I. Introduction

> "The true New Yorker secretly believes that people living anywhere else have to be, in some sense, kidding."[1]
>
> - John Updike

The American novelist, poet and literary critic makes a good point. New York City has a unique standing in world history as a cultural, financial, and social capital. It has maintained its rank as the most populous city in the United States for over a century.[2] Throughout the first half of the twentieth century, Manhattan emerged as the international center for industry, big business, and commerce. The city continued to increase in size and affluence despite the onset of the Great Depression across the rest of America in the 1930s. It was not until after World War II did the city begin to decline. Industry suffered, racial tension increased, and crime ran rampant as the Manhattan dealt with the usual problems of big cities.

New York which had seen unequaled growth and popularity for the last fifty years was on a downward trend. However, by the 1980s, the city had reason for optimism. Wall Street saw a major rebirth, consequently enabling New York to reclaim its dominant position as the world's financial capital. Growth halted again as recession hit in the early 1990s. Yet by 1994, New York again saw unprecedented economic growth with the success of financial markets propelled by the dot com technology stock market boom. Crime rates also saw a dramatic decrease during this time. Undeniably, the latter half of the 1990s was hailed by many to be New York's

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[1] John Updike in, "Live anywhere else? You must be kidding." The London Independent. April 16, 2007
[2] U.S. Census 2000, New York City Population – 8,008,287

comeback to its once glorious stature among the world's most influential and prosperous cities.[3]

This paper studies the impact of the volatile period between the late 1980s and the early 2000s on residential real estate in the New York City borough Manhattan. We examine how residential amenities unique to the region such as its subway system, Central Park, and Wall Street are capitalized into residential real estate prices. Drawing upon Sherwin Rosen's theoretical research on the hedonic price function, we examine the pricing dynamics of residential amenities by estimating repeat cross-sectional hedonic regressions during the period from 1986 to 2002. We initially apply a pooled hedonic regression to two time periods: 1986 to 1990 and 1998 to 2002. These two periods are ideal because they avoid any significant cyclical downturn. We discover four results of note that occurred between these two periods. First, the implicit price of the number of rooms per apartment decreased by nearly 50% from the earlier to the later period. Second, the price of proximity to public transportation such as subway stations has increased by more than two times. Third, the price of living on Central Park has surprisingly remained unchanged. In fact, the implicit price of Central Park is nearly the same in both the earlier and later periods. Fourth and finally, the volatile period between 1986 and 2002 did not affect all neighborhoods and regions within Manhattan homogenously. While some regions languished or even declined, some neighborhoods such as the West Village, Upper East Side, and Chelsea exhibited prices that more than doubled during the time span.

These changes in the prices of amenities beg us to ask the question: what are the primary drivers of residential real estate prices and amenities in Manhattan? The

[3] Marks, John et al. "New York New York." US News and World Report. Sept. 29, 1997: 44.

prices we observe in our data are fundamentally a function of the interaction between the supply and demand for housing in Manhattan. Hence, we first look at the change in housing stock in the borough during the period of interest. A better understanding of the housing supply in Manhattan gives more confidence to our opinion that the changes in real estate prices from 1986 to 2002 were primarily demand induced. The demand determinants that we study can be split into two categories: income changes and "street level" changes. America's financial markets experienced much volatility during this period. The late 1980s experienced high rates of growth, the early 1990s saw zero or low rates of growth, and the late 1990s was characterized by an internet high-tech stock market bubble. Despite cyclical volatility, overall real income rose significantly during this period as a result of the stock market and a booming economy towards the latter part of the decade. We test the hypothesis that fluctuations in wealth were the primary drivers of real estate prices and their respective amenities. Next, we postulate that the prices of these amenities were possibly driven through the avenue of "street level" changes. We define these changes as a combination of several factors at the level of the street such as citywide improvements, public infrastructure investment and declining crime. These are possible channels which made Manhattan a significantly more attractive place to live. On the other hand, increasing traffic congestion and air and noise pollution are possible disamenities which may have led to lower prices. Crime rates were the only variable for which we were able to obtain yearly region specific data. Thus, we test the hypothesis that declining crime was a significant factor in the changes of residential real estate prices and amenities during this time period. Finally, we consider the qualitative role of changing demographics and public infrastructure improvements as additional explanations for changes observed in hedonic prices.

After a brief literature review of relevant papers accompanied by a summary of the theoretical foundations and limitations of Rosen's hedonic framework, we summarize the steps in creating our data set. We then give a brief overview of Manhattan's supply of housing during the period of interest. Next, we detail the regressions and describe preliminary findings. We first show basic regressions which look at the values of each of these amenities in each time period. Second, we devote a significant portion in attempting to explain the pricing dynamics with changes in wealth. This is followed by two additional sections where we examine the possibility that other neighborhood level changes such as declining crime and changing demographics also contributed to the pricing dynamics. We end with potential biases, concluding remarks, and implications for future research. Please note that all figures and tables not show within the text can be found in Appendix A and Appendix B.

II. Literature Review

The literature surrounding the hedonic model is broad. It is often applied to labor economics to study wage determination. Researchers have also used the model to improve the accuracy of quality of life and housing indices. The following is a brief summary of the literature that focuses on the economic valuation of public, environmental, and locational amenities. Since many public goods do not explicitly trade on open markets, the hedonic method has become the standard to study the benefits provided by these goods. The implicit prices recovered by the hedonic method can offer insight into how individuals value amenities such as open space, clean air, convenience, and public transportation. Furthermore, because the approach is rooted in basic economic principles and empirical data, the approach represents a revealed preference alternative to easily biased survey-based contingent valuation techniques.

