to 1992. The reason for this difference is most likely to consumer expectations, an area that will be scrutinized more closely later on.



Finally, the Houston market, also graphed within the same time frame as the New York market also shows a harsh cycle occurring between 1978 and 1987. However, following the crash in prices in 1987, another bust has yet to occur. This graph introduces the possibility the different regions have different expectation regarding future price appreciation, and it may appear the consumers in the Houston market maintain more rational expectations, as a possible explanation for the lone cycle within the given time frame.



Each of these 3 markets shows different cyclical trends, based on many factors within each regional economy. The reasons for these occurrences will be analyzed through the 4-Quadrant model and the Stock – Flow model.

Before proceeding with an immediate analysis of the cyclical possibilities of various real estate markets, it is necessary to introduce an elementary model, which provides a theoretical understanding of the basics of the real estate market, and the relationship between the real estate market and exogenous economic indicators and variables. Following this introduction, this model will then be used to provide a theoretical possibility for the cyclical nature of some real estate markets. Upon presenting a theoretical explanation for a possible real estate cycle, a second model will be introduced, which will analyze the nature of various cycles, and which will introduce the possibility of how consumer perception can influence the direction and future of a regional real estate market. This, more complicated model, will provide intuitive reasoning for different types of cycles and their respective causes. Finally, following this analysis, several new econometric models will be introduced, each with the hopes of (building upon the previous models and) determining the true cause and origin of a cycle. We will hope to foster an understanding of the real estate cycle.

Exploring The Models

Economists classify real estate as a durable good, whose production scales and price levels are established in the capital market. Within this capital market, the demand to own real estate assets must equal the supply of real estate assets, following the general trend of most economic assumptions. Hence, real estate space price levels should directly depend on the number of consumers, landlords, or businesses, each of their respective space demands, and the amount of real estate space "on the market" at any given time. It is inferred that greater demand for real estate space will lead to greater prices, whilst similar reasoning suggests that depressed demand will lead to greater supply and lower prices.

The supply side of the real estate market is determined through the construction sector, which builds and develops real estate properties; here, as will soon be analyzed and discussed, the degree of supply depends on the current price of real estate compared to the cost of new construction or redevelopment:

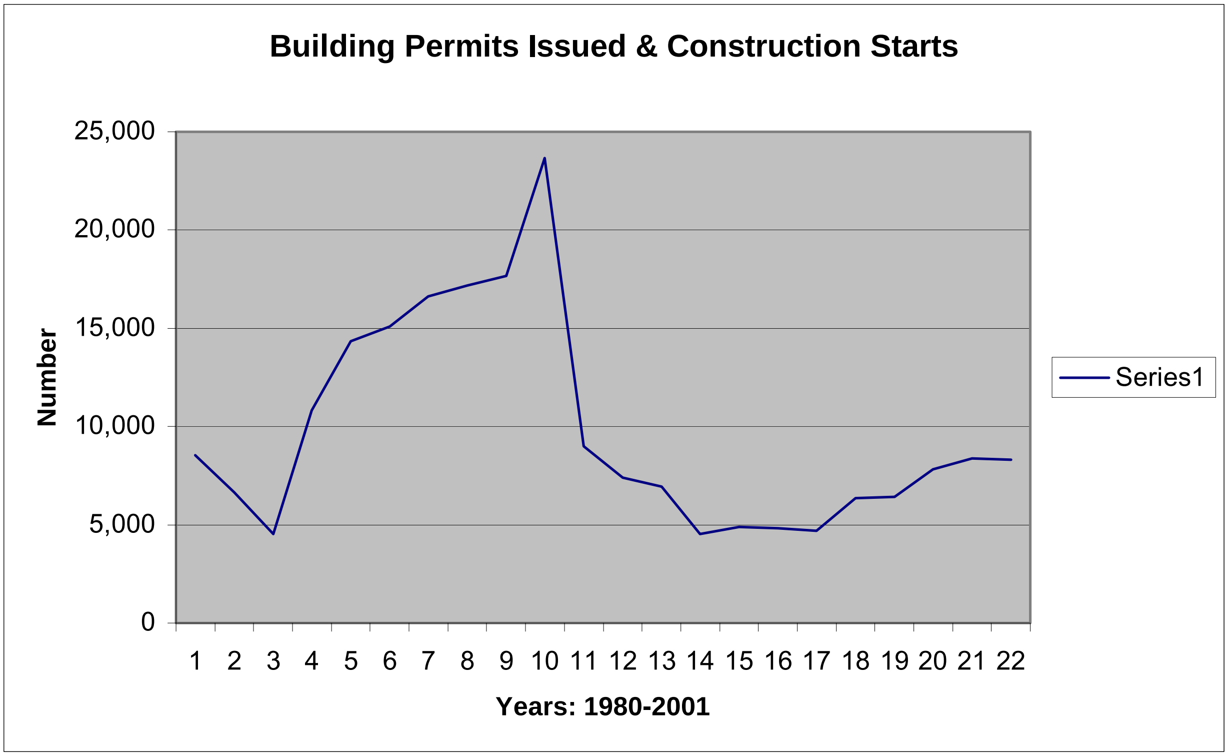
Dependent Variable: HTSS
Method: Least Squares
Date: 04/17/03 Time: 22:27
Sample: 1980 2002
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17211.02	4435.506	3.880285	0.0011
ASP	0.156436	0.133183	1.174594	0.2555
ASPL	-0.271525	0.120388	-2.255417	0.0368
CC	29.31642	10.61614	2.761495	0.0129
INFEX	-22.34062	300.7296	-0.074288	0.9416

R-squared	0.619742	Mean dependent var	17525.35
Adjusted R-squared	0.535240	S.D. dependent var	2855.091
S.E. of regression	1946.410	Akaike info criterion	18.17502
Sum squared resid	68193195	Schwarz criterion	18.42187
Log likelihood	-204.0127	F-statistic	7.334064
Durbin-Watson stat	0.950263	Prob(F-statistic)	0.001093

Here, we confirm that cost of construction and average sales price explain up to 62% of new housing starts, and we further note that everything is statistically significant.

In the long run asset market, things are expected to tend towards "economic normality" where it is expected that real estate prices will equal the cost of construction plus the cost of land. However the short run provides a far different and far more volatile possibility. In the short run, price levels may grossly differ from construction costs due to significant time lags in the decision -making and construction processes. In fact, as will soon be seen, the time lags are significant factors in creating cycles. To illustrate this possibility, consider a market in Los Angeles:



With fixed current space supply, as demand to own real estate space rises, space prices will be expected to rise relative to demand. Then, with prices significantly higher than construction costs, it is predicted that new development will commence, thus we see the start of a cyclical building cycle in the development sector as well, as development takes years to respond to current shocks. It is assumed that this greater supply of space will meet demand levels, and prices will fall back to equal construction costs, as shown by the nadir in the above graph. However, what if increased construction relative to current demand in period t surpasses demand in t+1?

There exist many determinants for real estate demand, however history reveals that real estate price and the rental income (otherwise regarded as free cash flows) that these real estate space assets can earn are significant determinants of demand, from a financial perspective:

Dependent Variable: HSSS
Method: Least Squares
Date: 04/17/03 Time: 22:30
Sample: 1980 2002
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1815.219	1745.856	1.039730	0.3109
ASP	-0.001693	0.036654	-0.046189	0.9636
USRENT	46.04430	46.53289	0.989500	0.3342

R-squared	0.677005	Mean dependent var	8275.739
Adjusted R-squared	0.644705	S.D. dependent var	1802.137
S.E. of regression	1074.193	Akaike info criterion	16.91763
Sum squared resid	23077812	Schwarz criterion	17.06574
Log likelihood	-191.5528	F-statistic	20.96021
Durbin-Watson stat	0.733002	Prob(F-statistic)	0.000012

Here, regression shows that these independent variables predict 68% of the independent variable, and again everything is statistically significant. From this regression, HSSS represents the number of houses sold in the United States, ASP represents the average selling price of these houses, and USRENT represents the occupancy cost of the space.

Both supply and demand on this level are each determined in the property market. In this market, demand derives from potential tenants (or renters). For households, the demand for space depends on income and the cost of occupying the space with regards to the cost of other commodities. For firms or households again, the cost of occupying the space can be considered as rent, the annual amount necessary to use and occupy space. For demand side owners however, rent can be regarded as the per annum cost of owning the property, or the real estate asset.

The two sub sector real estate markets can easily be distinguished: rent is determined in the property market for real estate space use, while ownership is determined in the capital market. In the property market, the supply of real estate space is assumed from the capital market. The demand for rent estate space depends on rent production, income, and/or members per household, etc. In an overall scope, the property market seeks to determine a rent level where the demand for real estate space equals the supply of real estate space. Again, it is inferred that as the number of people per household increase (i.e. the baby boom generation post World War 2), or firms expand, the overall demand for space increases. And with a current level of fixed supply in period t, rents will rise as well. Again, this can be substantiated with a simple regression:

Dependent Variable: HSSS
Method: Least Squares
Date: 04/17/03 Time: 22:35
Sample: 1980 2002
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11844.50	2977.379	-3.978163	0.0007
POP	0.006563	0.000969	6.775468	0.0000
R-squared	0.686131	Mean dependent var		8275.739
Adjusted R-squared	0.671185	S.D. dependent var		1802.137
S.E. of regression	1033.388	Akaike info criterion		16.80202
Sum squared resid	22425726	Schwarz criterion		16.90075
Log likelihood	-191.2232	F-statistic		45.90696
Durbin-Watson stat	0.715895	Prob(F-statistic)		0.000001

Here, although accounting for 69% of sales, population growth is surprisingly not significant. This is most likely due to the fact that in such an industrialized country, population is less of an issue or factor of demand determination (it would probably be more significant in emerging markets, or in Iraq now, where the large population will require much development following destruction from the war).

The capital market and the property market are connected through two distinct points (under this scenario, assume ownership demand is in regards to being a landlord). (1) Rent levels established in the property market are paramount in determining the demand for real estate assets (recall that when acquiring an asset, investors are ultimately purchasing the rights to cash flows associated with the asset). Business people are always looking to maximize profits; therefore, variances in rent levels within the property market directly affect ownership demand in the capital market. Further, it can be inferred that the capital market strictly consists of property owners, whereas the property market strictly consists of consumers. (2) Within the construction and development sector, as construction expands, and the supply of real estate assets increases, the effects are twofold: prices depress in the capital market and rents depress in the property market. The resulting interactions and connections within these two real estate sub-markets are depicted below through the four-quadrant model.

Within the graphical model, the two right-hand quadrants (northeast and southeast) represent the real estate property market (think space use), and the two left-hand quadrants (northwest and southwest) represent the capital market, think asset market for owning real estate. Specifically, the northeast quadrant shows how rents are determined in the short run. The northeast quadrant is composed of two axes: rent and built space space. The ray shows how space demand depends on rent levels, and given the state of the economy (as described earlier) greater presumed rents cause greater ownership demand. The slope of the line represents how much space would be demanded given a certain rent level. If space demand is inelastic with respect to rent levels, this ray will be vertical, and if the space demanded is perfectly elastic with respect to rents, the

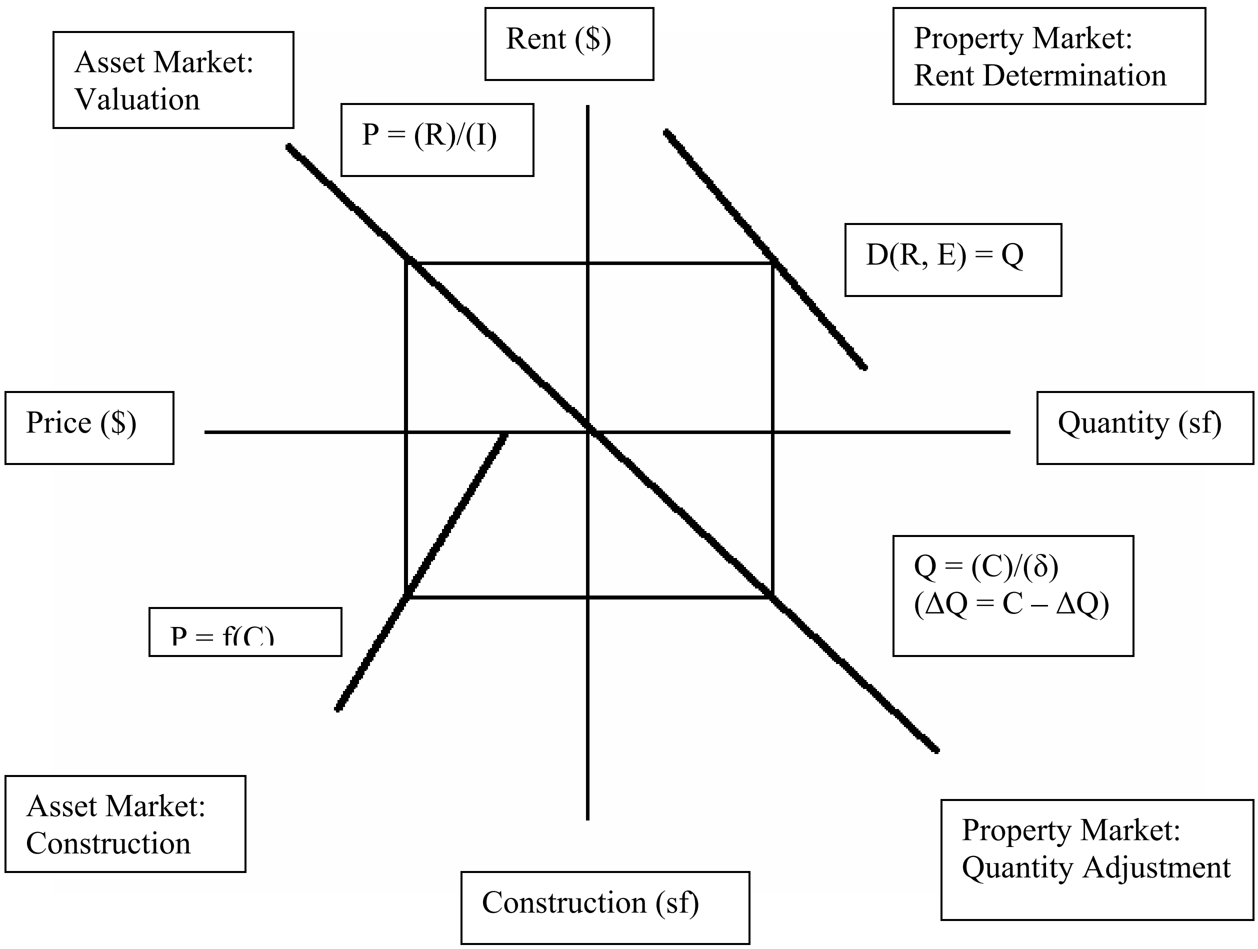


Figure 1: Real Estate Property and Asset Markets

ray will be horizontal. When the state of the economy changes, then the entire ray shifts: a shift upwards takes place when the economy expands, and the number of firms and/or households increase. Presumably showing that more real estate space is demanded for the same rent level, while on the other hand however, a downward shift signifies the economy contracting, with less real estate space demanded for the same rent level:

Dependent Variable: HSSS
Method: Least Squares
Date: 04/17/03 Time: 23:11
Sample: 1980 2002
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15053.12	5953.869	2.528292	0.0210
GNP	-0.799948	0.759875	-1.052737	0.3064
DJIA	0.556509	0.239391	2.324686	0.0320
INFL	-84.91929	100.1668	-0.847779	0.4077
MORT	-352.2710	206.9142	-1.702498	0.1059

R-squared	0.798542	Mean dependent var	8275.739
Adjusted R-squared	0.753774	S.D. dependent var	1802.137
S.E. of regression	894.2416	Akaike info criterion	16.61949
Sum squared resid	14394025	Schwarz criterion	16.86634
Log likelihood	-186.1241	F-statistic	17.83720
Durbin-Watson stat	0.894434	Prob(F-statistic)	0.000004

This regression shows that the combination of the gross domestic product, the stock market index, the inflation level, and the contract interest rate (on mortgages) are positively correlated with new housing sales, are each statistically significant, and account for 79% of new housing sales. Furthermore, this regression shows how exogenous factors are quite influential in determining housing sales.

At equilibrium, consumer demand for real estate space, D, equals the quantity of space on the market supplied by people looking to lease the space, Q. Consequently, rent level, R, is established where demand exactly equals quantity. Thus, in this model, demand is a function of rent levels and the state of the economy, E: D(R, E) = Q. And this relation is strongly substantiated by the following simple regression, where the combination of rent levels, gross national product, the stock market index, the inflation rate, and the interest rate significantly explain 87% of the variation in new housing sales (a very strong indicator of demand):

Dependent Variable: HSSS
Method: Least Squares
Date: 04/17/03 Time: 23:15
Sample: 1980 2002
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5223.700	5986.744	0.872544	0.3951
USRENT	-240.8159	81.45145	-2.956557	0.0088
GNP	6.158219	2.437741	2.526199	0.0217
DJIA	-0.129411	0.306427	-0.422322	0.6781
INFL	-352.8942	123.4146	-2.859420	0.0109
MORT	-310.7380	173.5956	-1.790011	0.0913

R-squared	0.866954	Mean dependent var	8275.739
Adjusted R-squared	0.827822	S.D. dependent var	1802.137
S.E. of regression	747.7845	Akaike info criterion	16.29157
Sum squared resid	9506089.	Schwarz criterion	16.58778
Log likelihood	-181.3530	F-statistic	22.15498
Durbin-Watson stat	1.024022	Prob(F-statistic)	0.000001

Now, given that space supply derives from the asset market, the rent level is established by using the quantity of space on the horizontal axis, drawing a line up to the demand curve, and then over to the vertical axis. Determining this rent level for the use of real estate space theoretically substantiated how rent depends on space quantity and ultimately consumer demand:

Dependent Variable: USRENT
Method: Least Squares
Date: 04/17/03 Time: 23:38
Sample(adjusted): 1980 2000
Included observations: 21 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	60.27369	28.26432	2.132501	0.0488
HFS	0.012850	0.009303	1.381249	0.1862
HSSS	0.025071	0.002301	10.89568	0.0000
HTSS	-0.007014	0.001402	-5.001531	0.0001
HTSSL	-0.002779	0.001552	-1.790183	0.0924

R-squared	0.887698	Mean dependent var	140.2857
Adjusted R-squared	0.859623	S.D. dependent var	30.19129
S.E. of regression	11.31176	Akaike info criterion	7.893820
Sum squared resid	2047.296	Schwarz criterion	8.142516
Log likelihood	-77.88511	F-statistic	31.61827
Durbin-Watson stat	1.577229	Prob(F-statistic)	0.000000

The capital market, represented in the northwest quadrant, symbolizes the initial part of the capital market and also is composed of two axes: rent and price. The diagonal ray bisecting the origin symbolizes the capitalization rate for real estate assets: the rent to price ratio. This number represents the current yield that investors (potential landlords) require in order to hold real estate assets. This capitalization rate is derived from four considerations: (1) the economy's long -term interest rate, (2) the expected growth in rents, (3) the inherent risks in the rental income stream, and (4) tax treatment. A higher capitalization rate is shown by a clockwise rotation of the ray, while a lower capitalization rate is represented by a counter-clockwise rotation. In this quadrant, the capitalization rate is assumed to be exogenous, based on interest rates, and other capital market indicators. The northwest quadrant assumes the rent level, R, from the northeast quadrant, and establishes a price for real estate assets, using a capitalization rate, I: $P = (R)/(I)$. This determination occurs by moving from the rent level on the vertical axis in the northeast quadrant over to the ray in the northwest quadrant, and then down to the horizontal axis, where asset price is given.