The primary premise of many hedonic studies is well summarized by Paul Cheshire and Stephen Sheppard in their paper, “On the Price of Land and the Value of Amenities.” They write, “a house represents not only a bundle of structural characteristics but also a set of location specific characteristics…” (Cheshire and Sheppard 1995). They draw on Wilkinson (1973), who made the fundamental distinction between dwelling-specific and location-specific attributes. Researchers have taken advantage of this distinction by analyzing many types of location specific attributes including environmental characteristics and risks. Smith and Huang (1995) examine the value of clean air. Using a hedonic model applied to property prices, they attempt to estimate the marginal willingness to pay for reducing particulate matter. Irwin (2002) studies the effect of permanently preserved open space on property values using a hedonic pricing model based on residential sales in Central Maryland. Results show that properties near open space exhibit significant premiums. The authors show that the open space is most valued for providing an absence of new residential development rather than for providing a bundle of open space amenities. With regards to environmental risk, Brookshire et al. (1985) estimates the effects of living in high-risk earthquake zones on real estate properties. They hypothesize that people pay less for houses located in relatively hazardous areas; in other words, homebuyers “self insure” against earthquake risk by purchasing homes in areas where the expected damage from earthquakes is relatively low. Their results indicate that living outside a less earthquake prone area can increase the home value by about the equivalent of half the impact of a swimming pool. Other hedonic studies have looked at the effect of noise (McMillan et al. 1980), water pollution (Leggett and Bockstael 2000), climate (Cragg and Kahn 1999), and proximity to hazardous waste sites (Nelson 1981) on housing prices. Refer to Boyle and Kiel (2001) for a full review and survey of real estate hedonic studies applied to environmental externalities.

Several papers have also studied how specific neighborhood characteristics are capitalized into real estate values. These characteristics range from historical district designation to quality of public school education to central business district proximity. Both Asabere and Huffman (1991) and Leichenko and Coulson (2001) measure the effect of historic districting on housing prices. Both discover that the net effect is significantly positive in Philadelphia, PA and Abilene, Texas, respectively. Asabere and Huffman (1991) find that residential parcels within historic districts can attract huge price premiums in some cases as high as 131%. Benson et al. (1998) specifically looks at the value of a view. The author accounts for different types and qualities of views in Bellingham, Washington. By employing a detailed classification scheme, they find that the premium of a view can range substantially depending on quality from just 8.2% to 58.9% for an unobstructed view of the ocean. Brasington (1999) explores which measures of public school quality are most capitalized into housing prices in New Orleans, LA. He finds that test scores, expenditure per pupil, and student/teacher ratio are consistently capitalized in property prices whereas graduation rate, teacher experience and education levels are much less so. The effect of architectural and visual quality has also been examined. Vandell and Lane (1989) begin preliminary analysis on the effect of design and architecture on office rents in Boston, Massachusetts. Their results confirm the hypothesis that well designed buildings require rent premiums. Similarly, Shilton and Zaccaria (1994) also study office buildings except their hedonic model looks at the effect of the presence of neighborhood landmarks, select "prestigious" addresses and building size in Manhattan. They look at midtown office buildings sales transactions between 1980 and 1990 and discover that proximities to landmarks such as Grand Central Station and Bryant Park substantially influence price. However, the avenue effect has a limited influence on the value of office buildings in Manhattan. Some researchers have also studied the economic benefits of urban cultural amenities. Clark and Kahn (1988) employ a two-stage hedonic wage model to derive the benefits of five cultural amenities including theaters, museums, zoos, and symphony halls. The results of their study demonstrate that many cultural amenities are important in the *intercity* choice of location.

Advances in computer and mapping technology have now made it easier to include proximity measures in hedonic models. Proximity to urban amenities is a significant component of neighborhood attributes. Geographical Information Systems (GIS), a software program that enables researchers to easily calculate distances between addresses and physical landmarks such as water, parks, and specific buildings has made the process more efficient by automating all distance calculations. Carroll et al. (1996) uses GIS to study the effect of proximity to churches on residential values in Henderson, Nevada. They find that churches of many different denominations all have positive effects on property values. Adair et al. (2000) use GIS to examine housing prices and accessibility in the Belfast, Ireland. Using transaction data from a sample of over 2000 residential properties sold during 1996, they implement GIS to measure properties' distance to workplace, shopping centers, and educational establishments. Their results are mixed; the variance in house prices across all Belfast that can be explained by accessibility is low, less than 2%. However in regions of lower income, this effect is magnified, implying that transport accessibility is more important for households whose income constrains car ownership/use and residential location choice. Paterson and Boyle (2002) use GIS to create a set of visibility indicators. They discover that the effect of living near a recreational amenity such as a lake is significantly greater if the amenity is in visible range. They also study disamenities such as new development which may lower property values. By creating visual indicators which determine if the disamenity is physically visible from the property, they find that these disamenities only detract from price if they are directly observable. Hence, GIS computer software has enabled researchers to study a plethora of new types of amenities that would otherwise have been too arduous to measure.

Li and Brown (1980) conduct a comprehensive study of neighborhood characteristics including visual quality, noise pollution, proximity to industries and commercial establishments, using detailed data to estimate the influence of these micro-neighborhood factors on housing prices. They include variables such as distance to oceans, rivers, recreation areas, quality of school system. Their empirical results show that all included proximity measures were statistically significant. Furthermore they find that income is positive and significant in the absence of these micro-neighborhood characteristics, but when these characteristics are included, income becomes insignificant. This leads to the conclusion that local income and other socioeconomic measurements often act as proxies for many of the micro-neighborhood characteristics. Their work is furthered by Cheshire and Sheppard (1995). They also include several locational amenities in their hedonic regression. They expand a standard hedonic model by adding layer after layer of location and neighborhood specific characteristics. Their results demonstrate the importance of location specific amenities, thus discovering that the market price of land not only reflects the price of land as a space with a particular level of accessibility to certain amenities, but also reflects the net value of neighborhood characteristics, local public goods, and all other non-structural characteristics of the property.