The southwest quadrant represents the section of the asset market where the quantity of new real estate assets is derived, or where the new amount of space available for rent is determined. This quadrant again strictly applies to investors. Within this quadrant, the f(C) curve corresponds to the replacement cost of capital for real estate construction. In this portion of the graph, cost of capital is expected to increase with more construction, (C), thus the curve moves in a southwest direction. This curve intersects the price axis at the at the minimum dollar value necessary to promote new construction. If this new development is supplied at any level with similar costs, the ray will tend to be vertical. However, hindrances to the construction process will lead to inelastic supply, and a more horizontal ray. Assuming the price of real estate assets from the northwest quadrant, constructing a line down to the replacement cost curve and over to the vertical axis, finds the level of new development where replacement costs are equal to asset prices. Here, depressed development would lead to surplus profits, and greater levels of development would lead to much decreased profits, and this begins to portray a cyclical structure. It is seen that new construction originates at level, C, where real estate asset price, P, equals the cost of replacement, f(C): $P = f(C)$.

In the southwest quadrant, the per annum amount of new construction, C, changes towards the long-run quantity of real estate space. The change in quantity, ΔQ, in any period, equals new development – losses from quantity determined by the annual depreciation rate, δ: $\Delta Q = C - \delta Q$. The ray stemming from the origin symbolizes the quantity of real estate space (on the horizontal axis), which necessitates a per annum level of replacement construction equal to the value on the vertical axis (to maintained the previously determined rents). At this level, the quantity of space, and analogous level of development, the quantity of space will be constant over the long-run, as depreciation levels will equal new real estate space. Thus, $\Delta Q = 0$, and $Q = (C)/(\delta)$. Overall, the southwest quadrant uses a given level of construction, and figures the resulting quantity of real estate space that would result if that construction level maintained constant, again all in hopes to maintain the determined level of rent.

From a complete perspective and regarding a complete analysis, the 4-quadrant diagram commences with a given quantity; the property market, and consumers, next establishes rents, which are then converted into property prices by the capital market, which is played by investors on the basis of achieving the greatest future cash flows. These asset prices determine the corresponding level of construction, which, in terms of the property market, yields a new level of real estate space. The property and capital markets tend towards equilibrium when the starting quantity of real estate space equals the ending quantity of real estate space. If however, ending quantity doesn't equal beginning quantity, then the corresponding values for R, P, C, or, Q fail to achieve equilibrium. On the other hand, if starting value of quantity is greater than the ending value of quantity, then R, P, and C have to increase to reach equilibrium. Similarly, if starting stock is less than ending stock, R, P, and C must decrease to reach equilibrium. Further, as will be seen, this model accurately portrays the workings of the real estate market, and justifies through the aforementioned sequence of events, how a cycle is developed.

Considering that this paper is devoted to the study of both the office market, and the residential market, it is necessary to inquire about the abovementioned process with regards to real estate space that is occupied and owned (and not rented) by the owner. In this scenario, the four-quadrants remain, however, real estate asset prices and rents are each established by the identical market participant, the owner occupant. Thus, although graphically similar, the structure of this market significantly alters. With respect to the market for owner occupied housing, the demand for real estate space depends on the number of households, the income per household, and the annual cost to maintain and own real estate space. For purposes of this scenario, this per annum cost is the same as rent. An increase in the number of households pushes the demand curve out. With increased demand and a fixed quantity or residential space, the per annum cost of ownership will increase. Assuming this, the northwest quadrant converts this cost into the price that owner-occupants are willing to pay to occupy residential space. It is perceived, in this scenario, that cyclical origin is determined primarily on the demand side, for which the owner-occupier is primarily responsible. However, as will be late seen, there are many more factors involved in this argument.

Similarly, lower interest rates mean that with the same per annum payment (or rent), households are able to afford greater (real estate space) purchasing prices. Thus, it is seen that under owner-occupied real estate, choices by the owner-occupant determine both the per annum payment (or rent) and the real estate asset price level. Additionally, these choices are persuaded by the exact economic and capital market settings that persuade rental space. The means that owner-occupants are driven by very similar motives as owners of rental property. And from this it is able to assume buyers and renters are driven by similar motives, and hence a single analysis can be applied towards both groups. After establishing the purchase price, the new construction levels and resulting new equilibrium quantity of real estate space can be concluded from the southwest quadrant and the southeast quadrant.

Applying this analysis to the market towards industrial space, the demand for space is driven by the per annum cost of ownership (rent) and the amount of firms in the market. At equilibrium, the per annum ownership cost compares demand levels with the fixed quantity of workspace. The capitalization rate translates this per annum cost into the (real estate) asset price that corporations are prepared to pay for the space.

This graphical interpretation provides the resulting implications and repercussions of the overall economy's impact on the real estate market. A further study is necessary to theoretically determine the real estate market's correlation with exogenous economic factors before analyzing the cyclical nature of the market in itself. As the economy grows, the curve in the northeast quadrant moves further northeast. This shift shows increased demand for real estate space at the current rent levels, as consumers would be able to afford more (similarly which would transpire with greater: production, income, or number of households). For any level of real estate quantity, rents will inflate if demand remains constant in an expanding economy. The inflated rents cause higher real estate asset prices in the northwest quadrant, which then spawn increased construction in the southwest quadrant. Ultimately, this will generate increased quantities of real estate space in the southeast quadrant. This simulation is shown in the following graphical analysis.

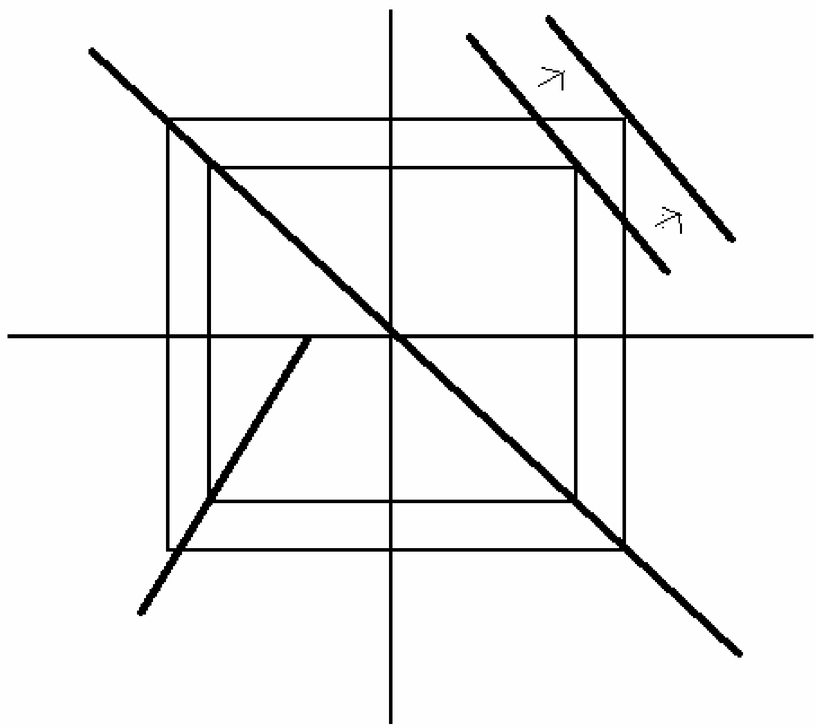


Figure 2: Real Estate Property and Capital Markets -- with greater demand

In this scenario, with increased demand, the new market equilibrium coerces an expansion of the original 4-Quadrant equilibrium parallelogram from the previous equilibrium. This larger parallelogram requires initial prices, rents, and construction levels to increase in response to the greater demand level. It is necessary to realize however, that the expansion of these variables depends on the relative elasticity's of each ray in each quadrant (thus, a square solution box in one period can turn into a rectangular solution box in the next period). A summary analysis provides that economic growth will expand all economic variables in the real estate market, while economic reduction, leads to a depression across each of these real estate indicators. From this, we can begin to see how the real estate market is correlated with the general economy and its direction. Thus, we may infer that the real estate market is correlated with the general business cycle, and may be more affected by exogenous factors than most economists anticipate.

From an alternative perspective, if the demand to own real estate assets changes, the resulting shock and result is starkly different than if the demand to use (rent) real estate shifts. Many factors influences changes in demand to own real estate space. For example, when interest rates increase, the existing yield from real estate assets becomes low with respect to fixed income securities, thus investors will move their money from the real estate sector (an inverse relationship). On the other hand, when interest rates decrease, the existing yield from real estate assets becomes high with respect to fixed income securities, and investors will move their money into the real estate sector. Likewise, if the risk associated with real estate investment is perceived to have exacerbated, then the existing yield may prove to be inadequate to entice investors to purchase real estate assets relative to other assets. Similarly, if this risk is perceived to have decreased, then the existing yield will likely be overly sufficient, and more investors will be drawn to invest in real estate. Lastly, changes in tax treatment of real estate income can have significant effect on the demand to invest in real estate assets.

Assuming that capital markets ably adjust, movements in real estate asset demand will change the capitalization rate at which investors will hold real estate. Decreasing the long term interest rate, reductions in the perceived risk levels, and/or favorable changes in real estate taxes will lower the yield that investors demand in order to hold real estate assets. This reaction is substantiated with the following graphical representation, where the capitalization rate ray shifts (in the northwest quadrant) in a counterclockwise rotation, causing real estate asset prices to increase (on the other hand, greater perceived risk, unfavorable tax changes, and higher interest rates move the ray in a clockwise direction, and depress real estate prices). Further, these possibilities intimate that the real estate market is correlated with macroeconomic policy, which is influenced by the economy. Thus, further reasoning is offered explaining how the real estate market can be correlated with the general business cycle.

Assuming rent from the property market, a lower capitalization rate increases real estate prices, and in the southwest quadrant this leads to greater construction. Ultimately, the increased quantity (in the southeast quadrant) then decreases rents in the in the property market for space, in the northeast quadrant. The resulting equilibrium forces the ending rent level to equal the starting rent level. This equilibrium causes a new solution parallelogram, which is both lower and wider than before (more rectangular). Thus, we start to see the development of a cyclical price fluctuation.

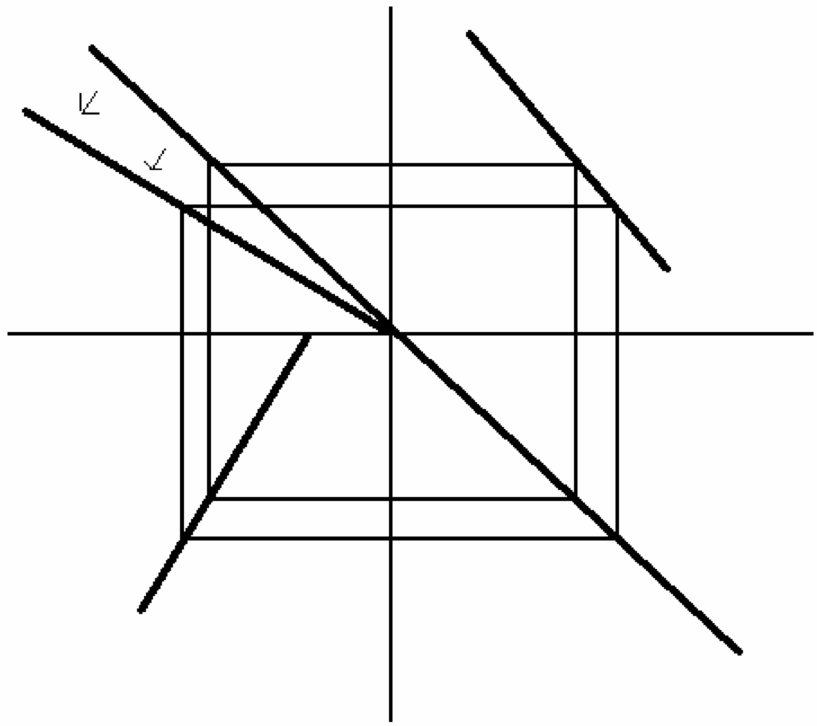


Figure 3: Property and Capital Markets -- changes in asset demand

In this new solution parallelogram, real estate prices will increase while rents will decrease, construction will increase, and the long-term quantity of real estate space will increase as well. As is shown in the above representation, a favorable movement in asset demand, like a favorable shift in space demand, will inflate prices, raise construction output, and increase quantity, though it will reduce rents.

The final exogenous shock that will impact the real estate market is an alteration in the supply schedule for new construction. This can occur under several circumstances: increased short-term interest rates, and a lack of construction financing will raise development costs, and ultimately cause reduced construction rates. Furthermore, stricter zoning codes and/or building restrictions will increase construction costs and reduce the potential profits of any given project. These negative supply shocks cause a westward shift in the cost schedule in the southwest quadrant. Meaning, for the same price level less construction will occur. On the other side however, positive supply shocks, such as easier access to financing, or less building regulations, move the ray eastward, and increase construction under the same price level. The long-run result of such a supply shock that would transpire with increased short-term interest rates is as follows:

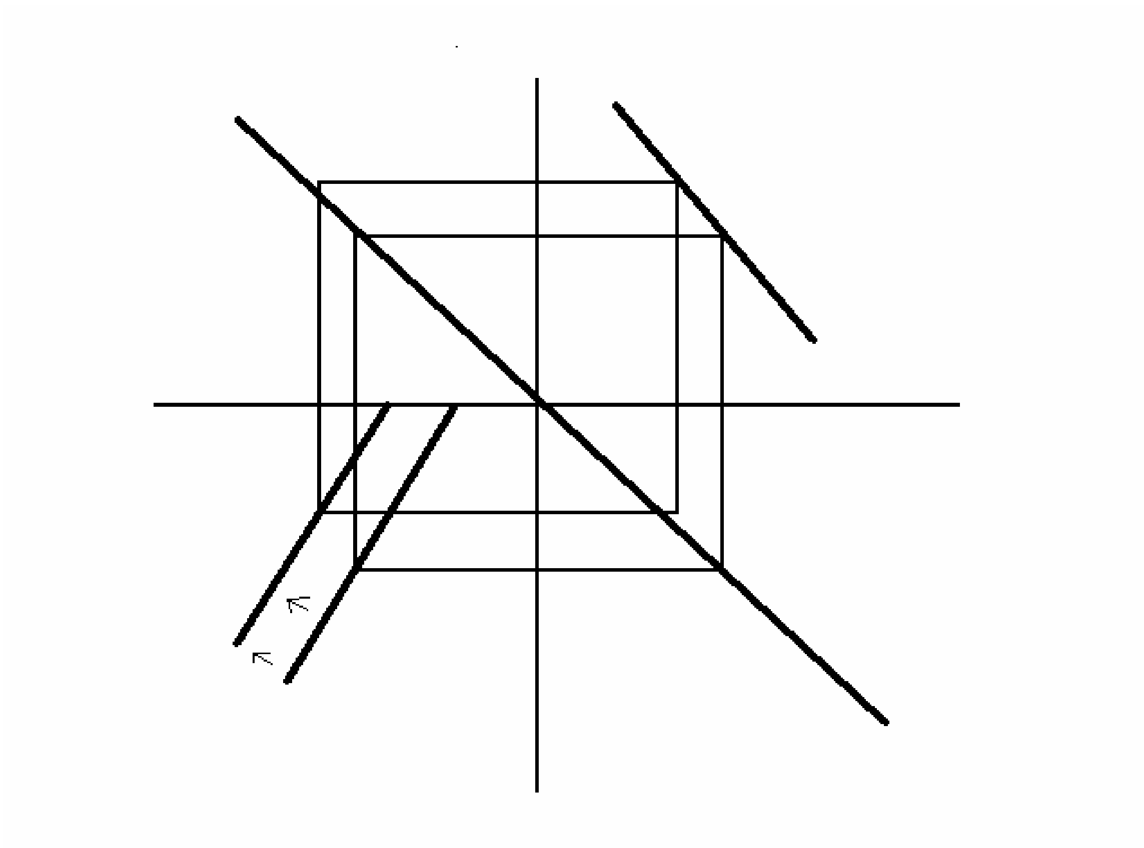
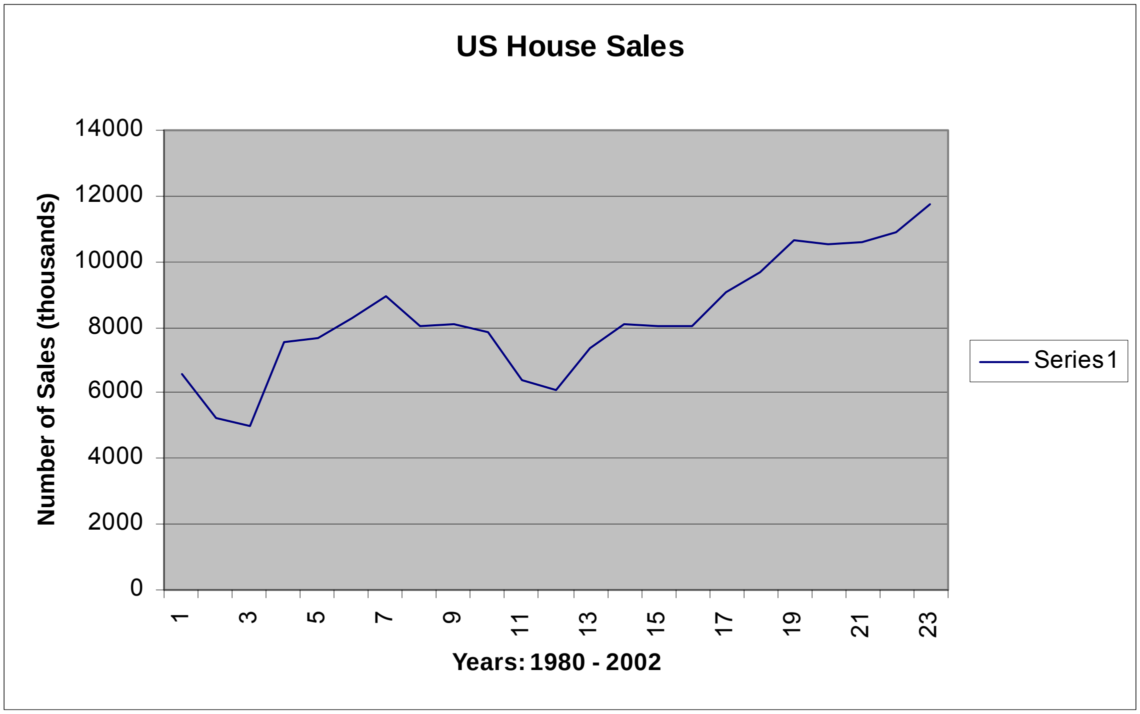
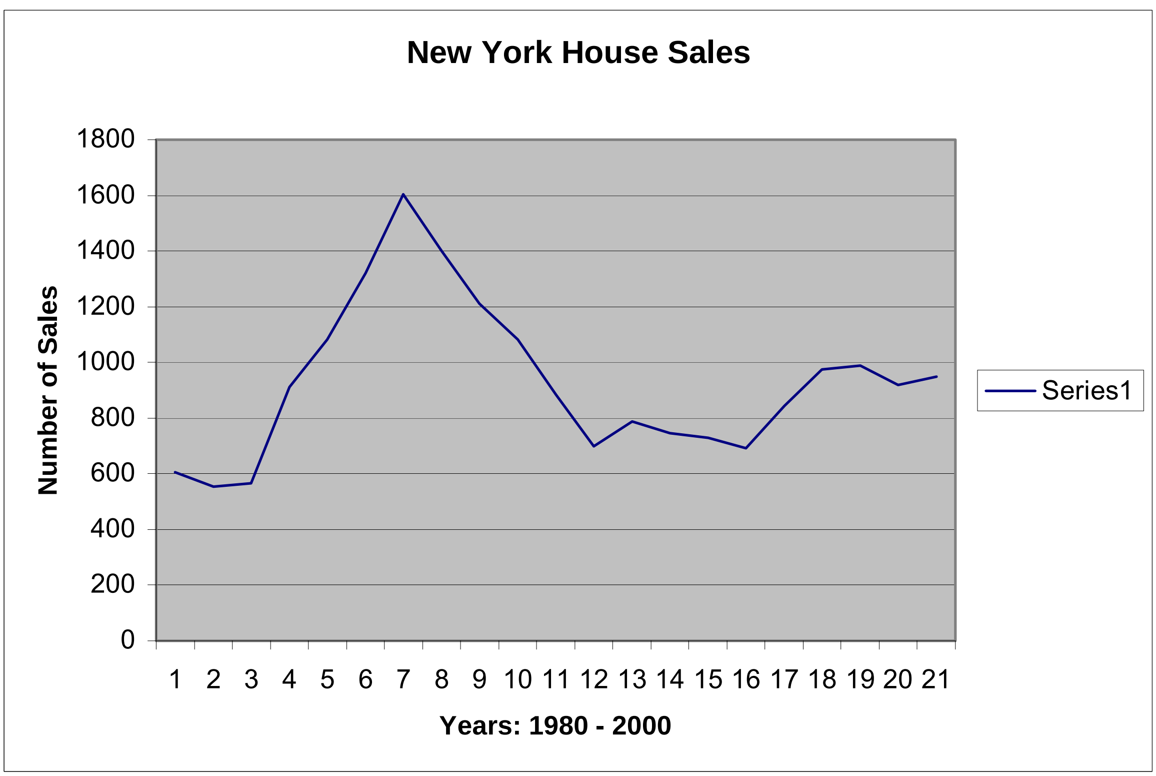