Because real estate property location is inherently a spatial choice, some studies have also looked at how the estimated hedonic prices can vary spatially by neighborhood. Traditional hedonic papers treat determinants of housing in fixed coefficient specifications. Such an assumption implies that these marginal prices of property characteristics carry the same weight across all neighborhoods in a particular sample. However, as mentioned earlier in Adair et al. (2000), the authors find that the effect of accessibility on housing price varies by sub-market. Can (1990) also refutes this assumption and attempts to account for “spatial dynamics operating in local urban housing markets.” By allowing for the quantification of neighborhood effects, they conclude that the contribution of various housing attributes varies spatially by neighborhood.

While Can (1990) tackles the inter-neighborhood spatial variations in coefficients for property characteristics, Edmonds (1985) analyzes the inter-temporal variances of hedonic price functions. The authors study price, site, and location characteristics of residential lots in Tokyo, Japan. The regressions they run on sales between 1970 and 1975 provide evidence of inter-temporal structural changes in the hedonic price function. In a more recent paper, Costa and Kahn (2003) examine the rising nature of implicit prices for non-market public goods. They claim that rising income has made normal goods such as safety, health, climate, and the environment more valuable, hence increasing demand for such amenities. More specifically, they examine the value of living in a temperate climate; supplies of this natural phenomenon are static and cannot change over time. They look at data from 1970, 1980, 1990, and 1999 with a vector for housing characteristics and vector for climate controls. Across all years, they discover that the price of owning a home in regions with warm January and cool July temperatures has increased significantly. In other words, the cost of purchasing homes in temperate climates is rising over time and they speculate that other non-market goods have experienced a similar appreciation.

Few papers have studied the Manhattan residential real estate market. Two relevant articles stand out. First, Glaeser et al. (2005) attempts to explain the underlying determinants of the significant real estate appreciation New York City experienced in the last decade of the 20th century. They argue that the primary reason for the rising prices is limited supply, constrained by artificial barriers to entry.

Increasing regulations and a restrictive building environment has curbed new housing construction, leading to only a ten percent growth in housing stock during the last two decades. They observe a significant gap between the marginal price of condominiums and the marginal cost of construction of new condominiums, hence creating a huge arbitrage opportunity for developers. Impossible in a truly free market, this gap which they attribute to an inhibitive regulatory environment is a primary driver of the run up in prices. Second, a paper by Schwartz et al. (2003) also tackles the mystery of Manhattan's residential real estate market. In particular they study the period between 1988 and 1998 and attempt to decompose the trends in the property values into three components: declining crime, investment in subsidized low-income housing, and the quality of public schools. Employing both hedonic and repeat-sales price models, they discover that falling crime violent crime rates have raised property prices by 8 percent over the entire time period and contributed to over a third of appreciation experienced during the post-1994 real estate boom.

Both Glaeser et al. (2005) and Schwartz et al. (2003) examine some of the underlying causes of Manhattan's real estate appreciation during the 1980s and 1990s. They each arrive at two different conclusions: strict policies regulating supply and declining crime. This paper adds to the literature by studying the impact of rising income and how it has subsequently affected prices of urban amenities in Manhattan over the last two decades. Building on the work of Schwartz et al (2003), we also look at how declining crime may have affected prices of urban amenities.

III. Theory and Limitations

Critical to Rosen's hedonic framework first published in 1974, is an understanding of the difference between explicit and implicit markets. For example, we can consider the automobile market as an explicit market with observed prices and transactions. However, although they are traded on a single market, cars are very heterogeneous goods. They are characterized by a range of prices corresponding to quality and attributes. Hence, we should look at the automobile not as a single entity, but rather as a bundle of characteristics. This idea was first proposed by Kelvin Lancaster (1966) who believed that our utility is generated not by the goods themselves, but rather the *characteristics* of those goods. When deciding which car to buy, we consider each of these different characteristics such as airbags, leather seating, navigation system, and horsepower. We then decide which attributes we value most and purchase the car whose "bundle" of attributes yields the highest utility. The notion of implicit markets hence is the production and consumption of those features of the car, making up the "bundle" which is explicitly traded in the market place. The hedonic approach provides a methodology for econometrically estimating and identifying the schedule of the prices for these implicit attributes. By examining the explicit market for the price of these bundles of characteristics, the hedonic method estimates the prices of the individual attributes that compose the parts of the "bundle."

In the estimation of the hedonic price function applied to real estate, consumers are assumed to derive and maximize utility from the consumption of a house that embodies a vector Z of N characteristics, plus the consumption of a composite commodity representing all other goods, X. The model assumes that every household has heterogeneous preferences and thus put different valuations on the different characteristics in the house. The preferences of the household can thus be represented by the utility function

$$U = u(Z, X, \alpha)$$

where α is a vector of demographic characteristics that describe the household. Assuming that the household faces a price function P(Z) for the house with characteristics Z and fixed income I, we can then assume a budget constraint

$$I = X + P(Z)$$

According to this budget constraint, the household will maximize utility by choosing a house with characteristics Z and an amount of X additional goods. Put another way:

$$\max u(Z, Y, \alpha) \text{ subject to } I \geq P(Z) + X$$

The derivative of P with respect to each of the characteristics in Z gives us the hedonic implicit price where the function P(Z) is the hedonic price function. On the supply side, each producer equates the marginal cost of each characteristic to its hedonic price. Producers will build houses until the marginal cost of building another house of type Z is equal to the value of the house P(Z). Sellers of existing housing stock are just a special type of producer whose cost function is determined by the costs of house repair and remodeling. When prices equalize demand and supply of every home Z, the market is in equilibrium.