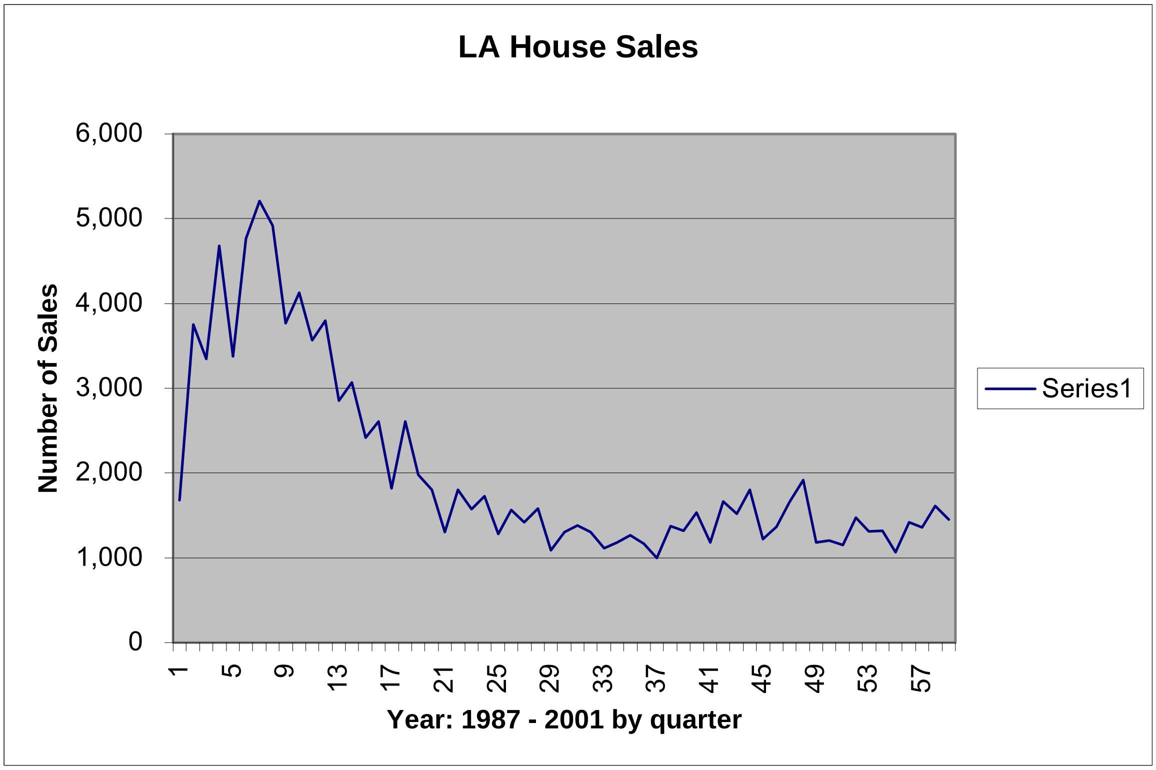
Figure 4: Property and Capital Markets -- assets cost shocks

For a given level of real estate prices, an unfavorable shift in the space supply sector, in the southwest quadrant, will depress construction, and ultimately reduce the quantity of real estate space on the market, according to the southeast quadrant. Given reduced real estate space in the northeast quadrant, rent levels will increase, which will force greater real estate prices in the northwest quadrant. Thus it is seen how a negative shock to the supply side can depress the market, and quickly end any booming period (though again remember that the end result will be lagged response, thus potentially causing a greater cyclical environment in later periods). When beginning and ending real estate prices equate, the market will reach equilibrium, and the solution parallelogram will lie northwest of the original solution box. In this scenario, real estate prices and rents will inflate, while construction levels and space quantity will decrease. Again, the degree of change depends on the respective elasticities of the respective market players.

Thus, the relevancy of this model is revealed, as it will now be shown that a combination of specific shocks can create an actual cycle. Having established how prices are determined and affected in the general market, it is now possible to see how real estate prices can tend toward a cyclical pattern. History has shown that real estate markets have often experienced periods characterized by a boom in prices, followed by periods characterized by a bust in prices (for example the boom and bust periods that occurred in many metropolitan statistical areas (MSAs) in the US commercial business real estate sector during the 1980s and 1990s). Over time, property markets have displayed lengthened periods of increased real estate space occupancy and rents followed by lengthened periods of decreasing or low occupancy rates and rents (see earlier graphs). Historically, this cycle has been observed to last between ten and twenty years from crest to crest, which is much longer than the traditional macroeconomic business cycle, possibly suggesting a causal relationship between the two cycles, though proving that these two cycles are indeed different in structure. Additionally, real estate space prices in the real estate capital market, as well as sales statistics in the property market similarly show lengthened periods of rise and fall patterns, as can be seen by the following sales graphs (contrast with price graphs in earlier pages). Specifically, note that in the New York market, the number of sales peaked in 1987, as did the price level.


US House Sales
Number of Sales (thousands)
14000
12000
10000
8000
6000
4000
2000
0
1
3
5
7
9
11
13
15
17
19
21
23
Years: 1980 - 2002
Series1


New York House Sales
Number of Sales
1800
1600
1400
1200
1000
800
600
400
200
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Years: 1980 - 2000
Series1



The aforementioned four-quadrant model can be applied to this boom and bust market to provide a theoretical explanation for this sequence of events, and begin to explore the question of whether a boom in any period creates and causes its own subsequent bust in the next period. It is theorized that the 1980's real estate cycle commenced with a shock to the system, a quick increase in consumer demand for commercial space in the property market, and an increase in investor demand for real estate assets in the capital market (actually quite similar to what we are seeing in today's market). For this analysis, the 4-quadrant diagram will be applied in an extended manner, so as to examine both the short run and long run ramifications of this cycle, and the correlation between the two time periods. Initially the model will explore the property market, the result of increased consumer demand, with the capital market held constant. Then, the model will explore the capital market, the result of increased investor demand for real estate assets, with the property market held constant. Finally, these two shocks will be analyzed in conjunction with one another, as they would be observed to occur simultaneously during any real estate cycle. A reasoned explanation will follow.

As prior, the result of a greater space usage demand can be shown by the following graphical analysis (though more in depth this time):

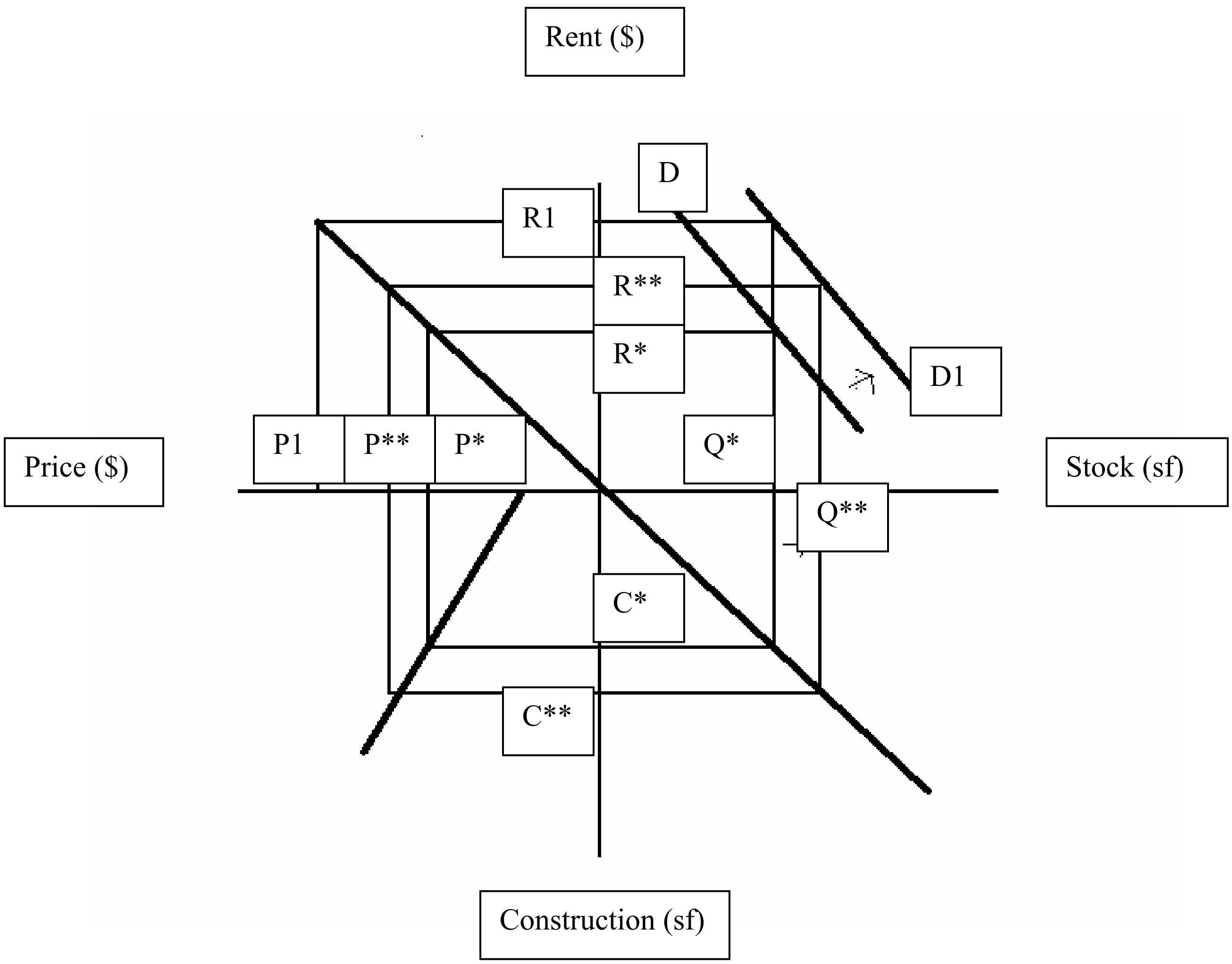
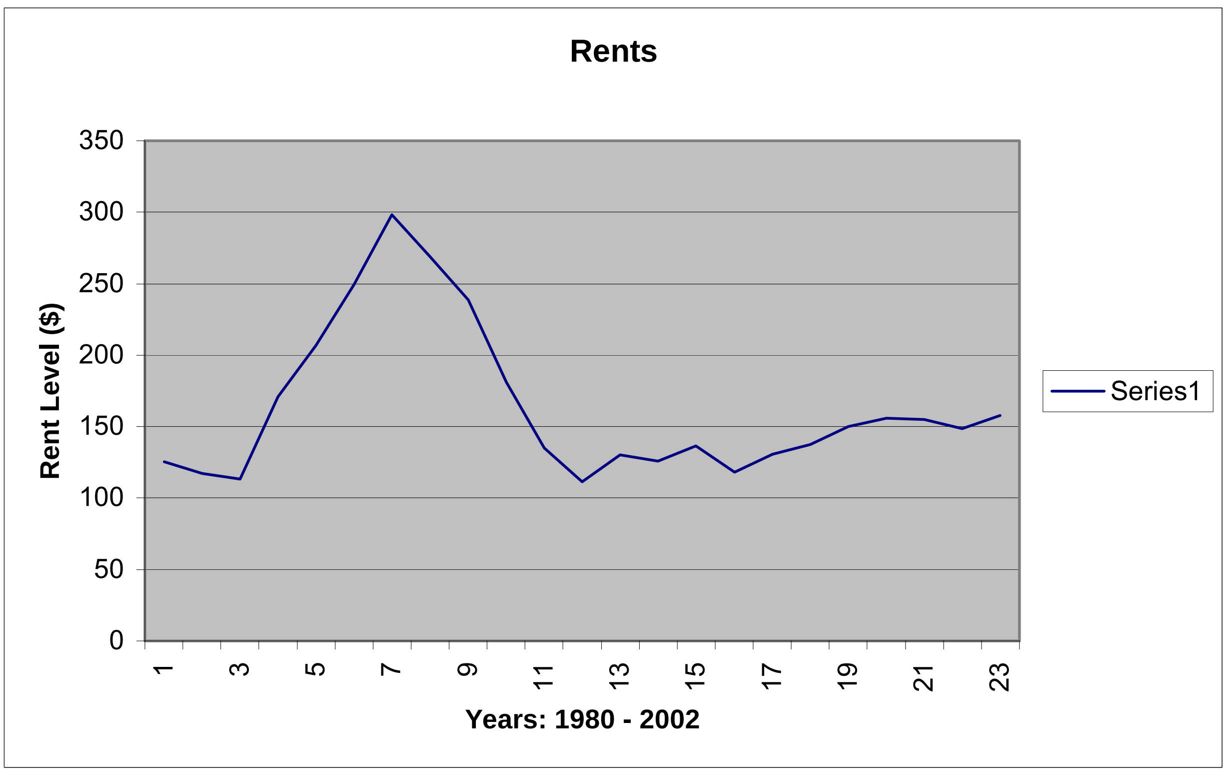


Figure 5: Effect of Demand Growth in Property Market

In this graph, demand moved from D to D1 in the northeast quadrant. The short run effect of this demand shock is marred by insufficient time for additional real estate space to be constructed in response to an unexpected sudden growth in usage demand (the time lag problem). Hence, unless developers and capital markets expect the demand shock, rents can inflate to levels, which cannot be maintained in the long run equilibrium. An example is shown in the following rent diagram:

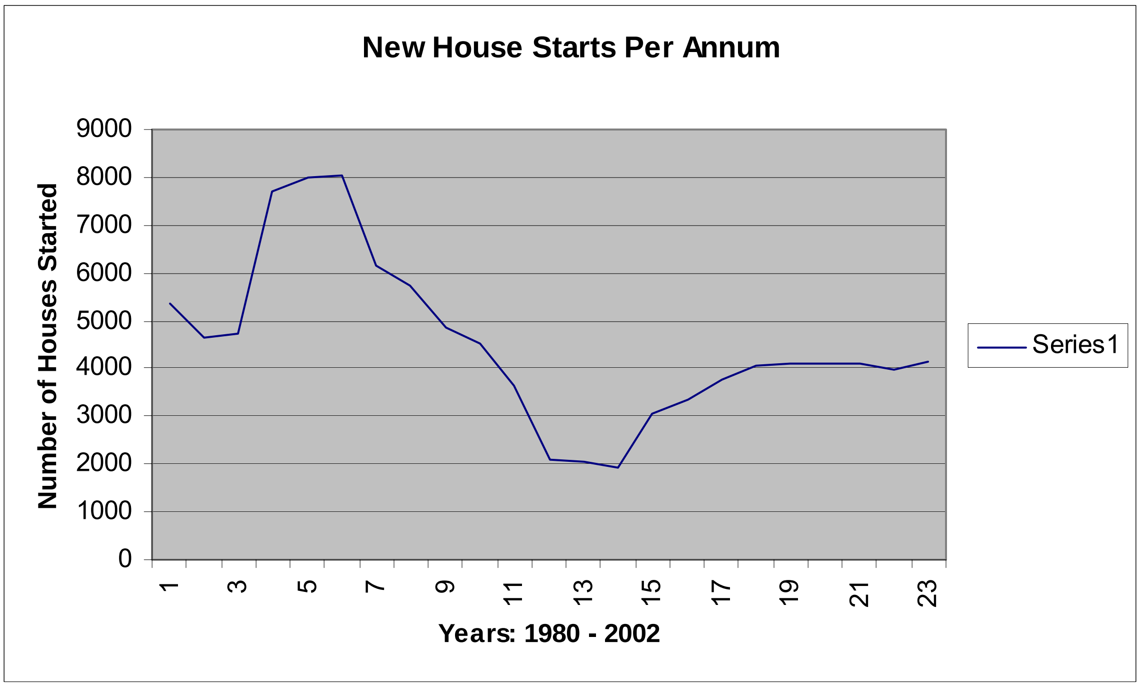


Specific to this exact system, increased demand forced rents to a transitory crest between 1988/1989. However, this exorbitant level could not be supported within the system, and rents sharply fell (crashed) to a more sustainable level around 1992. Further, as can be seen, consumers rarely learn from mistakes, as more subtle cycles occur continuously following the first major crash, which suggests that consumers have myopic expectations, and not rational expectations, as predicted by many recent economic and econometric models applied to this industry.

In entirety, this sequence is illustrated through the following process: On the vertical axis (in the below graph), rent levels shift from R* to a transitory level of R1 (from $113 to $298 in the above graph), as the current quantity of space attempts to fit an expanded demand function. However, in the long-run, as expanded construction is completed (in the next period) in response to this current demand shock, rents will decrease below the R1 level, as they would decrease to fit the greater quantity of space ($298 to $111 in the above graph).

In the long run, equilibrium is supported by the D1 increased demand level, which falls outside the existing solution box. The new long rum equilibrium is signified by points R**, P**, C**, and Q**. It is observed that the long run equilibrium rent level is below the temporary, albeit overshot, level, R1, though still above the initial equilibrium level R* (eventually, from $111 to $137 in the above graph). Seeing that R** > R* shows this property market to be characterized (as most in history are) by a slightly upward sloping long run marginal cost function, indicating greater real development cost. Further, the fact that the long run quantity of real estate space exceeds the supply at the existing demand level, Q** > Q*, the greater occupancy rates are still lower than they would have been if rent levels maintained their existing R* level (see above vacancy graph). This results because of the price elasticity of demand, as shown by the downward sloping demand curve in the northeast quadrant. From elementary economics, it is clear that greater reduce demand in an elastic market, as consumers are deemed more "price sensitive."

Analysis of the above graph reveals that the new solution parallelogram will lie outside of the original solution parallelogram due the heightened demand level, and given that the construction curve in the southwest quadrant exhibits increasing marginal costs (slopes outward). Within this scenario, rents, asset prices, and quantity of space will each increase in distinct proportions. For example, new house starts exhibit cyclical fluctuation, however in a much more elastic manner, and with a slightly different timed response:



From this graph it can be seen that supply increases to a high in 1986/1987, in direct response to the peaking rents in these years. However, as predicted from analysis, the lagged (over) supply be supported by the market equilibrium, thus as rents drop in 1991, new housing starts hit bottom in 1993/1994. The respective variables will each increase with respect to their own supply and demand elasticities, and will follow in a positively correlated manner with the direction and confidence of the capital markets. This relation follows through both the boom and subsequent bust periods. This will be shown in the following representation.