The estimation of the hedonic price function marks the completion of the first step of Rosen's framework. The hedonic price function can then be used as an input in the analysis of the consumer demand for specific attributes of the house. The second stage of the Rosen's framework uses the prices obtained in the hedonic price function to estimate a complete demand curve. Few studies have successfully estimated the structure of this demand and most have encountered difficulties arising from endogeneity and the non-linearity of the household budget function. Without household demographic and income data, however, the second stage of Rosen's framework is beyond the scope of this paper.

Limitations

As with many other economic models, the first stage hedonic price function comes with its own set of assumptions and limitations. We borrow heavily from A. Myrick Freeman's book, The Measurement of Environmental and Resource Values. First, we must assume that homebuyers maximize their utility and have perfect information. They are free to buy any house within the stated market, free of any moving and transaction costs. Hence, the prices should adjust instantaneously to changes in demand and supply. The coefficients estimated in the hedonic price function are also only those observed in equilibrium. The marginal implicit prices are the prices that just clear the market for a given housing stock. This equilibrium between supply and demand is a daring assumption. It implies that buyers and sellers are fully aware of the true willingness to pay and willingness to accept prices of amenities. However, sellers often will only accept prices above a certain threshold and furthermore, they are forced to evaluate each bid immediately hence preempting them from knowing if higher or lower bids will come along in the future. Another concern often associated with hedonic studies is how forward looking are individuals. If an environmental good is predicted to improve such as air quality or the introduction of a new subway station, it could be the case that expectations of the improvement will ensure that the market adjusts quickly to these new expectations. Omitted variable bias always poses a problem for hedonic studies since the objective of hedonic studies is to determine the hedonic price of a certain amenity holding all other attribute constant. However, hedonic studies applied to real estate are especially prone to omitted variable bias since prices are often affected by possibly several unobservable variables.

Finally, hedonic price functions applied to housing markets are especially vulnerable to the problem of spatial autocorrelation. The problem is similar to serial correlation in time series regressions. Because our cross sectional data is distributed across space, however, the autocorrelation of the error term could be in any direction. For example, condominiums in similar regions will exhibit prices that move together possibly due to common or correlated unobservable variables. Furthermore, many of the condominiums in the same neighborhoods share similar locational amenities such as similar proximities to subway stations. Hence, the prices of condominium in

Manhattan will inevitably depend on surrounding condominium prices. The result of this spatial dependency implies spatial autocorrelation in the residuals, thus breaking the ordinary least squares assumption that all observations are independent and identically distributed. Consequently, these violations of the ordinary least squares model imply that parameter estimates may be inefficient with inaccurate confidence intervals. In the case of positive spatial autocorrelation, significance tests will look overly optimistic due to the underestimated standard errors of the coefficients. Basu and Thibodeau (1998) account for the role of spatial autocorrelation in their analysis of single-family home transactions in Dallas, Texas. They find evidence of spatial autocorrelation in all eight of the submarkets they analyze. They conclude that using statistical methods to account for spatial dependency significantly improves the accuracy of the hedonic price function. The most robust way to account for spatial autocorrelation would be to create a spatial weights matrix model for the error term. However, developing such a matrix is beyond the scope of this paper. For the purposes of this paper, we will use clustered errors to account for within group correlation in the standard errors. Clustering by neighborhood effectively allows the error terms to correlate within neighborhoods and adjusts standard errors to account for this spatial dependency.

IV. Data and Variables

Property Sales Data

The condominium sales data set is from the First American Realty Corporation. The data includes every condominium deed on file from the New York

Recorders office in 2002. The dataset includes property characteristics such as total room count, floor number, total square footage, and number of stories in building. We limit the total transactions to those between 1986 and 2002 because few condominium transactions occur before this date. The total number of sales during this period with address and year attributed is 16,764. We exclude condominium transactions over $100,000,000 and less than $10,000. We also exclude condominium transactions with a total room count over 100. The number of transactions varies significantly by year, ranging from only 33 transactions in 1993 to over 2000 transactions in year 1999 (Table 1). Figure 1 shows the year dummies associated with these transactions (prices adjusted to 2002 dollars). The condominium market saw a steep decline from 1989 to 1995 and an unprecedented real estate boom from 1995 to 2002. Figure 2 shows the New York City Department of Finance's Manhattan residential real estate price index which includes sales of apartment buildings, condominium apartments, and single family homes. The sample used for this study seems to accurately represent the overall temporal pattern of the Manhattan residential real estate market.