The result of greater demand for real estate investment from investors in capital markets is shown by the following representation:

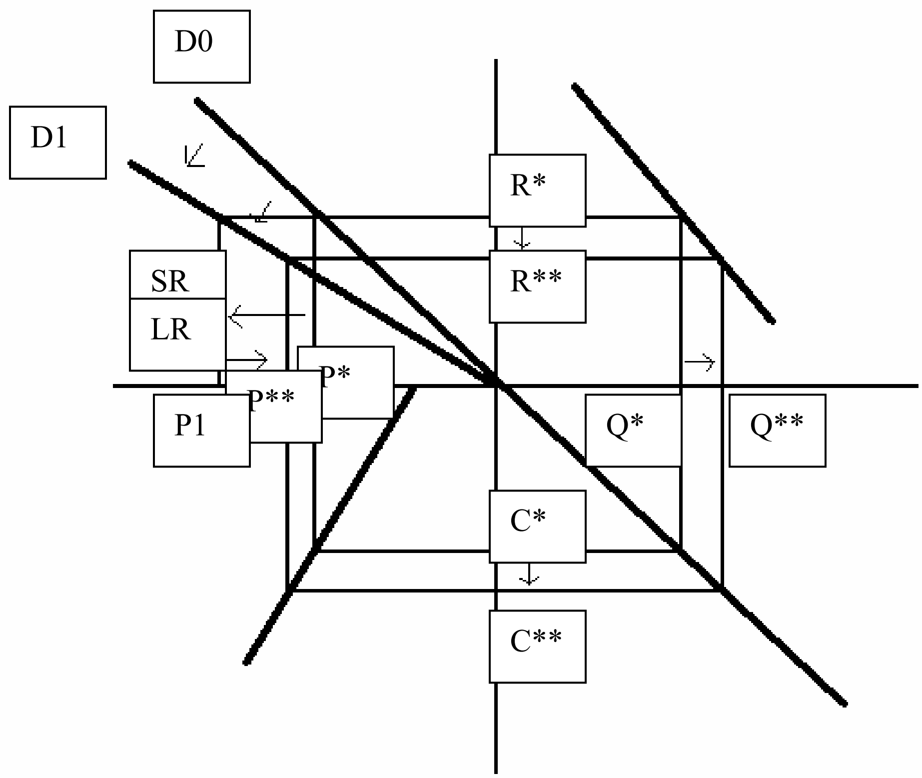


Figure 6: Demand Growth in the Property Market

Within the analysis, when demand grows in the capital market, the capitalization line moves downward in the northwest quadrant, from D to D1. This shift creates a significant increased revaluation of real estate assets. Initially, rents would stay at their existing levels; assuming supply and usage demand remain constant in the property market, in the northeast quadrant. If investors are myopic (a possibility that we will focus on in another model), and do not forecast the effect of increased financial capital invested in the real estate asset market into construction, then property prices could rise to a level above what is maintainable in the long run equilibrium (which they indeed did, as depicted in the 1987/1988 rent peak), this is shown by the short run price increase from P1 to P*.

The resulting long run equilibrium occurs with the solution parallelogram connecting variables: R**, P**, C**, and Q**. This equilibrium forces lower rent levels (R* < R**), and thus a greater quantity of space (Q** > Q*) than in the initial equilibrium (holding usage demand constant in the space market). The decreased rent levels imply that the lower capitalization rates in the asset market do not lead to long run real estate asset prices, P**, much higher than the initial real estate asset prices, P*. It is pertinent to note that this resulting long term equilibrium entails a significant increase in the quantity of constructed space (which was started with peaking construction levels in 1987/1988), and which ultimately presents the effect of a real estate development boom, that increased real estate quantity to Q**. This massive construction is a direct result of the flow of finance capital into real estate assets caused by the change in investor preferences towards real estate.

This graphical representation shows that greater investor demand for real estate assets will always lead to real estate asset prices and space quantities higher than initial equilibrium levels, while rent levels are lower than in the initial equilibrium. Again, the degree of shifts per variable depends on the respective elasticities of supply and demand.

Combined, these two graphical analyses can be used to portray and analyze the great real estate boom and subsequent real estate bust in the 1980s and 1990s. In the system, the initial demand shock occurred as a result of a change in preferences for investors, as they would become more willing to pay more for real estate assets. As stated earlier, this could occur either due to a favorable change in exogenous economic factors, lowered perceived real estate risk, or greater expected growth rates in the real estate sector. In the early 1980s specifically, a prospering economy, an aging population, and a technology boom, all fostered increased demand for various types of commercial property. Although this growth was anticipated in the real estate and capital markets, the exact scale, nature, and location of this space demand growth was unexpected (proving the inherent preclusion of perfect market foresight). This setting ignited the above graphical responses. With regards to the shock in the capital market, the perceived reduced risk of real estate originated in the late 1970s to the early 1980s in the US. As one example, the Employee Retiree Security Act (ERISA) enacted by congress in 1974, essentially promoted diversification out of traditional stock market holdings and possibly resulted into an inflow towards the real estate sector. This created a significant stream of capital from investors who were less concerned about real estate investment, because the bulk of their respective portfolios were still invested in traditional equity and debt offerings. Further, increased inflation in the late 1970s and early 1980s heightened uncertainty about inflation in general, and indirectly promoted real estate as a safer protection against inflation than other traditional investor holdings (further, explains why real estate is negatively correlated with expected inflation rates, as will later be seen in many econometric analyses). Finally, over this period, commercial real estate was given favorable tax breaks. Each of these shocks, individual or combined, could have increased the price to earnings ratio multiples in the real estate asset market, and fostered the subsequent movements in rents, new construction, and vacancy rates.

Overall, this example with the 4-quadrant model offers the following insight as to explain the reason for the real estate cycle in the 1980s. As seen, increasing levels of both space demand and asset demand occurred between 1975 through 1985 in the United States. It has been explained how both of these events can individually foster a transient overshooting of real estate asset replacing, in absence of perfect market forecasts. The concurrent occurrence of increased demand in each of the above two quadrants would aggravate this threat of asset price overshooting. The resulting effects would be an initial increase and then decrease in real estate asset prices, disregarding a decrease in demand for either space usage or real estate investment. The reduction in prices would only be exacerbated by a subsequent reduction in demand, which would always occur due to the highly elastic, extensive lagged construction rate responds to the price boom, and results in oversupply. A reduction of this sort did occur in the early 1990s as a result of economic recession and financial shifts. Overall, this model begins to show how a real estate cycle may be caused by differences between short run and long run disturbances of equilibrium without perfect foresight by market participants (to illustrate the significance of market foresight, and consumer expectations, it is necessary to analyze the stock-flow model, next).

The workings of the 4 Quadrant model can be applied to the price graphs at the beginning of this paper, to explain how each of them originated with respect to their individual market, and with respect to the general economy**.** The effects of this aforementioned cycle can further be observed in each the regional graphs, as well as in the vacancy graph. It is observed in the vacancy graph that vacancy rates reached a high in 1988/1989 and lows in 1994/1995, the time when the bust occurred. This follows the initial increase and decrease in rent levels and prices. Similarly, the New York, Los Angeles, and Houston markets reached respective lows in the mid nineties, either as part of this general depression, or as a subsequent result.

The Stock Flow model, which builds upon this basic four-quadrant diagram, predicts a theory regarding durable goods (an aforementioned type definition of real estate). The four-quadrant diagram has revealed how exogenous shocks will affect the real estate market, and it has begun to demonstrate how real estate cycles are created and how they create future cycles, however, the 4Q model fails to consider the timing of various shocks (though implications do arise as a result of the complementary graphs), whether the changes in price, rent, demand, or vacancy change in a smooth manner or a jagged manner, whether these exogenous shocks set off repetitive cycles, or whether new cycles are created with every shock. Further, the 4Q model fails to grasp the complexity of demand, for example how it is derived, and how it shifts. Essentially, the 4Q diagram presents theoretical reasoning for a cycle, however it fails to analyze the specific cause and effect doctrines of the cycle. The stock flow model explains the reasoning behind the various movements in the pricing graphs. In the forthcoming analysis, the stock flow model will be quantitatively presented, to show the basis of the model, and how it is used to conduct analysis. Next, variables in the model will be isolated and analyzed to show how the general results of the model can change by altering the assumptions behind some variables, a powerful tool within the model. Graphs and econometric analysis will be applied in conjunction with the model to analyze the significance of these variable assumptions. Finally, a conclusion will be made in context of the stock flow model, to see what determine the events in the New York, Houston, and Los Angeles regional real estate markets. The stock-flow model can provide insight into each of these questions, and will enable future forecasting depending on type of consumer expectations applied. Consumer expectations are of paramount importance to this model, as they influence the real estate market. The stock flow theory assumes that in the short run, real estate prices perfectly adjust to meet real estate demand with the existing quantity of real estate space available on the market. However, in this model, changes to the quantity of real estate space transpire gradually over time, and usually in lagged periods, as intimated in the previous model. These changes react to the real estate prices established in the short run, and this is consistent with both the graphical analysis performed under the 4Q model, and with general expectations.

Within this model, real estate space demand relies on population, income, current prices, and future price expectations.

Dependent Variable: HSS
Method: Least Squares
Date: 04/16/03 Time: 23:39
Sample: 1980 2002
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-71039.36	41660.99	-1.705177	0.1064
POP	0.029673	0.017853	1.662120	0.1148
PI	-1.347535	1.012962	-1.330291	0.2010
PICH	-780.1328	2049.988	-0.380555	0.7082
ASP	0.082552	0.061536	1.341525	0.1974
INFEX	382.0203	236.0160	1.618621	0.1239

R-squared	0.597028	Mean dependent var	8083.391
Adjusted R-squared	0.478507	S.D. dependent var	1565.914
S.E. of regression	1130.817	Akaike info criterion	17.11873
Sum squared resid	21738716	Schwarz criterion	17.41494
Log likelihood	-190.8654	F-statistic	5.037306
Durbin-Watson stat	1.066611	Prob(F-statistic)	0.005172

However, according to the above linear regression, this relation may be incomplete. According to historical data for the USA, the assumption that demand, as measured by new house sales -- hss, depends on population – pop, income – pi and personal income change – pich, current prices – asp, and future price expectations – infex, only accounts for roughly 60% of total house sales. While for the regional market, this relation only accounts for 55% of total sales according to the below regression:

Dependent Variable: HSSNYC
Method: Least Squares
Date: 04/16/03 Time: 23:48
Sample: 1980 2002
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17037.31	7447.932	2.287522	0.0345
POPNYC	-0.001067	0.000442	-2.414619	0.0266
PINYC	0.112064	0.032394	3.459400	0.0028
ASPNYC	-0.000635	0.000776	-0.818854	0.4236
INFEX	136.6319	42.78698	3.193305	0.0050

R-squared	0.547663	Mean dependent var	926.2174
Adjusted R-squared	0.447144	S.D. dependent var	266.7633
S.E. of regression	198.3499	Akaike info criterion	13.60760
Sum squared resid	708168.4	Schwarz criterion	13.85445
Log likelihood	-151.4874	F-statistic	5.448341
Durbin-Watson stat	0.846098	Prob(F-statistic)	0.004700

Though the New York example is not as statistically significant, both data sets show that the model's assumption may be too simple in reality.

Next, given that lofty real estate prices in the existing market depress demand, the expectation of capital gains through increasing space prices fuels demand, which already increases complexity from the previous model. This historically substantiated behavior relies on the degree to which consumers care about capital gains, and how consumers develop projections regarding capital gains. Thus, opposed to the Four Quadrant model, the addition of capital gains in the asset market adds another revenue stream for the investor and another market determinant, which can be effected by additional exogenous factors and additional expectations.

As previously stated, the stock flow model presumes that real estate prices in period t are established by the contemporaneous values of other variables in the model (also in period t), whilst real estate quantity relies on lagged values of these associated variables. These assumptions capture the fact that prices can move instantly and freely, as they are not constrained to any boundaries, whereas construction takes time. Also within this model, demand for real estate space, Dt, is taken to be relative to the current number of consumers, Ct, and also to a term, which relies both linearly and negatively on the per annum cost of owning real estate space, Ut (which can also be thought of as rent)**:**

Dependent Variable: HSS
Method: Least Squares
Date: 04/17/03 Time: 00:34
Sample: 1980 2002
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7758.360	20825.36	-0.372544	0.7134
POP	0.005806	0.009931	0.584621	0.5653
USRENT	-13.44738	66.90654	-0.200987	0.8427
R-squared	0.310333	Mean dependent var		8083.391
Adjusted R-squared	0.241366	S.D. dependent var		1565.914
S.E. of regression	1363.905	Akaike info criterion		17.39520
Sum squared resid	37204756	Schwarz criterion		17.54331
Log likelihood	-197.0448	F-statistic		4.499743
Durbin-Watson stat	0.594895	Prob(F-statistic)		0.024344

Again, according to a regression on historical USA data, this relation may also be incomplete, as the combination of population – pop, and rent – usrent, only accounts for 31% of historical new house sales, or demand – hss.

It is expected that demand increases with consumers, and decreases with the cost of ownership, as a greater population requires more space, though with respect to the elasticity regarding the price and affordability of this space. And this is substantiated with the above data. Further, this fact begins to explain why markets such as New York historically maintain higher real estate price levels than Houston markets, due to the perpetually larger and denser population, and its greater demand requirements (despite seemingly perpetual increasing rent levels). The constraint, $\alpha 0$ represents the degree of consumers who would own real estate space if the per annum cost of capital were to be 0,which in a capital society is perceived to be a very large number regardless of whatever regional market. The constraint $\alpha 1$, measures the sensitivity of this percent to changes in the per annum cost of ownership, and this number is also expected to be high as people are very sensitive to rents and prices: $Dt = Ct (\alpha 0 - \alpha 1 * Ut)$. This per annum occupancy cost relies on the current prices of real estate assets, Pt, the current mortgage rate (assume 30 year), Mt, and the projected rate of future space-price inflation, It (where t represents the period where this expectation was determined): $Ut = Pt (Mt - It)$. This relation is fairly simple, as lower mortgage rates lower prices, and greater expected inflation will enable consumers and investors to purchase more real estate assets and/or real estate space. Further, this relation is more significant, as mortgage rates account for a large part of demand decisions, according to the below regression:

Dependent Variable: HSS
Method: Least Squares
Date: 04/17/03 Time: 00:57
Sample: 1980 2002
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-367.3232	2999.316	-0.122469	0.9038
ASP	0.040901	0.010013	4.084571	0.0006
INFL	389.1271	108.4805	3.587071	0.0020
MORT	115.4181	190.7585	0.605048	0.5523
R-squared	0.669348	Mean dependent var		8083.391
Adjusted R-squared	0.617140	S.D. dependent var		1565.914
S.E. of regression	968.9208	Akaike info criterion		16.74701
Sum squared resid	17837343	Schwarz criterion		16.94449
Log likelihood	-188.5907	F-statistic		12.82073
Durbin-Watson stat	1.155503	Prob(F-statistic)		0.000082

Overall, the model assumes that current real estate space prices change so that ex ante demand for space equals the current quantity of space on the market, Qt: Dt = Qt. However, this relation appears over simplified in reality.

Plugging these equations into one another, Ut = Pt (Mt – It) into Dt = Ct (α0-α1 * Ut), then plugging this into Dt = Qt, and solving for price yields the following solution: Pt = (α0 – St/Ht)/(α1(Mt – It)). According to this solution, the stock flow model presumes this relation to hold to perpetuity. Thus, this relation provides that the current price level will be greater when the existing proportion of quantity of space to consumers is decreased, mortgage rates are depressed or projections of future price inflation are favorable. Theoretically this makes perfect sense, however in reality the market is again more complex, as consumer expectations are paramount. Further, this relationship can as well be tested against historical data. Specifically looking at the Los Angeles housing market, it is observed that the above predicted relations generally hold in good times, however fall in the face of a bust. As can be seen from the data, these relations hold until 1992, when the market drastically changes, and goes against the predictions. Hence,

Year	Population	Pop Change	Housing Stock	Change House Stock	Mortgage Rate	Average Sales Price	Expected Inflation
1987	27777160	674922	12121503	198625	8.81	$171,669	9.775
1988	28464250	687090	12338060	216557	9.76	192165	9.55
1989	29218165	753915	12512281	174221	9.68	213334	9.7
1990	29959515	741350	12665776	153495	10.49	224163	8.125
1991	30470736	511221	12778135	112359	9.02	224337	5.375
1992	30974659	503923	12848544	70409	7.96	207231	4.475
1993	31274928	300269	12894877	46333	7.03	201685	3.9
1994	31484435	209507	12926381	31504	7.26	211416	4.4
1995	31696582	212147	12950975	24594	7.65	221068	4.225
1996	32018834	322252	12972265	21290	7.56	244838	3.9
1997	32486010	467176	13000010	27745	7.57	251561	3.225
1998	32987675	501665	13029562	29552	6.95	259312	3.675
1999	33499204	511529	13062629	33067	6.94	293217	5
2000	34000446	501242	13114071	51442	7.41	306487	5.8
2001	34501130	500684	13184115	70044	6.9	321926	3.875

although a generally good model, the Stock Flow Theory does not seem able to predict constant relations regarding real estate, that hold throughout a cycle.

Due to its aforementioned durability, the quantity of real estate space on the market depends on a sequence of equations. The initial equation relates the difference in quantity of space between periods t and t-1, new construction in period t-1, less a fraction of space in t-1 that was demolished: $Qt - Qt\text{-}1 = Ct\text{-}1 - \alpha Qt\text{-}1$. This equation implies that quantity will rise as long as new construction rates top demolition rates, and vice versa (again a pretty simple reason). Further, when new construction rates equal demolition rates ($Ct = \alpha Qt$), then the existing quantity of space on the market will maintain ($Qt - Qt\text{-}1 = 0$). This is all fairly obvious reasoning. However, as will be seen, not enough significance is given to the construction sector with this model.

It is shown how the level of new construction relies on the existing price level and the existing quantity of space. Increasing space prices leads to new construction, as the sector looks to increase profits, which continues until land prices at the perimeter of a metropolis equate to the opportunity cost of the land alone (as it is not profitable to develop land that would be equal to the developed property – see appendix). Assuming that equilibrium quantity of space, EQt equals the long run quantity of real estate space, if the actual quantity or current real estate space equals EQt, then no new construction is undertaken. If real estate prices rise, potential land rents increase, EQt rises, and construction increases until urban rents equate with rural rents. With this relation, construction is a transient stream that lasts until actual quantity equals the long run quantity, as predicted by land rent theory (see appendix). Further, construction, which is initially influenced by price levels, is shown to create cycles, which ultimately affect price levels. Thus, we begin to see how real estate is maintains a circular trap. The equations depicting this relation are as follows: $EQt = -\beta 0 + \beta 1 * P1$ and $Ct = \tau\,(EQt - Qt) \geq 0$. In the first of the two equations, $\beta 1$ establishes how quickly rising prices lead to new land to be developed. In practice, this obviously takes time, and does in fact heavily influence the timing, length, and degree of a cycle. While the relation of ($\beta 0/\beta 1$) represents the smallest price of completed development that covers development costs and generate positive land rent. In the second equation, τ relates the rapidity of construction rates in response to a variation between existing real estate quantity and the long run equilibrium predicted by rent theory. To maintain the reality of this model, as a constraint, EQt must be greater than current quantity to a large enough margin as to cause a construction rate that equals the space depreciation rate. Combining the above equations with the equation, $Qt – Qt\text{-}1 = Ct\text{-}1 – \delta Qt\text{-}1$, yields the connection amongst the current price of real estate space, and the rate of increase, or decrease, of the quantity of real estate space:

$$Qt – Qt\text{-}1 = \tau(-\beta 0 + \beta 1 * Pt\text{-}1 – Qt\text{-}1) – \delta Qt\text{-}1 \qquad \text{if } –\beta 0 + \beta 1 * Pt\text{-}1 > Qt\text{-}1$$

$$Qt – Qt\text{-}1 = -\delta Qt\text{-}1 \qquad \text{if } –\alpha 0 + \beta 1 * Pt\text{-}1 < Qt\text{-}1$$

These equations project that quantity will increase if the price of space in the preceding period is great enough so the long run equilibrium quantity ($-\beta 0 + \beta 1 * Pt\text{-}1$) is greater than the existing quantity by an amount ample enough where the rate of construction will exceed the rate of demolition ($\alpha Qt\text{-}1$). However, in reality, and with ever changing figures, it is hard to apply a model with equilibrium, as one never really exists in practice. Further, the supply sector is not observed to be so "forward-looking." As quantity expands, the number of demolitions increases until the quantity of space on the market stabilizes. At this point, a "steady state" level would be realized, where the quantity of space, Q*, represents the number that would be reached if real estate prices in one period lagged (Pt-1) would maintain perpetually. Combining the above equations, and solving for Qt = Qt-1, the steady state equation, Q*, would be:

$$Q^* = (\tau(EQt – Q^*)) / (\delta) = (\alpha(-\beta 0 + \beta 1 * Pt\text{-}1 – Q^*)) / (\delta) = (\tau(-\beta 0 + \beta 1 * Pt\text{-}1)) / (\delta + \tau)$$

This equation states that if current real estate prices are too low in relation to current quantity, then the construction rate will be inadequate to replace the space lost to demolitions, and the quantity will begin to decrease. The smaller the existing quantity, the lower the rate of construction will be required for replacement, and the eventual creation of a new steady state equilibrium, Q*. For any given level of one-period lagged real estate prices, Pt-1, the above equation delineates the quantity that will prevail if Pt-1 holds perpetually. Further, it can be seen that Q* will be greater with a greater lagged price level, and Q* will be lower, with a lower lagged price level. This relation further intimates cyclical fluctuations in response to profit maximizing builders who build to constantly maintain equilibrium. Again, more will be analyzed in this regard, in later sections.

The above three equations each show how real estate quantity acts as a function of the price level. While the equation defining price level proves that current price levels are a function of the existing real estate quantity (amongst other exogenous economic variables). Hence, this comes to be a simultaneous system of equations. In summation of the workings of this model, if initially, the quantity of space is relatively low; the price of real estate space (from the price equation) will be great enough where new construction surpasses replacement. Here, quantity starts to rise. On the other hand, if existing quantity is relative too great, then real estate prices will be depressed enough where the construction rate falls below the demolition rate. Here, real estate quantity will decrease. Now, assuming fixed values for the exogenous variables in the model, there is always a specific parameter for quantity of stock, which sustains sufficient new construction to maintain the current quantity of space. This quantity parameter, together with the related price level, P*, provides the complete steady state solution to the model. Combining and solving the price equation and the quantity replacement equation derives this conclusion. The result, the simultaneous system of equations are depicted below, in terms of price and quantity:

$P^* = (\alpha 0 - (Q^*)/Ht)) / (\alpha 1(Mt - It))$

$Q^* = (\tau(-\beta 0 + \beta 1 * P)) / (\delta + \tau)$

This solution calculates the equilibrium price that will exist in the real estate market if space, price expectations, mortgage rates, and the parameters: α0, α1, τ, δ, β0, β1) maintain constant. This solution provides that P* rises as households expand; expectations improve regarding future price inflation, or current mortgage rates decrease. If P* is greater, then Q* will be greater as well, as the variables that are positively correlated with these expressions. Though this steady state solution doesn't hold so tightly in reality, as the exogenous variables are not constant for a long enough time period to realize complete stabilization, this model does offer powerful insight into the reasoning behind market changes. In reality, the number of households usually increases or decreases with the economy, interest rates rarely maintain constant levels, and future expectations change as well, thus altering the steady state solution.

As described, this simultaneous model provides a fairly accurate description of the drive and direction of the real estate market, however, to tackle the question of real estate cycles with respect to Stock flow, it is necessary to focus on consumer expectations regarding future price inflation, It, and how these expectations can influence the model (this model assumes demand derived and shaped cycles). The first possible assumption considers consumer expectations as exogenous, and mutually exclusive from the real estate market. This means that consumer real estate decisions are persuaded by the general inflation rate, and not by direction and level of real estate prices. However, this according to data, this assumption is quite unrealistic (as it is one of many potential factors in demand determination:

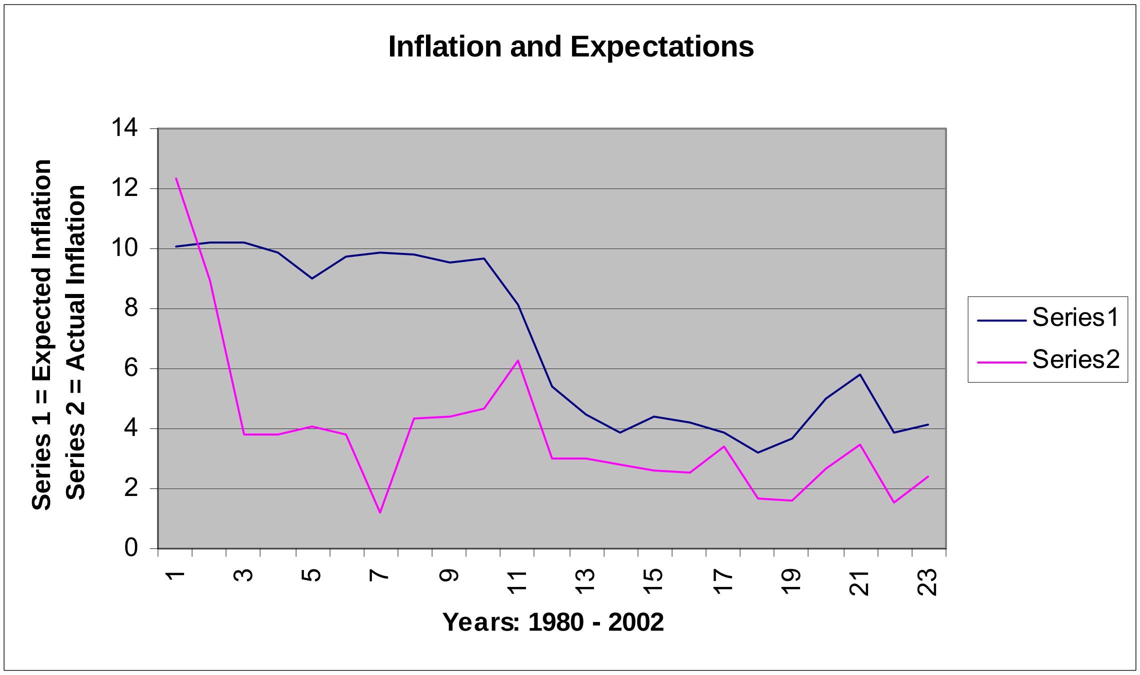
Dependent Variable: HSS
Method: Least Squares
Date: 04/25/03 Time: 02:15
Sample: 1980 2002
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9059.491	876.1300	10.34035	0.0000
INFEX	-142.0455	118.4983	-1.198713	0.2440

R-squared	0.064042	Mean dependent var	8083.391
Adjusted R-squared	0.019473	S.D. dependent var	1565.914
S.E. of regression	1550.593	Akaike info criterion	17.61360
Sum squared resid	50491113	Schwarz criterion	17.71234
Log likelihood	-200.5564	F-statistic	1.436913
Durbin-Watson stat	0.482460	Prob(F-statistic)	0.243992

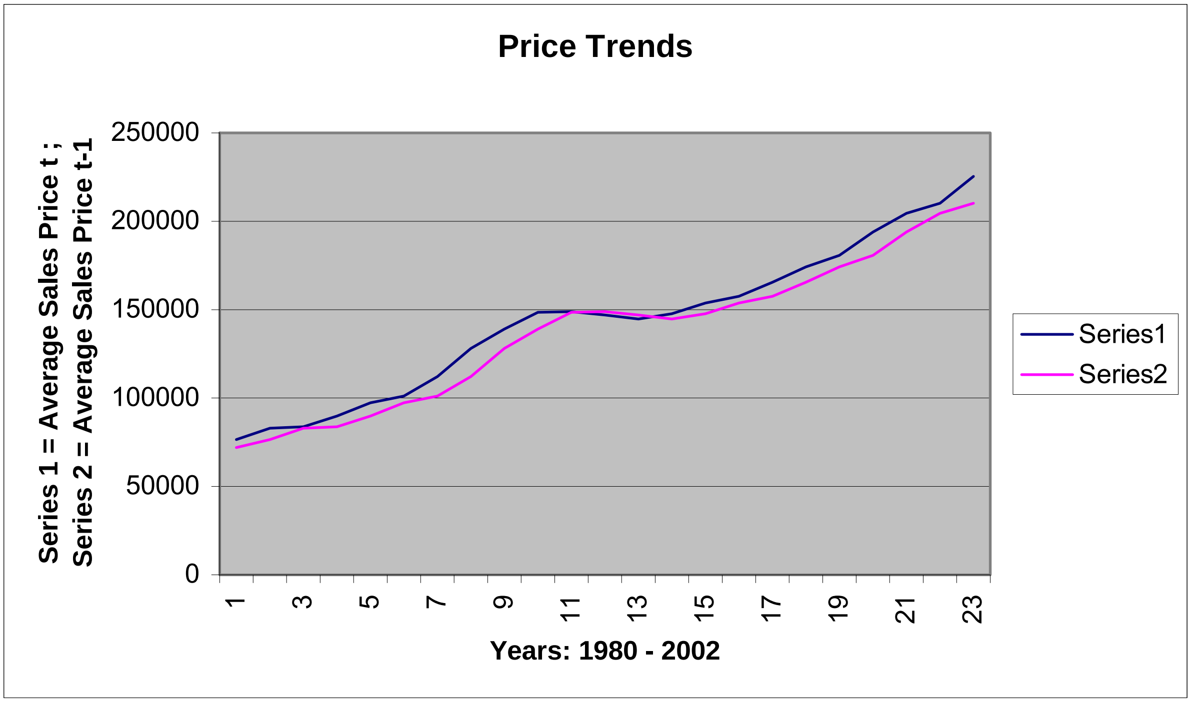
Here, regression shows that exogenous expectations, such as expected inflation, explain roughly 6% of real estate demand.

Under this scenario, a positive shock leads real estate prices and construction rates to exceed their new equilibrium levels, once they stabilize. While a negative demand shock leads real estate prices and construction rates to miss their new equilibrium levels, once they stabilize. On the other hand, the quantity of real estate space never exceeds the new equilibrium level, and thus the possibility of creating a real estate cycle is precluded. In practice however, this assumption does not hold. This conclusion provides that the historically observed cyclical cycles in the real estate market are caused by the cyclical nature of the exogenous variables that influence and determine the real estate market, suggesting that no real estate cycles actually exists in itself**.** The possibility of applying this assumption to the aggregate market is precluded, as each of the regional price time series graphs considerably differ from one another, thus consumers have different expectations. Meaning, that their purchasing decisions do not solely rely on exogenous factors. However, applying this to specific regions is also precluded because a graphical analysis of inflation and the future inflation rate shows a far different directional trend than the earlier price graphs, as well as from sales graphs and construction graphs:



Further, the fact that consumers appear perpetually wrong about inflation rates, and in some cases inflation direction, the rationality of consumers comes into question.

While interesting, this conclusion is rarely seen in practice, as most consumers have been proven to predict future price trends heavily based on their past performance:



This graph shows how prices in current periods are highly correlated with prices during past periods. Therefore, these consumers would be deemed to have myopic price expectations. Historically speaking, when real estate prices are increasing, consumers will expect that future prices will increase in a similar manner; this approach suggests that consumers may be bad forecasters, and it appears that events such as the recent internet bubble substantiate this theory.

Within this assumption, an equation relating the expected per period rate of price inflation to current or past price changes must be added to the previous model based on exogenous expectations: $It = ((I)/(n-1)) * ((Pt-1 – Pt-n)/(Pt-1))$; where $n > 1$. Within this equation, if $n=2$, consumers derive their projections of future price inflation solely based on the past period. This however is a bit extreme, as purchasing decisions and demand is seemingly based on a combination of myopic, endogenous, and exogenous factors. Therefore, more reasonable expectations might be formed over the course of several periods of price fluctuations, such as when $n = 6$. The addition of this equation has profound implications for the model; current prices are no longer exclusively established by current values of exogenous variables. Further, this market allows for the possibility that two distinct real estate markets (see the space market and the asset market) with identical households, quantity, and interest rates could support very diverse price levels. For example, in a booming market, expectations of future price inflation would be elevated, and the expected total ownership cost would be low. This would increase demand levels, as well as current price levels. However, a slumping market would experience lesser prices, as the expectation, as the expectation of persisting depressed price levels would increase the cost of ownership. In each illustration, existing and lagged price fluctuations are positively correlated due to their link through the development of expectations.

Including the possibility that previous price increases affect current price levels, the stock flow model can begin to portray cyclical fluctuations in response to various shocks. The reasoning is as follows: in the period where the shock occurs, the myopic expectations model acts similar to the exogenous expectations model; applying a positive shock, prices increase until market clearing. However, in the subsequent period, this price increase causes consumers to project future price appreciation. Under this assumption, as supply expands, prices continue to appreciate, which causes increased construction rates that ultimately lead to overbuilding. At this point, prices reach a zenith, and then begin to cool off. This forms ensuing pessimistic expectations among consumers, which moves to decrease demand and depress prices. Thus, it is shown that this model introduces the possibility of a real estate market marred by an endless cycle of bubbles and bursts. Thus, it appears that myopic expectations regarding price appreciation are able to construct a perpetually (endogenous) real estate cycle in response to a one – time market shock (however, assuming a combination of myopic and exogenous expectations, which will be presented later, a one time shock leads to a single cycle).

A final theory, which offers another, albeit, middle ground perspective, is that of rational expectations. Assuming rational expectations, following a shock to the real estate market, consumers will be able to correctly estimate the response of the market, in other words, the future level of prices that consumers project to occur following a shock, will indeed occur, excluding the first period price change following the shock. However, as applauded this model is by economists, in reality this does not hold either (see above graph). Under this assumption, the projected inflation rate at time t, will equal the actual inflation rate from tome t to tome t+1. Thus, the equation estimating inflation rates becomes: It = (Pt+1 – Pt)/ (Pt). The outcome of this model is quite similar to that of the exogenous expectations model, however in this model there is less of an initial price increase following a negative shock (and vice versa), as consumers will be able to predict the increased supply, and thus less of a depression of prices. The reason for the lesser price increase occurs because consumers realize that construction will increase, and that long-term price levels will be lower. The correct expectation of these long term price depressions lower current demand, and ultimately lead to a smaller price increase following the shock.

Hence, with rational expectations, a shock to the real estate market does not create a potentially perpetual market cycle. In this model following a shock, there is only a one period overshoot in price level, and a resulting lone construction surge. Again, in practice, it appears that consumer expectations are derived from a combination of the previous two scenarios, and this was demonstrated by exhibited statistical significance with exogenous factors.

The stock flow model presents a powerful but complex analysis. It comes to many conclusions regarding real estate cycles, however these conclusions depend on many open-ended possibilities, and are based on many questionable and incomplete assumptions. Thus, there must be a better model, one that involves an alternative simultaneous system, one that is derived from an exploration of past data, and one that can accurately be applied to the real estate market.

A NEW MODEL

The previous models have begun to intimate the complexity of the real estate cycle. From evidence, it appears that the cycle is ignited by demand derived price inflation. In response to this, the construction sector increases production until prices are eventually driven down. As a result, it appears that the demand side plants the seeds to a cycle, and supply side grows the cycle by overestimating future demand, thus both sides are responsible for cyclical market fluctuations. To construct an accurate and significant model, it is necessary to determine what drives demand to desire additional real estate holdings. The assumptions of this new model will be that real estate demand is a complex organization, though at times irrational, and that the supply sector relies on irrational expectations, as builders are feverishly driven by the chance to achieve immediate maximum prices and profit margins. Thus, it is possible to classify the supply sector as a group of irrational profit maximizes, and the demand sector as semi-rational consumers. This new model will seek to determine what specifically effects prices and supply. From these variables the rest can be assumed to determine the cause and structure of a cycle. Notably however, vacancy rates will be left out of this model, as they are assumed to be in direct response to price levels and economic conditions. Because price is a complex dependent variable that depends on the interaction of supply and demand forces in the real estate market, it is therefore necessary to employ a simultaneous equations system. This new model will take into account the interactions between the property market and the capital market, and consumer expectations. Specifically, this model will not assume rational expectations, but a combination of myopic and exogenous expectations. Following the model specification and introduction, it will be applied to various regional markets to substantiate its feasibility and its accuracy.

MODEL SPECIFICATION

The multi-equation model of the property market proposed in this study is a linear model that consists of three equations: an equation for new houses sold, an equation for new houses started, and an equation for average sales price. This model enables the interaction of the space market and asset market through the interaction of supply of new housing space, average sales price, average rent level, demand by number of sales, number of houses for sale, construction costs, mortgage rates, and macroeconomic variables, including: inflation rates, expected inflation rates, gross national product, population rates, and income levels.

In the first equation of the system, from the supply side, the number of new houses started is expressed as a function of average sales price in the current period, rent levels in the current period, construction costs, lagged house sales, and the current interest rate. It is projected that the supply of houses will directly depend on average sales prices, as builders project their future margins on current observed profits. Further, it is also expected that house starts will depend on rent levels for similar assumed reasons. Construction costs are expected to be a significant determinant, as this will establish the budget and how much space could be built for profit. House sales last period are important, as this society is assumed to maintain partially myopic expectations. Finally, the interest rate is included in this relation because it helps to determine the cost of capital. Specifically, the equation is given as follows:

$$htts_t = \alpha 1\ rent_t + \alpha 2\ asp_t + \alpha 3 cc_t + \alpha 4\ hsss_{t-1} + \alpha 5 int_t + u_t$$

Here, htts refers to new house starts, asp refers to average sales price, cc refers to the cost of construction, hsss refers to house sales, and int refers to the interest rate.

The second equation of the system, from the demand side, establishes the number of new houses sold. This equation is as follows:

$$hsss_t = \beta 1\ djia_t + \beta 2\ infex_t + \beta\ 3\ asp_t + \beta 4\ asp_{t-1} + \beta 5\ mort_t + \beta 6\ rent_t + \beta 7\ in_t + \beta 8\ pop_t + e_t$$

Within this system, the average sales price results as a function of supply and demand. Specifically, the average sales price will depend on the Dow Jones industrial average, the expected inflation rate, average sales price, average sales price lagged, mortgage rate, rent level, personal income, and the population. House sales are assumed to be a complex statistic, based on relatively rational reasoning. The purchase decision is assumed to be relatively rational, as consumers have historically bought houses outside of their expected price range, when mortgage rates have been low. Thus, despite being normally a calculated decision, based on many substantial factors, it is assumed that occasionally people get over excited about lower mortgage rates, and this leads them to potential irrationality. Specifically, it is expected that house sales can depend on the DJIA for two distinct reasons: (1) a relatively high DJIA can signify the current strength of an economy, consumers may have access to extra money as a result, and thus they might be able to afford "better" housing. (2) Or from the alternative perspective, a low DJIA may cause investors to reevaluate the risk factor of the market, and thus they might move money into more stable assets, such as real estate. The expected inflation rate is considered significant to the real estate investment decision as well. For example, speculators, looking to make capital gains, will purchase housing when the expected inflation levels are relatively high. Further the fact that real estate is considered a more stable asset in times of higher expected inflation, for investors, warrants the significance of this variable**.** Overall however, an expected inflation rate regarded as being too high will be viewed with caution. This can also influence any cycle, as houses on the market can either be flooded or drastically reduced, and thus exacerbating any cyclical effect. Further, it would normally be openly expected that house sales will directly depend on the average sales price because purchase decisions are usually based on price, however in real estate these two variables are codependent. In this market, a high current sales price and a high lagged sales price will usually cause people to purchase more real estate, as they would expect prices to rise. While a low sales price, and/or lagged sales price would have the opposite effect. However, this relation becomes intricate when economists begin to speculate about when consumers will consider prices either two high or two low, and a bubble will either begin or will burst. Additionally, lower mortgage rates will usually increase sales, as they would increase real purchasing power. And similarly, house sales are expected to be positively related to population and income, as a larger population (i.e. The baby boom generation) will require more space, while greater income will enable consumers to purchase either additional or "better" housing, as their purchasing power would again increase.