Figure 1

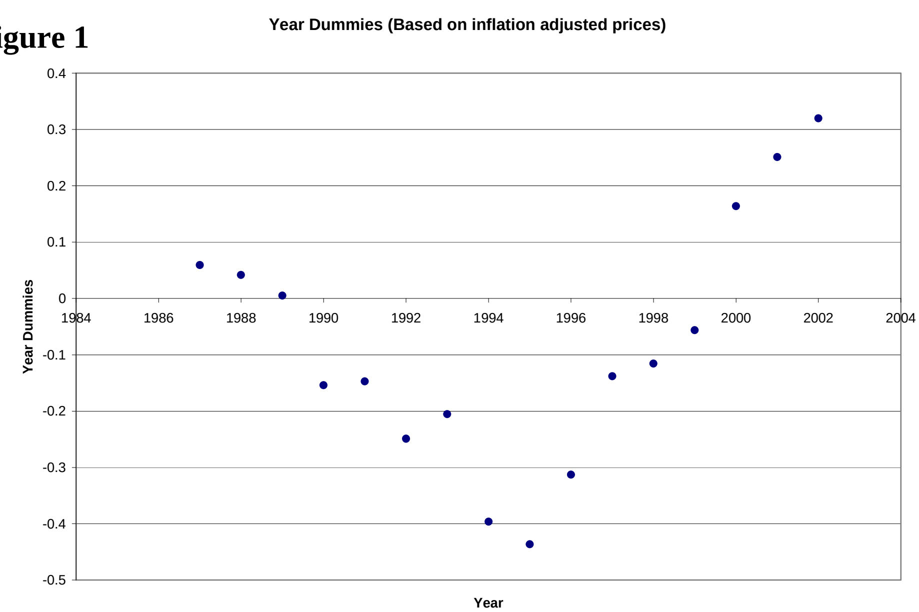


Figure 2

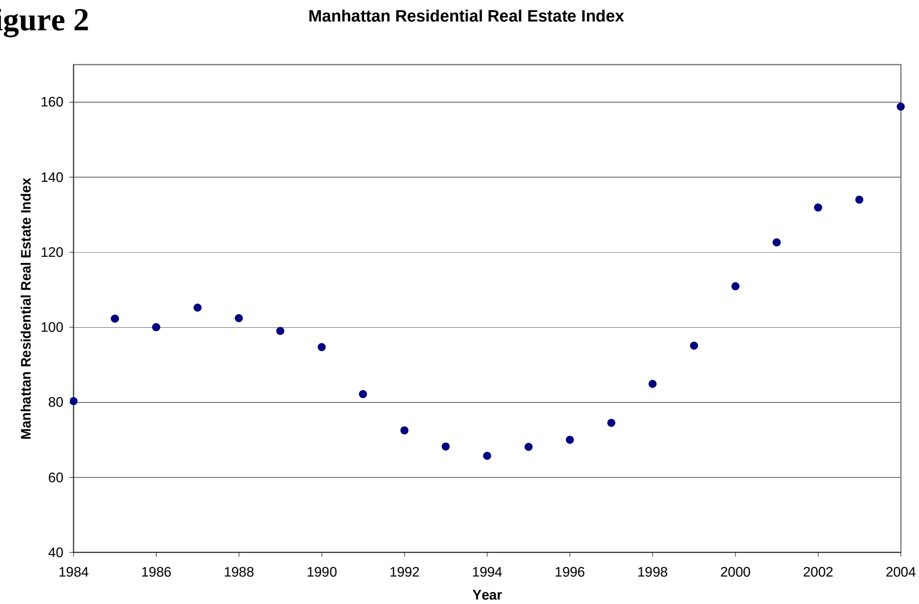
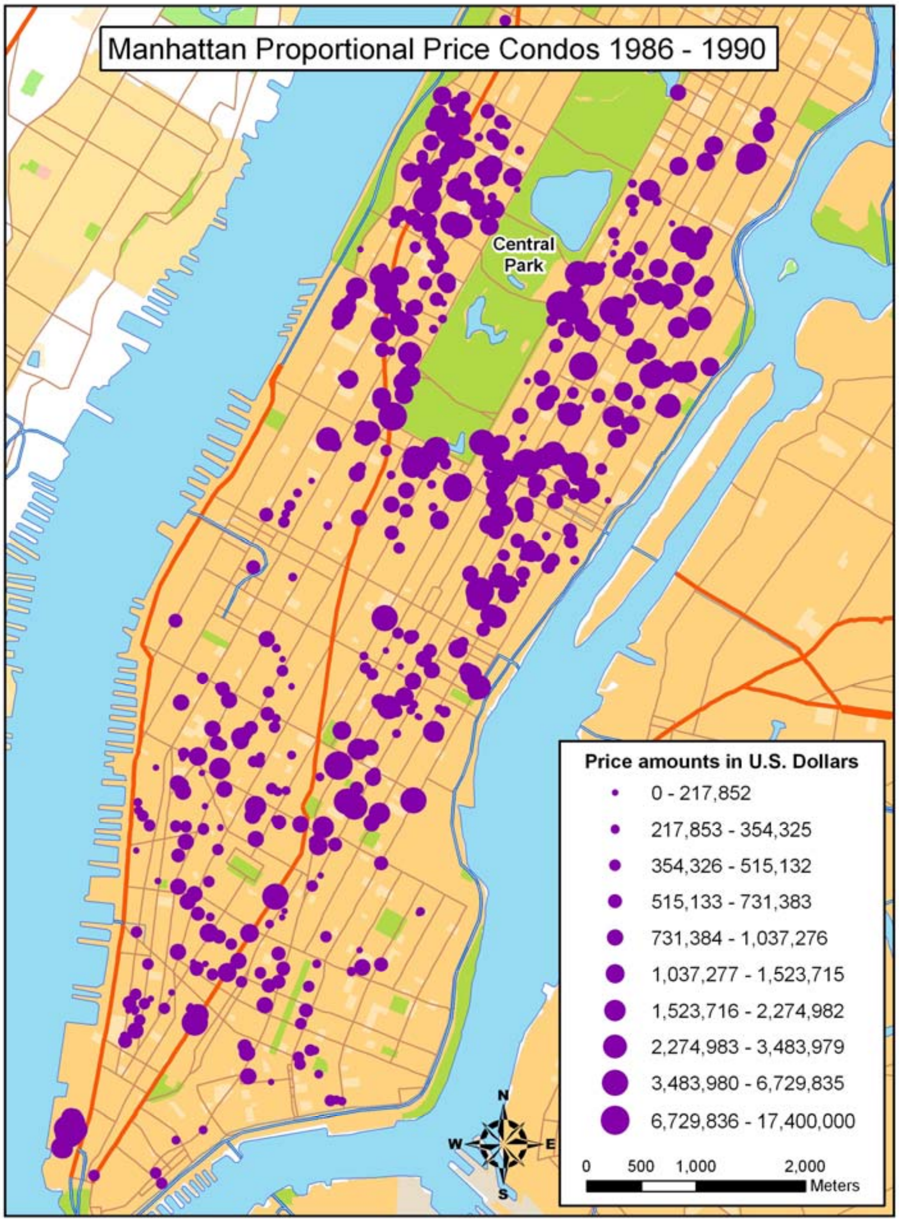