Finally, in the third equation, price is taken to depend on housing starts, housing sales, houses for sale, lagged housing starts, and twice lagged housing starts. In this equation, asp refers to sales price, htss refers to the number of new houses started, and hfs refers to the number of houses for sale (on the market). This third equation is represented as follows:

$$asp_t = \gamma 1\ htss_t + \gamma 2\ hsss_t + \gamma 3\ hfs_t + \gamma 4\ htss_{t-1} + \gamma 5\ htss_{t}\text{-}2 + \varepsilon_t$$

Similar to many other variable in this model, price is considered to be another intricate codependent, and complex variable. It is projected that prices have the ability to perfectly adjust to market conditions, which explains why asp is assumed to be dependent on current housing starts, current houses for sale, and current housing sales. Further, lagged housing starts are included to show how prices are also dependent on past housing starts. And, the assumption that houses take 2-3 years to be completed (this is assumed to occur after the building permit has been obtained), shows how a housing build-up can occur, and how high prices can cause greater housing starts, which can subsequently cause lower prices in later periods, due to the overbuilt space.

From a description of this system, the interaction between the asset market and the space market can begin to be seen. It is assumed that rent is a determinant of sales, where through the capital market consumers demand real estate assets based on their potential for future cash flows (sales). Thus, in this scenario, rent is determined in the property market, but sales are determined in the capital market, with the link already established. Additionally, due to the various assumptions, it is assumed that this model will be able to account for real estate cycles, and this will be explained later.

Further, because these equations are in structural form, with many variables dependent on each other, it is necessary to derive the reduced form equations, before a regression and subsequent analyses can commence. The reduced form equation for new house sales in this model is as follows:

$hsss_t = \Pi 100\ djia_t + \Pi 101\ infex_t + \Pi 102\ rent_t + \Pi 103\ cc_t + \Pi 104\ hsss_{t-1} + \Pi 105\ int_t + \Pi 106\ hfs_t + \Pi 107\ htss_{t-1} + \Pi 108\ htss_{t-2} + \Pi 109\ asp_{t-1} + \Pi 110\ mort_t + \Pi 111\ in_t + \Pi 112\ pop_t + V_t$

Where:

$\Pi 100 = (\beta 1 - \beta 1\ \gamma 1\ \alpha 2) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 101 = (\beta 2 - \beta 2\ \gamma 1\ \alpha 2) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 102 = (\beta 3\ \gamma 1\ \alpha 2 + \beta 6 - \beta 6\ \gamma 1\ \alpha 2) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 103 = (\beta 3\ \gamma 1\ \alpha 3) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 104 = (\beta 3\ \gamma 1\ \alpha 4) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 105 = (\beta 3\ \gamma 1\ \alpha 5) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 106 = (\beta 3\ \gamma 3) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 107 = (\beta 3\ \gamma 4) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 108 = (\beta 3\ \gamma 5) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 109 = (\beta 4 - \beta 4\ \gamma 1\ \alpha 2) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 110 = (\beta 5 - \beta 5\ \gamma 1\ \alpha 2) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 111 = (\beta 7 - \beta 7\ \gamma 1\ \alpha 2) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

$\Pi 112 = (\beta 8 - \beta 8\ \gamma 1\ \alpha 2) /(1 - \gamma 1\ \alpha 2 - \beta 1\ \gamma 1)$;

V_t = ERROR TERM

The reduced form equation for housing starts is as follows:

$htss_t$ = Π200 $rent_t$ + Π201 $djia_t$ + Π202 $infex_t$ + Π203 asp_{t-1} + Π204 $mort_t$ + Π205 hfs_t + Π206 $htss_{t-1}$ + Π207 $htss_{t-2}$ + Π208 cc_t + Π209 hss_{t-1} + Π210 int_t + Π211 in_t + Π212 pop_t + V_t

Where:

$$\Pi200 = (\alpha 1 - \beta 3 \gamma 2 \alpha1 + \beta 6 \gamma 2 \alpha2) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi201 = (\beta 1 \gamma 2 \alpha2) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi202 = (\beta 2 \gamma 3 \alpha2) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi203 = (\beta 4 \gamma 2 \alpha2) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi204 = (\beta 5 \gamma 2 \alpha2) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi205 = (\gamma 3 \alpha2) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi206 = (\gamma 4 \alpha2) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi207 = (\gamma 5 \alpha2) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi208 = (\alpha 3 - \beta 3 \gamma 2 \alpha3) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi209 = (\alpha 4 - \beta 3 \gamma 2 \alpha4) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi210 = (\alpha 5 - \beta 3 \gamma 2 \alpha5) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi211 = (\beta 7 \gamma 2 \alpha2) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$
$$\Pi212 = (\beta 8 \gamma 2 \alpha2) /(1 - \gamma 2 \beta3 - \alpha 2 \gamma 1);$$

V_t = ERROR TERM

The reduced form equation for average sales price is as follows:

$asp_t = \Pi300\ rent_t + \Pi301\ cc_t + \Pi302\ hss_{t-1} + \Pi303\ int_t + \Pi304\ djia_t + \Pi305\ infex_t + \Pi306\ asp_{t-1} + \Pi307\ mort_t + \Pi308\ hfs_t + \Pi309\ htss_{t-1} + \Pi310\ htss_{t-2} + V_t$

Where:

$\Pi300 = (\gamma 1\ \alpha 1 + \gamma 2\ \beta 6) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi301 = (\gamma 1\ \alpha 3) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi302 = (\gamma 1\ \alpha 4) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi303 = (\gamma 1\ \alpha 5) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi304 = (\gamma 2\ \beta 1) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi305 = (\gamma 2\ \beta 2) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi306 = (\gamma 2\ \beta 4) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi307 = (\gamma 2\ \beta 5) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi308 = (\gamma 3) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi309 = (\gamma 4) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi310 = (\gamma 5) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi311 = (\gamma 2\ \beta 7) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

$\Pi312 = (\gamma 2\ \beta 8) / (1 - \gamma1\ \alpha 2 - \beta3\ \gamma 2);$

V_t = ERROR TERM

From these three equations, the α s, β s, and γ s are the structural parameters to be estimated, and ut , et , and εt are represented by vt in the reduced form equations, and they each represent stochastic disturbances. In the model, these disturbances are each assumed to be normally distributed, homoskedastic, and serially uncorrelated. Thus, in the structural equation system, the three endogenous variables asp_t, $htss_t$, and $hsss_t$ are determined in terms of the exogenous variables and the disturbances. Moreover, the reduced form equation for average sales price will be analyzed using a two stage linear least squares test. A two stage linear least squares test (TSLS) will be used for the analysis opposed to an ordinary least squares test (OLS), due to identification and simultaneity issues. To estimate accurate numerical values for the structural parameters of the aforementioned system, the equations must be identified. However, because the number of exogenous variables is greater than the number of endogenous variables in the above reduced form equation, the equation is over-identified. Thus, it is possible only to make estimate for the profit function, and it is not possible to make estimates regarding the structural parameters. This means that potentially there can be more than one value for the structural parameters of the equations when they are reconstructed from estimated of the reduced form coefficients. Thus, OLS estimator may not prove to be consistent with each other. This problem; deemed the "simultaneity problem" occurs when endogenous variables on the right side of the equations in the system are correlated with the disturbance term of the equation, and this results from interaction and cross-determination of the variables in such a system. And when this happens, OLS can lead to biased estimates when the structural parameters are reconstructed from the reduced form equation.

THE RESULTS: US MARKET

Dependent Variable: HSSS
Method: Two-Stage Least Squares
Date: 04/23/03 Time: 04:00
Sample(adjusted): 1980 2000
Included observations: 21 after adjusting endpoints
Instrument list: C DJIA INFEX USRNT CC USHSL INT HFS USHSTL USHSTLL AVSPL MORT IN POP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17393.94	35673.51	0.487587	0.6407
DJIA	0.479594	0.445947	1.075452	0.3178
INFEX	-522.7754	293.5856	-1.780657	0.1182
USRNT	94.69540	178.8663	0.529420	0.6129
CC	22.17491	8.867058	2.500819	0.0409
USHSL	-0.747567	0.443801	-1.684466	0.1360
INT	-159.2007	152.5693	-1.043465	0.3314
HFS	0.444407	0.604251	0.735467	0.4860
USHSTL	0.374150	0.151069	2.476685	0.0424
USHSTLL	-0.056916	0.102974	-0.552724	0.5977
AVSPL	0.017709	0.046467	0.381107	0.7144
MORT	-28.86411	269.4749	-0.107112	0.9177
IN	-1.259219	1.079294	-1.166707	0.2815
POP	-0.003269	0.013598	-0.240375	0.8169

R-squared	0.980095	Mean dependent var	7985.667
Adjusted R-squared	0.943128	S.D. dependent var	1593.166
S.E. of regression	379.9357	Sum squared resid	1010458.
F-statistic	26.51287	Durbin-Watson stat	3.047175
Prob(F-statistic)	0.000111		

The demand regression shown above is statistically significant at a 99% confidence level, and the regression has an R-squared exceeding 98%. Further, the addition of an adjusted R-squared exceeding 94% suggests that the inclusion of most all of the independent variables is significant in terms of explaining investments in the dependent variable. From analysis, the coefficient estimates (in terms of the respective profit functions) for construction costs (cc), expected inflation rate (infex), lagged house sales (ushsl), lagged house starts (ushstl), twice lagged house starts (ushstll), housed currently for sale (hfs), mortgage rate (mort), income level (in), aggregate rent level (usrnt), average sales price last period (avspl), the interest rate (int), and population (pop), Dow Jones Industrial Average (DJIA) each possess the correct theoretical signs at the .01 level. Specifically, because the estimates are in terms of profit functions and not in terms of the structural parameters, and also because putting the reduced form equations back in terms of the structural parameters would be exorbitantly mathematically rigorous, and ultimately impossible, we are only able to assume causal relations from the data (those based on the profit functions). From the regression it is seen that greater construction costs leads to greater (house) sales volume. This suggests that as building costs increase, which usually occurs as builders build more (in response to greater price demand), demand will be much greater, in fact the demand is what causes the increased construction rates. Further, this fact was substantiated by earlier data and graphical analysis. The positive coefficient for houses started last period suggests how housing starts may depend on past values, and thus it is again seen how a bubble can be created through myopic expectations. On the other hand, the negative coefficient for twice lagged housing starts suggests that greater houses started two years prior will lead to less house starts today, possibly due to overbuilding. The positive coefficient for average sales price lagged shows that sales can increase as people expect future prices will depend on past prices. Moreover, the fact that greater sales prices last period lead to greater sales today strongly suggests that consumers are partially myopic, as speculators would by property in hopes of capital gains, which would be expected to follow time trends. Further, the positive coefficient with rent levels show that as rents increase, investors will look to purchase more housing due to future expected cash flows. The negative parameter associated with interest rates suggest that as the cost of borrowing increases, people cannot afford as much, real purchasing power decreases, and housing sales decrease. Finally, the negative coefficient associated with lagged house sales, shows that demand is based on many factors in addition to myopic preferences, and this is substantiated with the statistically significant relations with expected inflation, income, population, etc. Finally, the negative coefficient with mortgage rates shows that as rates increase, purchasing power decreases, and sales will again decrease. An increased mortgage rate resulting in decreased sales makes perfect sense, as the greater rate would increase any cost of occupancy. However the fact that a slight increase in income results in a slight decrease in sales does not seem too significant, further, it questions whether increasing income is a determinant of demand. Most likely a combination of other factors are more influential.

Overall, the strength of this model is substantiated from the point of sales. The above regression shows the significant determinants of demand, and each variable seems to follow our reasoning followed throughout the paper. However, to maintain the accuracy of these estimates, it is necessary to test for multicollinearity amongst the independent variables. This is shown in the appendix, as it is a technicality, which is easily corrected, and does not change the power of the model. According to the, the LM Test for serial correlation has a probability of 0.01, thus it is necessary to accept the null hypothesis of no serial correlation. This affirms the strength of this relation.

Next, the regression against supply:

Dependent Variable: HTSS

Method: Two-Stage Least Squares

Date: 04/23/03 Time: 03:56

Sample(adjusted): 1980 2000

Included observations: 21 after adjusting endpoints

Instrument list: C USRNT DJIA INFEX AVSPL MORT HFS USHSTL USHSTLL CC USHSL INT IN POP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11451.81	63313.98	-0.180873	0.8616
USRNT	695.6649	317.4550	2.191381	0.0645
DJIA	2.500837	0.791474	3.159719	0.0159
INFEX	-1310.948	521.0610	-2.515920	0.0400
AVSPL	-0.035995	0.082471	-0.436451	0.6757
MORT	799.0852	478.2688	1.670787	0.1387
HFS	4.281148	1.072436	3.991985	0.0052
USHSTL	1.278034	0.268119	4.766660	0.0020
USHSTLL	0.157923	0.182760	0.864098	0.4162
CC	41.67766	15.73741	2.648318	0.0330
USHSL	-3.503869	0.787665	-4.448426	0.0030
INT	-1042.336	270.7826	-3.849344	0.0063
IN	-5.893485	1.915550	-3.076655	0.0179
POP	0.005613	0.024134	0.232584	0.8227

R-squared	0.980860	Mean dependent var	17300.71
Adjusted R-squared	0.945315	S.D. dependent var	2883.576
S.E. of regression	674.3166	Sum squared resid	3182920.
F-statistic	27.59490	Durbin-Watson stat	3.062525
Prob(F-statistic)	0.000097		

The supply side regression shown above is statistically significant at a 99% confidence level as well, and the regression has an R-squared exceeding 98%. Further, the inclusion of an adjusted R-squared exceeding 94% again suggests that the inclusion of most all of the independent variables is significant in terms of explaining investments in the dependent variable. Finally, the coefficient estimates for rent levels (usrnt), Dow Jones Industrial Average (DJIA), expected inflation rate (infex), lagged average sales price (avspl), mortgage rate (mort), twice lagged house starts (ushstll), construction costs (cc), income (in), and population (pop) are each significant in determining house starts at the .01 level. Only, houses for sale (hfs), lagged house starts (ushstl), lagged housing sales (ushsl), interest rate (int), are not significant. This suggests issues regarding the dependency of housing starts. From the regression it is seen that greater construction costs lead to greater houses started, which again is expected because in a growing market, such as real estate, new construction will cost more. The positive coefficient for rent levels again show how housing starts depend on expected future profits, with higher rents leading to higher starts. Specifically, the increase in rent levels, a representation of future cash flows, leading to a sharp increase in housing, does show how a cycle may be born The negative coefficient for lagged sales price goes against intuition, however this can be due to the difficulty in attempting to forecast an aggregate market. The fact that greater house starts twice lagged result in greater house starts this period, again suggests a myopic trend. Finally, the relationship between starts, income, and population, though again against expectations, does show how house starts can also depend on exogenous factors outside of the real estate market. Finally, because this model is being applied to the aggregate housing market, some relationships between variable may be different that what would normally be expected. As mentioned earlier, this is the difficulty in attempting to estimate the overall market. In an application to several regional markets, the aforementioned relations will be reexamined for casual positive and negative relations. This model however is important in determining the relevance of the many predicted explanatory variables.

Overall, the strength of this model is substantiated, due to the high correlation coefficient. The above regression shows the significant determinants of demand, however, greater accuracy in the actual relations (not significance) between variables can more likely be ascertained through a study of regional markets, which is done later in the paper. Again however, to maintain the accuracy of these estimates, it is necessary to test for multicollinearity amongst the independent variables. According to the analysis, the LM Test for serial correlation has a probability of 0.01, thus it is necessary to accept the null hypothesis of no serial correlation. This affirms the strength of this relation.

Next, the regression for sales price:

Dependent Variable: ASP
Method: Two-Stage Least Squares
Date: 04/23/03 Time: 03:58
Sample(adjusted): 1980 2000
Included observations: 21 after adjusting endpoints
Instrument list: C USRNT CC USHSL INT DJIA INFEX AVSPL MORT HFS USHSTL USHSTLL IN POP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-192766.6	210392.6	-0.916223	0.3900
USRNT	3481.406	1054.904	3.300210	0.0131
CC	-16.78403	52.29548	-0.320946	0.7576
USHSL	-2.239346	2.617414	-0.855557	0.4206
INT	-123.4319	899.8118	-0.137175	0.8948
DJIA	5.998762	2.630073	2.280835	0.0566
INFEX	250.0901	1731.488	0.144437	0.8892
AVSPL	0.133701	0.274051	0.487869	0.6406
MORT	3356.030	1589.289	2.111655	0.0726
HFS	2.037425	3.563710	0.571714	0.5854
USHSTL	-0.190815	0.890962	-0.214168	0.8365
USHSTLL	-1.278108	0.607313	-2.104529	0.0734
IN	-14.99907	6.365379	-2.356352	0.0506
POP	0.034437	0.080196	0.429418	0.6805

R-squared	0.998762	Mean dependent var	137055.6
Adjusted R-squared	0.996462	S.D. dependent var	37671.83
S.E. of regression	2240.757	Sum squared resid	35146938
F-statistic	434.3026	Durbin-Watson stat	2.638934
Prob(F-statistic)	0.000000		

The model does an excellent job in determining sales price, as shown from the R-squared being greater than 99% and the adjusted R-squared being greater than 96% (each at the 1% level). This is very important because, as states earlier, price levels are paramount in determining a cycle (either causing greater house starts that cal lead to oversupply, or reducing sales, which can lead to greater vacancy rates and lower housing starts). Within this model, though again marred by being at the aggregate level, it is interesting to observe that price is negatively correlated with lagged house starts and with twice lagged house starts. This fact can help substantiate the hypothesis regarding the creation of a cycle, and how high levels of construction will eventually depress prices. Further, in light of this being an aggregate model, specific correlations will not be examined here, though it is important to see that in this model, everything is statistically significant.

An overall examination of the US market shows the power and accuracy of this model, and substantiates the significant relationship between many of the variables. However, as mentioned prior, it is necessary to study regional markets to determine the specific causal relationships between many of these variables. This is important because many regional markets depend on regional variables, and when added together with all regional markets, the overall relations may grossly differ. In light of this theory, the model will next be applied to the New York housing market:

THE RESULTS: NEW YORK MARKET

Dependent Variable: NYHSS
Method: Two-Stage Least Squares
Date: 04/23/03 Time: 04:04
Sample(adjusted): 1980 1999
Included observations: 20 after adjusting endpoints
Instrument list: C DJIA INFEX NYRNT NYCC NYCHSS INT HFS
NYHST NYHSTL NYCASP MORT NYPI NYPOP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	26856.66	12262.13	2.190212	0.0711
DJIA	-0.042707	0.082486	-0.517753	0.6232
INFEX	-12.73490	45.44258	-0.280241	0.7887
NYRNT	8.114208	23.24714	0.349041	0.7390
NYCC	5.191487	3.234207	1.605181	0.1596
NYCHSS	0.431913	0.341639	1.264238	0.2530
INT	12.26514	29.94735	0.409557	0.6964
HFS	-0.084583	0.145661	-0.580682	0.5826
NYHST	-0.205125	3.761168	-0.054538	0.9583
NYHSTL	0.402358	1.292748	0.311243	0.7661
NYCASP	-6.97E-06	0.000897	-0.007773	0.9941
MORT	-112.7096	91.81946	-1.227513	0.2656
NYPI	-0.083501	0.139800	-0.597291	0.5721
NYPOP	-0.001480	0.000672	-2.202008	0.0699

R-squared	0.979751	Mean dependent var	930.1500
Adjusted R-squared	0.935877	S.D. dependent var	285.8329
S.E. of regression	72.37999	Sum squared resid	31433.18
F-statistic	22.33126	Durbin-Watson stat	1.934372
Prob(F-statistic)	0.000527		

Again, the model does an excellent job of predicting housing sales, as proven by R-squared value exceeding 97% and the adjusted R-squared value exceeding 93%. And despite the fact that the correlation coefficient is slightly lower for the regional model, the standard error for this regression is also much lower: 72 opposed to 380. Similarly, in this regression, the coefficient estimates for the Dow Jones Industrial Average (DJIA), expected inflation rate (infex), regional rent level (nyrnt), regional construction costs (nycc), regional lagged house sales (nychss), the interest rate (int), regional houses for sale (hfs), lagged regional house starts (nyhst), twice lagged regional house starts (nyhstl), lagged regional average sales price (nycasp), contract mortgage interest rate (mort), regional personal per capita income levels (nypi), and regional population (nypop) are each highly significant in determining house sales at a 99% confidence level. Specifically, house sales are seen to be negatively correlated with the DJIA, and this seems to suggest that as the DJIA decreases, house sales will increase, as investors will move money into less (perceived) risky assets, such as real estate. The positive coefficient with regional rent levels, suggests that as rents increase, house sales will increase, as investors see the possibility for greater future cash flows. The negative coefficient for lagged house starts shows that greater house starts last period lead to fewer sales today. This relation could occur for several reasons. For example, greater house starts last period could suggest that demand is very high, less houses are currently available on the market, and thus less sales will occur today. Further, the positive parameter for twice lagged house starts suggests that demand is rising, more houses will be built, and by the time they are ready, two periods later, more houses are available and will be sold. Moreover, sales price has such a small projected parameter, which suggests that while price is a significant factor in sales, it does not really affect sales volume. The negative correlation with inflation apparently suggests that sales will increase when an economy appears more stable. Finally, the significant relations with population and income show how sales also can depend on exogenous factors. Also, despite having opposite parameters than one might expect, adding regional income and population significantly reduced the standard error of the regression (and this can be seen in comparison with the regressions for the Los Angeles market which, due to lack of available data, omitted these respective parameters). Overall, this regression shows the strength of the model in predicting sales. As was expected, real estate demand relies on many factors, and thus it is hard to determine exact causal relationships. In practice, people are fickle, and demand determinants can change. The main point for including a regression for sales was to show the strength of the model's predictability. It is expected that housing starts and sales price will be clearer to predict, as they are assumed to rely on more simple factors. Again, to maintain the integrity of the model, it is necessary to perform another LM tests, and for all of the remaining regressions performed, this is shown in the appendix.