Table 2 details a few key summary statistics describing the structural characteristics of the sample. The median number of rooms across all observations is 3 rooms with 75% of all observations having four or less rooms. The median floor number is 11 with 75% of all observations below or at the twentieth floor. With regards to square footage, only 80% of the data has this variable with a median of 798 square feet and a 75th percentile of 1,127 square feet. The median inflation adjusted condominium sales price is approximately $480,000 and the highest value transaction during this period was just over ten million dollars. Table 3 shows the number of condominiums by neighborhood and average price in each neighborhood. Neighborhoods which dominate by volume are typical residential areas such as the Upper East Side, Upper West Side, East Midtown, Lincoln Square, and Murray Hill. As expected, the prestigious Upper East Side is by far the most expensive neighborhood with an average real price of $786,843, well above the Manhattan wide median of $345,000 and mean of $481,000. It is also not surprising that some of the city's historically poorest neighborhoods such as East Harlem, the Lower East Side, and Hamilton Heights exhibit the lowest average prices. For a visual representation of these sales, please refer to Appendix C.1 – C.4. These maps which disaggregate the data into the year buckets 1986 – 1990, 1991 – 1994, 1995 – 1998, and 1999 – 2002 show the location of every single transaction represented in the dataset. The size of the circle corresponds to the size of the transaction. Below is a map of the entire sample



Proximity Calculations and Geographical Information Systems

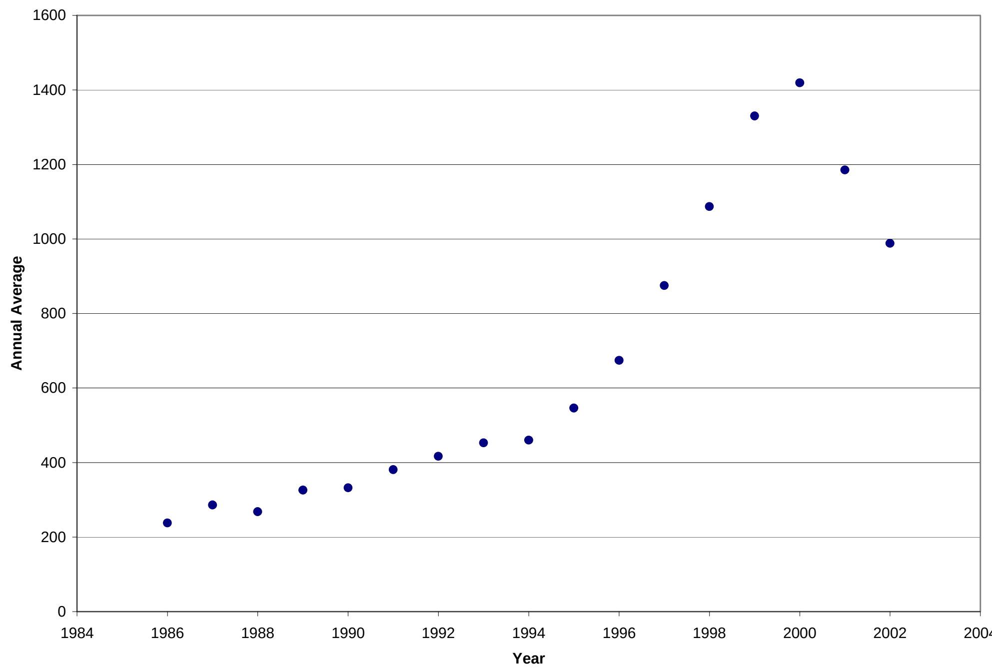
With the assistance of GIS specialist Jeff Blossom, we employed the software ArcGis to geocode each individual condominium transaction address to a digital map interface. After adjusting and accounting for address discrepancies, we were able to successfully geocode a total 17,058 sales with year, room counts, and price attributed during the period of interest. Once geocoded, we began the proximity calculations which included distances to Wall Street, Central Park, Park Avenue, Fifth Avenue, any large water body (ex: Hudson River), and proximity to subway transportation. Our proximity calculations were Cartesian point-to-point measurements rather than network calculations which correspond to the distance required for automobile travel. For the subway proximity calculations, we acquired a subway map in the ArcGis shapefile format from Community Cartography. The variable included in regressions is a more easily interpretable binary variable that indicates if the condominium's address is located within 100 meters of a subway station. We also created binary variables to indicate whether the property was located at an address directly on Central Park. Finally, we mapped every address into a Manhattan neighborhood and police precinct map published by the New York City Planning Department (see Appendix C.5 for a detailed map of neighborhoods and subway stops). Table 3 also shows the average distance to each of the amenities by neighborhood. The neighborhoods Chelsea, Midtown, Union Square, Soho, Tribeca, and the Lower East Side seem to have the greatest accessibility to subway stations. The condominiums with addresses bordering Central Park are heavily represented by the neighborhood Midtown South. The Upper East Side only accounts for 26 transactions and the Upper

West Side (including Lincoln Square) accounts for just over 100 sales bordering Central Park. Finally, 42 condominiums in East Harlem South also border Central Park. Please see Appendix C.5 for a map of the neighborhoods and subway stations.

S&P 500 and Crime Data

The stock market data was obtained through Yahoo Finance. They are annual averages of the S&P 500. As Figure 3 shows, the index grew at moderate growth rates during the late 1980s.

Figure 3: Annual Average of the S&P 500



In the early 1990s, the United States entered a recession and the annual growth rates of the index were nearly zero. Indeed, this recession was particularly deep and severe in the New York Metropolitan region. Yaro and Hiss (1996) write, “From 1989 to 1992, the region lost 770,000 jobs – the largest job loss of any U.S metropolitan region since World War II – eliminating virtually all of the region’s growth during the

1980s…" The region continued to suffer into the years 1993 and 1994 when jobs only grew 1% from the bottom of the recession in 1992. By the latter half of the 1990s, however, the index grew dramatically reflecting the technology and internet boom before slowing down by 2000. In 2001, the sharp dive is a reflection of the burst of the technology bubble further worsened by the terrorist attacks on Manhattan.

Crime statistics were only available in electronic form from 1990 to 2002. While the original source of this data is the NYC Police Department, it was available in electronic form by precinct and year from the NYU Furman Center for Real Estate and Urban Policy's "New York City Housing and Neighborhood Information System." Each condominium was coded a precinct level of crime and then mapped into a neighborhood. Figure 4 shows the stunning drop in the rate of violent crimes experienced in Manhattan from 1990 to 2002. The crime reductions are also consistent across all types of crime and neighborhoods.

\Figure 4: Rate of Violent Crimes by Year (per 10,000 individuals)

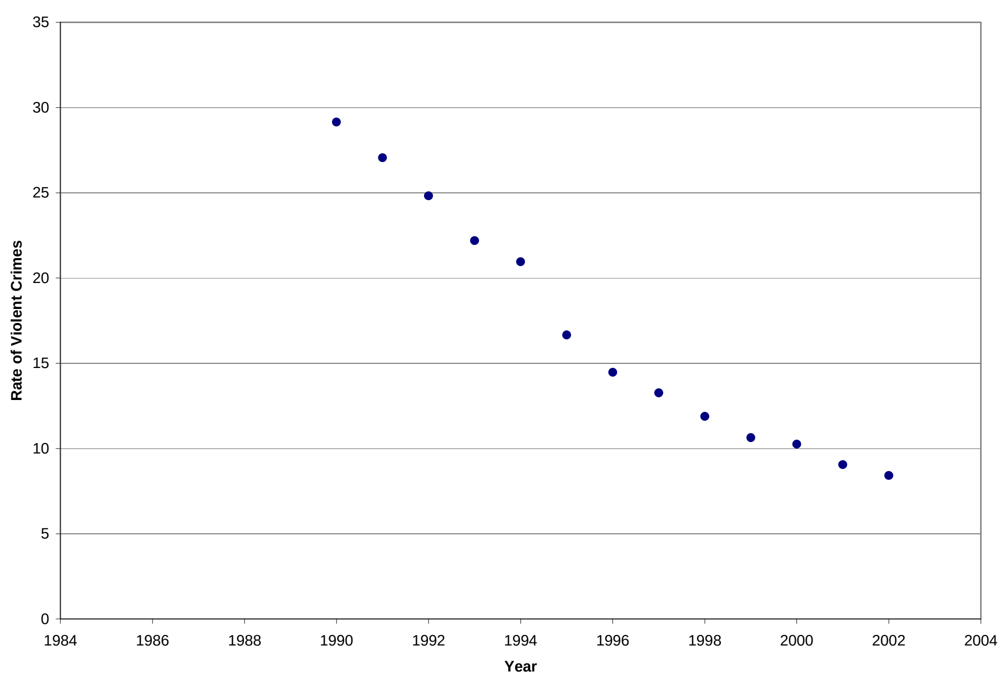


Table 5 shows the average rate of violent crimes across the entire time period by neighborhood. The neighborhoods Clinton and Midtown South in addition to several in upper Manhattan neighborhoods such as Harlem exhibit the highest average rates of violent crime across the entire time period.

V. Housing Inventory in Manhattan

Before delving into the empirical strategy and results of our analysis, we first look more closely at the nature of housing stock in Manhattan to ensure that changes in supply do not confound our analysis. Rising demand can only affect prices if supply is not growing as quickly. The supply of new housing in Manhattan is particularly limited. Glaeser et al. (2005) attribute this fact to a restrictive regulatory environment and high construction costs make new construction expensive. To analyze the supply side we look at two resources: the U.S. Census and the New York City Housing and Vacancy Survey. The U.S. Census in 1990 and 2000 provides some general trends. Overall Manhattan's net housing stock (including new construction and losses) grew by only a paltry 1.6%, an increase of only 13,017 units over the 785,127 units in 1990. The region which includes neighborhoods Chelsea and Clinton saw their respective housing stock increase by only 0.6% during the decade. Both the Upper East Side and Upper West Side actually saw a decline in the overall housing stock, -.05% and -.3.4%, respectively.

The New York City Housing and Vacancy Survey conveys similar information at a yearly level. Table 6 shows the number of newly constructed units by year from 1981 to 1999 in Manhattan only. We see that during late 1980s there was a large construction boom. From 1986 to 1990, Manhattan saw an average of 5,450 newly built housing units per year. By the early 1990s, this number had decreased to 2,579 new units. This sharp decline was most likely a function of decreased demand for housing caused by the recession of the early 1990s. However despite the economic boom during the late 1990s, there was no clear upward trend in construction as in the previous economic boom of the late 1980s. To be sure, it does seem new construction does respond to rising demand especially in 1998, with the construction of more than 5,000 new housing units. Nevertheless, the average number of units constructed per year during this period was nearly identical to that of the period between 1991 and 1995.