Next, the regression for New York housing starts is as follows:

Dependent Variable: NYHST
Method: Two-Stage Least Squares
Date: 04/23/03 Time: 04:09
Sample(adjusted): 1980 1998
Included observations: 19 after adjusting endpoints
Instrument list: C NYRNT DJIA INFEX NYCASP MORT HFS NYCHST NYCHSTL NYCC NYCHSS INT NYPI POPNYC

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2945.902	942.6747	3.125047	0.0261
NYRNT	4.898785	2.164381	2.263366	0.0730
DJIA	-0.021348	0.006731	-3.171326	0.0248
INFEX	-1.720395	5.047595	-0.340835	0.7471
NYCASP	0.000210	0.000127	1.645327	0.1608
MORT	-22.31338	5.370987	-4.154428	0.0089
HFS	-0.035958	0.011834	-3.038494	0.0288
NYCHST	-0.104518	0.372389	-0.280668	0.7902
NYCHSTL	-0.259869	0.119465	-2.175278	0.0816
NYCC	0.968506	0.211159	4.586618	0.0059
NYCHSS	0.141447	0.056455	2.505482	0.0541
INT	4.230420	2.730167	1.549509	0.1819
NYPI	-0.039162	0.012403	-3.157516	0.0252
POPNYC	-0.000159	5.23E-05	-3.032052	0.0290

R-squared	0.995749	Mean dependent var	164.7263
Adjusted R-squared	0.984698	S.D. dependent var	57.53484
S.E. of regression	7.117222	Sum squared resid	253.2742
F-statistic	90.09900	Durbin-Watson stat	2.876408
Prob(F-statistic)	0.000049		

Again, the strong predictability of the model is substantiated from the above regression. As the data shows, the model very accurately predicts the significant causal relation for real estate starts, as shown by the R-squared value greater than 99%, the adjusted R-squared value greater than 98%, the low standard error of 7, and a 99% confidence level. These figures are especially significant since we are assuming that housing starts cause real estate cycles. Thus, from the regression, it should be possible to determine the structure, origin, and relationships regarding a cycle. Specifically, it is projected that increased rent levels cause greater house starts, a lower DJIA causes lower house starts, a higher lagged sales price causes higher house starts, a higher mortgage rate causes lower house starts, greater houses for sale cause less house starts, greater lagged house starts as well as greater twice lagged house starts cause decreased house starts, and greater lagged sales cause greater house starts. Again, these relationships are highly significant for the following reasons. The positive correlation with rents suggests that high rent levels cause greater concurrent house starts, as builders want to capitalize in greater expected profits, and this is similar for the positive relationship with lagged sales prices. Specifically, as greater prices are being observed, construction levels will increase (albeit with very poor foresight) to try and capitalize on these higher levels. However, negative effects of this relationship, and the reasoning for a cycle, are seen from the negative relationships with lagged house starts. From these numbers, it is shown how inflated sales prices cause greater current house starts, but in the future this increased construction rate causes an ultimate depression of prices. Thus, a cyclical, circular cycle can be observed, based on irrational profit-seeking preferences. Finally, the positive relation with lagged house sales shows how builders will increase construction rates because of increased observed sales volume. This is interesting, as it suggests the possibility of myopic forecasting. This is significant because, according to the stock flow model, myopic forecasting causes a never-ending cycle, as such we have just intimated with the cyclical circular assumption. Similar reasoning intimates the negative relation between houses for sale and new house starts, as less houses are available on the market, more will be created, again, leading to potential oversupply, based on the builders presumed preferences/expectations. Finally, the negative correlation with mortgage rates suggests that when mortgage rates are high, and the real purchasing power of the consumer is reduced, builders will expect less of capital gains from their investment, and will therefore respond with an immediate reduced construction rate. However, it is expected that this decision will lead to temporary undersupply, resulting in greater prices, which will influence greater building rates. Thus, it is clear how this regression substantiates the assumption of a supplier caused cycle, as was initially predicted by the structure of this model.

Having justified how a cycle can be created by increased housing starts, a direct result of sales price, it is now time to see how the average sales price is determined in this market:

Dependent Variable: NYASP
Method: Two-Stage Least Squares
Date: 04/23/03 Time: 04:07
Sample(adjusted): 1980 1998
Included observations: 19 after adjusting endpoints
Instrument list: C NYRNT NYCC NYCHSS INT DJIA INFEX NYCASP MORT HFS NYCHST NYCHSTL NYPI NYPOP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4626791.	3499502.	1.322128	0.2434
NYRNT	19398.88	8034.856	2.414341	0.0605
NYCC	668.9701	783.8883	0.853400	0.4324
NYCHSS	107.7164	209.5790	0.513966	0.6292
INT	18012.15	10135.23	1.777182	0.1357
DJIA	-11.55676	24.98929	-0.462469	0.6632
INFEX	-2471.607	18738.24	-0.131902	0.9002
NYCASP	0.180272	0.472847	0.381249	0.7187
MORT	-21081.62	19938.78	-1.057318	0.3388
HFS	-96.55964	43.93212	-2.197928	0.0793
NYCHST	679.8665	1382.422	0.491794	0.6437
NYCHSTL	-551.2880	443.4903	-1.243067	0.2690
NYPI	-105.5905	46.04267	-2.293317	0.0704
NYPOP	-0.275133	0.194108	-1.417426	0.2156

R-squared	0.926054	Mean dependent var	266473.7
Adjusted R-squared	0.733796	S.D. dependent var	51209.12
S.E. of regression	26421.34	Sum squared resid	3.49E+09
F-statistic	4.816710	Durbin-Watson stat	2.910307
Prob(F-statistic)	0.046655		

Though this model does not predict sales price as well as would be desired, with an R-squared of 92% an adjusted R-squared of 73%, and a standard error of 26,000 (relatively not that high considering that sales prices were observed in the $100,000's), it does a fairly accurate job, and is still a strong indicator of sales price. However, even this is less significant, considering house starts are of paramount importance to the assumptions of the model, especially because they are thought to establish a cycle. Specifically, it is seen that the average sales price in New York is positively correlated with rent, construction costs, lagged housing sales, interest rates, lagged sales price, and lagged housing starts, and is negatively correlated with the DJIA, the expected inflation rate, the contract mortgage rate, houses for sale on the market, and twice lagged housing starts. Again, population and income are included as they significantly reduce the standard error of the model. Fortunately, each of the relationships derived from this regression make perfect logical sense. It is obvious to expect that higher rent levels would cause a greater selling price, as investors could expect a greater return from their (real estate) investment. Further, the positive relationship with construction costs suggests that increased construction costs (which consequently results from increased building rate) causes and is reflected in a higher sales price, since builders want to maintain profit margins as high as possible. The positive relationship with interest rates similarly suggests that a higher cost of capital will lead to a higher sales price. The negative correlation with the DJIA suggests that as stocks decrease, it is expected that real estate will be a more desirable asset, thus demand will increase, as will price. The negative correlation with expected inflation disproves the theory presented from the Stock Flow model. The positive relationship with lagged sales prices suggest that prices depend on their previous values, thus it is easy to see how a running cycle can be created. The negative relationship with mortgage rates shows that as the contract interest rates decrease, builders will expect that consumers will be able to afford more, and being the profit seekers that they are observed to be, prices will increase as a result. The negative relationship with houses currently for sale on the market proves how excess supply reduces price levels. The positive relationship with lagged house starts shows the codependence of this relationship: high prices cause greater house starts, which temporarily cause higher prices (due to demand side myopic expectations). However, the negative relationship with twice lagged house starts shows how eventually this codependent relationship will lead to too much supply, and a reduction in prices. Again, the overall strength and feasibility of this model is substantiated with a series of these regressions, and from this it can be seen how the cycle is created and prolonged.

In hopes to maintain the reliability of this model, it will next be applied to the Los Angeles real estate market:

LOS ANGELES MARKET

(Again, one could perform an LM test to check for autocorrelation, and then employ an ar(1) correction to correct for the serial correlation, however the idea here is just to show how this model applies to different markets.)

Dependent Variable: LAASP
Method: Two-Stage Least Squares
Date: 04/23/03 Time: 00:21
Sample(adjusted): 1989 2000
Included observations: 12 after adjusting endpoints
Instrument list: C CC LAHSSL INT DJIA INFEX LAASPL MORT HFS LAHSTL LAHSTLL

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-211511.0	91756.97	-2.305122	0.2606
CC	620.8627	103.4314	6.002652	0.1051
LAHSSL	104.9474	27.38611	3.832140	0.1625
INT	10967.42	1345.178	8.153133	0.0777
DJIA	-23.19385	9.060010	-2.560025	0.2371
INFEX	-221.6747	1541.167	-0.143836	0.9091
LAASPL	0.099126	0.224167	0.442197	0.7349
MORT	-38581.73	6743.288	-5.721501	0.1102
HFS	11.94762	3.464265	3.448819	0.1797
LAHSTL	2.629977	1.108088	2.373438	0.2539
LAHSTLL	10.95181	1.513149	7.237760	0.0874

R-squared	0.999885	Mean dependent var	247270.1
Adjusted R-squared	0.998735	S.D. dependent var	40534.68
S.E. of regression	1441.503	Sum squared resid	2077932.
F-statistic	869.6906	Durbin-Watson stat	3.162988
Prob(F-statistic)	0.026383		

Again, the model accurately estimates the market. With respect to the Los Angeles market, the model does a far superior job of projecting the average price level at a 99% confidence level. In this case, both the R-squared and the adjusted R- squared are greater than 99%. Further, the standard error is high due to the omission of income and population, and despite the fact that the Durbin – Watson statistic suggests potential first order serial correlation, this could be corrected with the addition of the ar(1) correction in the model. However, since this will not significantly alter the above casual relationships derived between the parameters, these additional statistical regressions will be excluded from this paper. In this regression, the coefficient estimates for: regional construction costs (cc), lagged house sales (lahssl), the interest rate (int), the Dow Jones Industrial Average (DJIA), the expected inflation rate (infex), lagged average sales price (laaspl), the contract mortgage rate (mort), regional houses for sale (hfs), regional lagged house starts (lahstl), and regional twice lagged house starts (lahstll) are each highly significant in estimating average sales price (laasp) at the .01 level. From the data, it is shown that many of the same relationships hold in the Los Angeles market, as did in the New York market. However, the sole, and the major difference between these regional markets is that price is positively correlated with both lagged housing starts and twice lagged housing starts. According to the price graphs in the beginning of this paper however, this makes perfect sense, as the LA market seems to experience a far longer and more subtle cycle than New York, thus these parameters are surprisingly expected. Otherwise everything else holds similar relationships, though with a much greater accuracy in Los Angeles.

Next, the estimates for new housing starts in Los Angeles are as follows:

Dependent Variable: LAHST

Method: Two-Stage Least Squares

Date: 04/23/03 Time: 00:18

Sample(adjusted): 1989 2000

Included observations: 12 after adjusting endpoints

Instrument list: C DJIA INFEX LAASPL MORT HFS LAHSTL LAHSTLL CC LAHSSL INT

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-32056.40	43665.17	-0.734141	0.5968
DJIA	-3.821314	4.311464	-0.886315	0.5383
INFEX	39.57339	733.4083	0.053958	0.9657
LAASPL	0.109732	0.106676	1.028643	0.4910
MORT	-1885.547	3208.985	-0.587583	0.6618
HFS	-2.276406	1.648569	-1.380837	0.3990
LAHSTL	1.281038	0.527315	2.429360	0.2486
LAHSTLL	-0.032273	0.720075	-0.044819	0.9715
CC	36.10100	49.22078	0.733450	0.5971
LAHSSL	9.149374	13.03246	0.702045	0.6103
INT	480.4516	640.1415	0.750540	0.5901

R-squared	0.995636	Mean dependent var	7016.833
Adjusted R-squared	0.951996	S.D. dependent var	3130.939
S.E. of regression	685.9805	Sum squared resid	470569.2
F-statistic	22.81492	Durbin-Watson stat	3.162988
Prob(F-statistic)	0.161628		

Also similar to the New York market, the model strongly estimates house sales in the Los Angeles market, with a correlation coefficient greater than 99% and an adjusted R-squared greater than 95%. Specific to this regression, house starts are negatively correlated with DJIA for similar reasons as previously discussed. House starts are positively correlated with average sales price, as a higher price will foster greater construction levels. The negative relation with the contract mortgage rate suggests that under this condition, greater prices will result (due to greater consumer purchasing power) and again the construction rate will increase. The negative relation with houses for sale shows that as fewer houses are available on the market, demand is heightened, prices will be rising, and thus builders will again increase construction rates in a futile attempt to capitalize in this current economy. Furthermore, the positive relationship with lagged housing starts and negative relationship with twice lagged house starts follows the cyclical relation as described in the New York market. And, similar reasons hold for the relationship with lagged house sales, construction costs, and the interest rate. Thus, this regression proves that despite the application to an ulterior market, the model still carries many of the same relations, and ultimately intimates the same prediction of a supply induced real estate cycle.

Finally, the relationship for LA house sales is as follows:

Dependent Variable: LAHSS
Method: Two-Stage Least Squares
Date: 04/23/03 Time: 00:24
Sample(adjusted): 1989 2000
Included observations: 12 after adjusting endpoints
Instrument list: C DJIA INFEX CC LAHSSL INT HFS LAHSTL
LAHSTLL LAASPL MORT

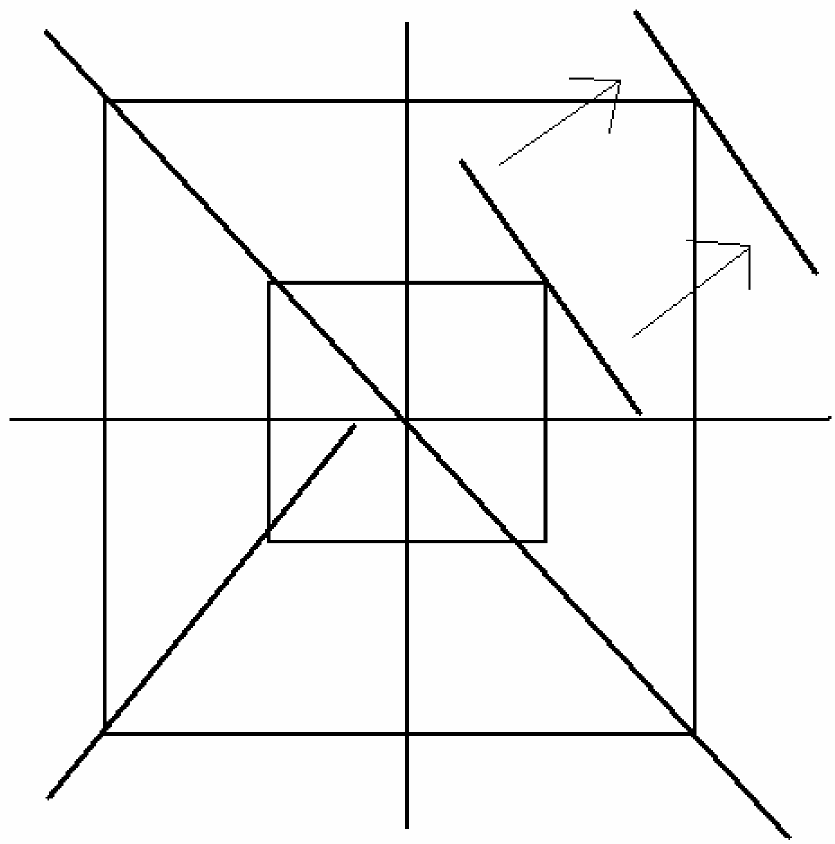
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6381.086	5944.296	-1.073480	0.4774
DJIA	-0.844915	0.586935	-1.439537	0.3865
INFEX	-86.82069	99.84151	-0.869585	0.5443
CC	10.23487	6.700601	1.527456	0.3690
LAHSSL	1.809246	1.774156	1.019779	0.4938
INT	114.8067	87.14476	1.317426	0.4133
HFS	-0.300549	0.224426	-1.339193	0.4083
LAHSTL	0.032699	0.071785	0.455517	0.7279
LAHSTLL	0.082485	0.098026	0.841460	0.5547
LAASPL	0.027302	0.014522	1.880040	0.3112
MORT	-457.3706	436.8507	-1.046972	0.4854

R-squared	0.996032	Mean dependent var	2556.083
Adjusted R-squared	0.956348	S.D. dependent var	446.9662
S.E. of regression	93.38499	Sum squared resid	8720.757
F-statistic	25.09927	Durbin-Watson stat	3.162988
Prob(F-statistic)	0.154209		

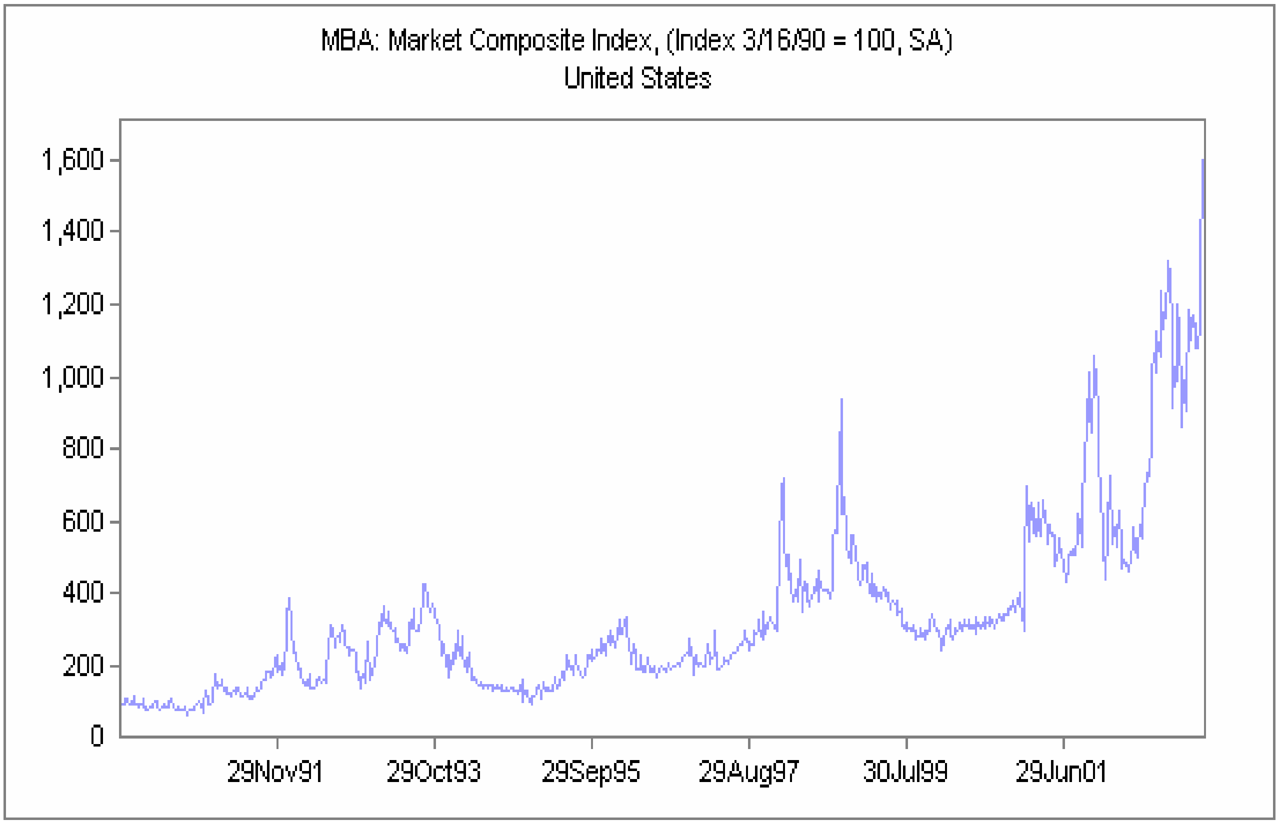
When applied to estimating house sales in Los Angeles, the model again presents very strong correlation coefficients: R-squared exceeds 99%, while adjusted R- squared exceeds 95%. And again, it is proved how demand is based on houses for sale, house starts, and low mortgage rates. Thus, we can ascertain, the complexity of demand.

THE FUTURE OF REAL ESTATE

In a recent speech, famed economist, Lester Thurow, predicted that the housing market would soon be in dire straights, the victim of overconfidence in the market, and from the effects of his projected double dip recession (Lecture during MIT forum). He predicted that the possibility for households to refinance their current mortgages would be devastating. As a result, it would enable people to overspend, and eventually it would lead to people not being able to afford their housing. Further, the current exorbitantly low mortgage rate will hurt the long run real estate market. As predicted from the model, this lower mortgage rate will increase demand and house sales, which will ignite development and foster greater construction rates. Prices will be bid up even further, and eventually within a few years, the current spending of many consumers will catch up with them, they will not be able to afford payments, and the housing market will crash. The ultimately problem with the current market, is that it cannot be supported by the current economy speaking in terms of a graph, we are here (see below). As can be observed from the graph, a combination of very favorable mortgage rates, risk perception, and myopic expectations (as people have observed housing prices rise considerably over the past few years) have caused the demand function to shift out very far. As a result of observations and expectations, consumers and investors have been led to make irrational (purchasing) decisions, which will lead to the aforementioned irrational supply sector to respond in such a way as to create a drastic bust in the market, of a proportion not seen in years.



Though logically, these assumptions appear to make perfect sense, many real estate pundits have argued extensively over this issue, and many disagree with one another. For example, on June 4, 2002, the Wall Street Journal printed the following passage: “Many economists argue that markets like San Francisco might be extraordinarily overpriced.” While economists at such firms as Miller Samuel, a leading Manhattan real estate assessor, and Business360 argue that the Manhattan mass-market is not overvalued. These economists that higher incomes and lower mortgage rates make real estate as affordable as it was ten years ago (though real estate prices have risen 58.1% higher than income since 1998” (The Wall Street Journal, October 3, 2002)). People are indeed taking advantage of these low mortgage rates, as shown by the following graph:



Further, these economists argue that regardless of the fact that real estate gains have outstripped personal income gains, these numbers have historically lagged (after they were corrected by a market crash, of course). Currently, the average wage earner will require 7.9 years to earn the equivalent cash value of a 1000 square foot house. In 1996, it took 5 years, while in 1983 it took 19.3 years (Business360.com). What these economists are avoiding however, is the fact that the aggregate market crashed and corrected itself in 1991.

Moreover, these same economists also argue in favor of the virtues of the low mortgage rate, glorifying the fact that a low contract rate makes purchasing "relatively inexpensive" (Business360.com). The current problem facing the market is that people are leveraging too much of their demand, and as a result of this the supply side will respond to a “false” statistic, that cannot be supported in the economy. However, again these economists ignore the fact that consumers are now purchasing housing units outside of their income range. Furthermore, in addition to these concerns, bond markets have recently exhibited increased volatility, and there is a growing fears that this may cause interest to rise quickly and unexpectedly. Moreover, because of the high debt levels, a recessive economy, or an increase in this debt burden through higher interest rates would preclude consumers the ability to afford their mortgages. Finally, new higher property tax will begin to change the direction of demand. Any of these factors will shift the curve in the bottom left hand corner of the above graph, and again will exacerbate any directional market change, or bubble burst.

Overall**,** the problem with many of the assumptions made by the economists at Miller Samuel and at Busines360 is that they focus strictly on the demand side. Yes, consumers may be able to afford greater housing, but as a result, prices are skyrocketing, and builders are starting more and more houses in response to this. What happens when consumers can no longer afford their housing? What happens when these ill-timed housing starts are finally completed and the market is oversupplied? Unfortunately, as described above, the end result could be a substantial market decline in the near future.

CONCLUSION

Questions arise over the development of such a cycle. Does it represent correlation with the economy? Is it the result of imperfect market foresight? Is it a speculative bubble?

An analysis of the historical data in conjunction with economic theory substantiates the fact that the real estate cycle is the end product of an imperfect economy, marred by the lagged, highly elastic supply schedule. It has been shown that both consumers and producers exhibit relatively poor foresight, and each of their respective actions will force markets to perpetually act in a cyclical fashion. Unfortunately this appears to be a problem, which cannot be resolved without significant regulation, as people's actions will always be performed in an attempt to maximize their individual profits. Some would go so far as to call this the dark side of capitalism.

As has been proved, the real estate cycle is a speculative bubble, it is ignited be demand side consumers and it is formed by "unbridled optimism" of developers. Further, it has been seen how demand is derived as a result of myopic and exogenous expectations and preferences. People have currently and historically to increase demand following a positive exogenous shock as lower interest rates, lower tax rates, changes in risk perception, etc. Due to this positive demand shock, prices (with a current fixed supply) appreciate past a level that can be supported in the long run economy. However, consumers see this price appreciation, and make additional purchase decision based on the observation of increasing prices, and prices increase even more. Thus, a speculative bubble is formed as prices are bid up. In response to this price inflation, the irrational, profit maximizing competing construction sector responds by increasing house starts. Again this is an exhibit as imperfect market foresight because rather than rationally expecting prices to fall in the future, each builder wants to try and optimize the inflated market. Thus, as more houses are started, the more the market will be flooded in the future, and the greater will be the resulting price depression. In response to this, people will buy and sell houses, and the vacancy rate will wildly fluctuate, as has be seen by observation movements in the actual vacancy rate.

All of this results in a circular, cyclical cycle in the real estate market, where consumers will perpetually buy and sell based on the price level, and the degree if this cycle depends on the direction of the economy. From this it should be expected that the New York and Houston real estate markets should eventually experience a major crash, while the Los Angeles real estate market should experience more mild succession of boom and bust periods, as consumer expectations in that region have been observed to be less correlated with the economy than other markets. Unfortunately, in practice, speculative trends dominate over fundamental knowledge, and the fact that long time lags are required to deliver real estate space to the market ensures that the market will forever maintain a cyclical structure.

References

1. DiPasquale, Denise and William C. Wheaton, Urban Economics and Real Estate Markets, 1996, 6-57, 242-266.
2. DiPasquale, Denise and William C. Wheaton. "The Markets for Real Estate Assets and Space: A Conceptual Framework." Real Estate Economics, 185-195, 1992.
3. David Geltner and Norman G. Miller, Commercial Real Estate Analysis And Investments, 22-50, 2001.
4. Peijie Wand, Econometric Analysis of the Real Estate Market and Investment, 2001.
5. Jeffrey M. Woolridge, Introductory Econometrics, A Modern Approach, 525-546, 2003.
6. William B. Brueggeman and Jeffrey D. Fisher, Real Estate Finance and Investments, 79-111, 176-206, 2001.
7. Robert Thompson and Sotiris Tsolaces. "Projections in the Industrial Property Market using a Simultaneous Equations System." Journal of Real Estate Research, 165-187, 2000.
8. John D. Benjamin, G. Donald Jud, Daniel T. Winkler, "A Simultaneous Model and Empirical Test of the Demand and Supply of Retail Space." Journal of Real Estate Research, 1-12, 1998.
9. Mark Gallagher and Antony P. Wood, "Fear of Overbuilding in the Office Sector: How Real is the Risk and Can We Predict It?" Journal of Real Estate Research, 3-31. 1999.
10. Robert P. Flood and Robert J. Hodrick, "On Testing For Speculative Bubbles." The Journal of Economic Perspectives, 85-100, 1990.
11. Michael Youssefmir, Bernard A. Huberman, and Tad Hogg. "Bubbles and Market Crashes." Xerox Palo Alto Research Center, 2-19.

12. C.W.J. Granger. “Investigating Causal Relations by Econometric Models and Cross-spectral Methods,” Econometrica, 424-438, 1969.
13. Jacques Gordon, Paige Mosbaugh, Todd Canter, “Integrating Regional Economic Indicators with the Real Estate Cycle.” The Journal of Real Estate Research469-499, 1996.
14. Kicki Bjorklund and Bo Soderberg. “Property Cycles , Speculative Bubbles, and the Gross Income Multiplier.” Journal of Real Estate Research, 151-171, 1999.
15. Joseph L. Pagliari, Jr and James R. Webb. “On Setting Apartment Rental Rates: A Regression-Based Approach” The Journal of Real Estate Research, 37-59, 1996.
16. Max Kummerow. “A System Dynamics Model of Cyclical Office Oversupply.” Journal of Real Estate Research, 233-253, 1999.
17. Terry Grissom and James R. DeLisle. “A Multiple Index Analysis of Real Estate Cycles and Structural Change.” Journal of Real Estate Research, 97-126, 1999.
18. Waldo L. Born and Stephen A. Pyhrr. “Real Estate
19. Business360. “What Real Estate Bubble?” 2003.

Economic Data

20. Miller Samuel
21. Bureau of Economic Analysis
22. Economy.com
23. Freelunch.com
24. Economagic.com
25. Federal Reserve, Board of Governors
26. Census Bureau
27. Bureau of Labor Statistics
28. Department of Commerce
29. National Association of Home Builders
30. Rebuz.com
31. Businesscycle.com

APPENDIX

A

Ricardian Rents:

Based upon the monocentric city model, where commuting to the sole employment center gives rise to respective property rents, or transportation costs, based on (1) payments that a tenant would offer for housing, or (2) the annual amount the owner would be willing to pay for space occupancy use.

B

Land Rent Theory:

Based on the following equation: R(d) = y-kd-x^0. A theory of determining house rents, where at the center of the monocentric city (d=0), commuters will have no commuting cost, and thus rent at this location, R(0), will equal y-x^0. Moving outwards from this point, rent will decline dollar for dollar as commuting costs relatively increase. At some distance, b, the city ends and housing rent will be at its cheapest level. Finally, it is the cost of constructing new housing space that determines the cheapest rent levels at the city's edge.

C

Regression Follow Up:

LM Tests:

1. US Housing Sales

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.394788	Probability	0.161287
Obs*R-squared	8.531357	Probability	0.014042

Test Equation:
Dependent Variable: RESID
Method: Two-Stage Least Squares
Date: 04/22/03 Time: 21:34
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3469.457	6360.616	-0.545459	0.6024
DJIA	0.367681	0.291764	1.260198	0.2480
INFEX	90.04432	126.6326	0.711067	0.5000
USRNT	24.58867	65.01000	0.378229	0.7165
CC	-11.42204	10.81417	-1.056210	0.3260
HSSSL	-0.210105	0.384007	-0.547138	0.6013
INT	-22.74448	122.8420	-0.185152	0.8584
HFS	-0.061764	0.534233	-0.115612	0.9112
HTSSL	0.179380	0.141235	1.270076	0.2446
HTSSLL	-7.95E-05	0.046978	-0.001691	0.9987
ASPL	0.015092	0.025866	0.583469	0.5779
MORT	82.33947	275.4693	0.298906	0.7737
RESID(-1)	-0.226127	0.522635	-0.432668	0.6783
RESID(-2)	-1.416559	0.655042	-2.162547	0.0674

R-squared	0.406255	Mean dependent var	-5.07E-12
Adjusted R-squared	-0.696414	S.D. dependent var	258.0457
S.E. of regression	336.0954	Akaike info criterion	14.70739
Sum squared resid	790721.0	Schwarz criterion	15.40374
Log likelihood	-140.4276	F-statistic	0.368429
Durbin-Watson stat	2.695435	Prob(F-statistic)	0.942926

2. US Housing Starts

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.354696	Probability	0.165186
Obs*R-squared	8.445975	Probability	0.014655

Test Equation:
Dependent Variable: RESID
Method: Two-Stage Least Squares
Date: 04/22/03 Time: 22:54
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3915.188	15525.62	0.252176	0.8081
USRNT	-49.77390	166.6422	-0.298687	0.7739
DJIA	0.429912	0.650812	0.660578	0.5300
INFEX	58.68052	303.1901	0.193544	0.8520
ASPL	0.030731	0.064098	0.479440	0.6462
MORT	34.15581	637.2416	0.053599	0.9588
HFS	-0.115881	1.271171	-0.091161	0.9299
HTSSL	0.151981	0.292962	0.518774	0.6199
HTSSLL	0.073373	0.122639	0.598281	0.5685
CC	-1.992549	25.39491	-0.078463	0.9397
HSSSL	-0.531131	0.874713	-0.607206	0.5629
INT	-184.1433	290.4437	-0.634007	0.5462
RESID(-1)	-0.458416	0.451368	-1.015616	0.3436
RESID(-2)	-0.973660	0.454150	-2.143917	0.0692

R-squared	0.402189	Mean dependent var	3.08E-11
Adjusted R-squared	-0.708031	S.D. dependent var	644.4331
S.E. of regression	842.2202	Akaike info criterion	16.54468
Sum squared resid	4965344.	Schwarz criterion	17.24103
Log likelihood	-159.7192	F-statistic	0.362261
Durbin-Watson stat	2.438649	Prob(F-statistic)	0.945825

3. US Average Sales Price

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.787168	Probability	0.236025
Obs*R-squared	7.098418	Probability	0.028747

Test Equation:
Dependent Variable: RESID
Method: Two-Stage Least Squares
Date: 04/22/03 Time: 23:10
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-19341.50	52139.80	-0.370955	0.7216
USRNT	120.7539	591.4963	0.204150	0.8440
CC	-35.64136	83.70304	-0.425807	0.6830
HSSSL	2.032631	2.941353	0.691053	0.5118
INT	-462.0512	924.2826	-0.499903	0.6325
DJIA	1.100246	2.002531	0.549428	0.5998
INFEX	344.7036	987.7592	0.348975	0.7374
ASPL	-0.038503	0.240720	-0.159949	0.8774
MORT	931.9144	2099.268	0.443924	0.6705
HFS	3.773928	4.663223	0.809296	0.4450
HTSSL	-0.758031	0.976567	-0.776220	0.4630
HTSSLL	-0.153490	0.388341	-0.395246	0.7044
RESID(-1)	0.149866	0.410868	0.364754	0.7261
RESID(-2)	-0.731945	0.393481	-1.860179	0.1052

R-squared	0.338020	Mean dependent var	2.17E-12
Adjusted R-squared	-0.891372	S.D. dependent var	1968.710
S.E. of regression	2707.511	Akaike info criterion	18.88017
Sum squared resid	51314303	Schwarz criterion	19.57652
Log likelihood	-184.2418	F-statistic	0.274949
Durbin-Watson stat	2.108343	Prob(F-statistic)	0.978603

4. New York Housing Sales

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.801663	Probability	0.491409
Obs*R-squared	4.217414	Probability	0.121395

Test Equation:
Dependent Variable: RESID
Method: Two-Stage Least Squares
Date: 04/18/03 Time: 06:46
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NYCC	-0.746002	2.629886	-0.283663	0.7862
GNP	0.009114	0.404396	0.022537	0.9828
INFL	13.63362	27.95529	0.487694	0.6431
NYHSTL	0.563951	1.280842	0.440297	0.6751
HFS	-0.085854	0.120291	-0.713724	0.5022
MORT	14.97759	52.06613	0.287665	0.7833
NYPI	0.060959	0.118926	0.512585	0.6266
NYCRENT	-6.979909	24.22095	-0.288177	0.7829
NYHST	1.210709	1.676549	0.722144	0.4974
NYASP	-0.000213	0.000512	-0.415283	0.6924
NYASPL	-0.000369	0.000769	-0.479645	0.6485
INFEX	1.165809	44.63677	0.026118	0.9800
RESID(-1)	-0.725900	0.665478	-1.090795	0.3172
RESID(-2)	-0.614653	0.762872	-0.805710	0.4512

R-squared	0.210871	Mean dependent var	-0.043285
Adjusted R-squared	-1.498909	S.D. dependent var	41.58817
S.E. of regression	65.74233	Akaike info criterion	11.40539
Sum squared resid	25932.33	Schwarz criterion	12.10240

5. New York Housing Starts

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	4.840207	Probability	0.047876
Obs*R-squared	11.60677	Probability	0.003017

Test Equation:
Dependent Variable: RESID
Method: Two-Stage Least Squares
Date: 04/18/03 Time: 06:50
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NYCC	-0.135523	0.107155	-1.264729	0.2464
GNP	0.026457	0.024317	1.088028	0.3126
INFL	-3.638892	2.273564	-1.600523	0.1535
NYHSTL	-0.032776	0.104520	-0.313588	0.7630
HFS	0.013396	0.008533	1.569975	0.1604
NYASPL	-2.62E-05	7.93E-05	-0.330679	0.7506
INFEX	3.997567	3.943541	1.013700	0.3445
NYHSS	-0.033491	0.019439	-1.722840	0.1286
NYASP	7.33E-05	5.00E-05	1.467386	0.1857
MORT	-6.376334	3.965386	-1.607998	0.1519
NYCRENT	-0.657161	0.617801	-1.063710	0.3228
RESID(-1)	-1.306786	0.420374	-3.108631	0.0171
RESID(-2)	-0.502186	0.354746	-1.415622	0.1998

R-squared	0.580338	Mean dependent var	0.026556
Adjusted R-squared	-0.139081	S.D. dependent var	6.352566
S.E. of regression	6.779951	Akaike info criterion	6.915995
Sum squared resid	321.7742	Schwarz criterion	7.563221
Log likelihood	-56.15995	Durbin-Watson stat	2.647275

6. New York Average Sales Price

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.237409	Probability	0.162644
Obs*R-squared	6.641744	Probability	0.036121

Test Equation:

Dependent Variable: RESID

Method: Two-Stage Least Squares

Date: 04/18/03 Time: 06:52

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NYHST	814.1724	1191.355	0.683400	0.5116
NYASPL	0.680455	0.606905	1.121189	0.2912
INFEX	-23706.12	26379.06	-0.898672	0.3922
NYHSS	-179.8110	197.7244	-0.909402	0.3868
INFL	2001.167	11517.06	0.173757	0.8659
MORT	3472.157	18155.52	0.191245	0.8526
NYPI	-18.64935	34.02016	-0.548185	0.5969
NYCRENT	1816.458	3223.436	0.563516	0.5868
GNP	16.71930	93.32711	0.179147	0.8618
RESID(-1)	-1.010962	0.608008	-1.662743	0.1307
RESID(-2)	-0.625255	0.447315	-1.397794	0.1957

R-squared	0.332087	Mean dependent var	-22.82243
Adjusted R-squared	-0.410038	S.D. dependent var	36455.15
S.E. of regression	43288.67	Akaike info criterion	24.49066
Sum squared resid	1.69E+10	Schwarz criterion	25.03831
Log likelihood	-233.9066	Durbin-Watson stat	1.627067