At the same time, Manhattan also lost a substantial amount of housing units during this period. Table 7 shows the losses from inventory in pooled years. Overall from 1991 to 1999, Manhattan saw a loss of 27,942 units from its housing inventory, thus negating the entirety of the newly constructed units from 1991 to 1999 (22,807). Both the U.S. Census data and the New York Housing and Vacancy Survey data convincingly demonstrate that supply changes were small and negligible during the period of interest. It is evident that we must look to changes in demand to better explain the observed pricing dynamics.

VI. Regression Models

Now that we have observed that changes in supply are unlikely to be a confounding factor in our analysis, the following section lays out the empirical strategy of this paper. We apply the hedonic price function to help us recover the implicit prices for residential amenities such as Central Park, rooms, lower crime, and proximity to public transportation. Running these models in different time periods will indicate whether these hedonic prices have changed. Then including determinants of demand, namely changing wealth and crime rates, will enable us to tease out the effect of these demand shifters on overall price and the implicit prices of the amenities.

The dependent variable must be some form of condominium price. We adopt the commonly applied logarithmic functional form as follows:

$$\text{Log } Y = \beta_0 + S\beta_1 + N\beta_2 + L\beta_3 + \varepsilon$$

where the β's are the coefficients which correspond to the hedonic prices. S is a vector of structural characteristics, N a vector of neighborhood characteristics and L a vector of locational characteristics. This log-linear form has many attractive features. For example, the coefficients are easily interpretable. The logarithmic transformation implies that the coefficients are essentially percentages. For example, an increase in the number of rooms from 1 to 2 would imply that the condominium price would increase by a percentage β_1*100. The dollar price of any single characteristic would vary with the level of the characteristic as well as with the level of other characteristics of the properties. Hence, it implies that prices are non linear. If we employed a purely linear model, the price of adding an additional room would be the same for both a cramped studio apartment and a 15-bedroom penthouse apartment, an unlikely possibility. We also take the log of certain explanatory variables in some cases, in other words, a log-log specification. In this instance, the interpretation of those coefficients is essentially a price elasticity with respect to a change in the explanatory variable.

Common to all regressions are basic housing characteristics such as rooms, floor, and number of stories in the building. The variable ROOMS is the number of total rooms in the unit. FLOOR controls for any value gained from living on higher floors such as less noise, safety, and most importantly better views. The variable STORIES captures the effect of living in taller buildings. One could imagine that this might be a proxy for other unobserved structural amenities such as attended lobbies, age, and quality of construction.

Basic pooled regressions

We divide the entire time span into two five year periods: an earlier (1986 to 1990) and a later one (1998 to 2002). The pooled early and late period regressions convey to us the changes which may have occurred during this period. All pooled regressions include both year and neighborhood fixed effects. Time fixed effects eliminate any omitted variable bias from unobserved variables that are consistent across entities but evolve over time. For example, they will control for any unobserved bias caused by general trends such as population growth that may affect all real estate prices across all neighborhoods. Neighborhood fixed effects account for any omitted variable bias arising from unobserved characteristics that may vary across neighborhood but stay constant over time. For example, the Upper East Side has seen consistent price premiums for its prestige, history, and exclusivity. The model used for the basic pooled regressions follows directly below:

$$\text{LOG(REALPRICE)} = \beta_0 + \text{ROOMS}\beta_1 + \text{FLOOR}\beta_2 + \text{STORIES}\beta_3 + \text{CENPARKBIN}\beta_4 + \text{SUBBLOCK}\beta_5 + \text{WALLPROX}\beta_6 + \text{Year Dummies} + \text{Neighborhood Dummies} + \varepsilon$$

In addition to comparing the prices of the above amenities between the two periods, we also compare the change in the neighborhood dummies between the two regressions, enabling us to understand which neighborhoods grew in value and which neighborhoods remained stagnant.

Wealth Elasticities

To analyze the effect of increasing wealth on Manhattan residential condominium prices, we include an annual average of the S&P 500 stock market index with the assumption that changes in wealth are well approximated by this measure. By taking the log of the S&P 500, we can interpret the coefficient as the price elasticity with respect to changes in the stock market level. Furthermore, we use a lagged stock market variable because it is likely that it takes time for the real estate market to adjust prices to changing economic conditions. Although the data for this study ends at 2002, we know that residential sales began to turn downwards in 2003. Thus the substantial drop in the S&P 500 in 2001 and 2002 does not seem to reflect in housing prices until 2003. In this way, there is often a disconnect between home sellers and home buyers during the beginning of a possible recession. Home sellers are unwilling to lower their prices and home buyers are unwilling to pay higher prices due to the high amount of uncertainty. Hence, using the previous year's level seems appropriate.

In addition, we are specifically interested in the effect of increasing wealth on the price of a particular amenity. We include an interaction term between the S&P 500 and the amenity of interest to tease out this effect. This additional coefficient would be the effect of the S&P 500 on the condominium price through the channel of that particular amenity. The proposed specification follows directly below:

$$\text{LOG(REALPRICE)} = \beta_0 + \text{Rooms}\beta_1 + \text{Unitsf}\beta_2 + \text{Floor}\beta_3 + \text{Amenity}\beta_4 + \text{LOGSTOCKLAG}\beta_5 + \text{LOGSTOCKLAG*AMENITY}\beta_6 + \text{TREND}\beta_7 + \text{TREND\_AMENITY}\beta_8 + \text{Neighborhood Dummies} + \varepsilon$$

We adjust all condominium sales prices to a base year of 2002. By adjusting prices for inflation, we account for any nonlinear changes in inflation rates. Also included in the regression is a simple linear trend variable to "detrend" the condominium prices. Because the stock market variable only differs by year, it is impossible to include year fixed effects in the same regression. This trend variable will control for linear trends in real estate values experienced during this period aside from general price increases indicated by the CPI. It will allow us to study only the deviations of price from this linear trend. We then control for any amenity trends by including an interaction term between the trend and the amenity of interest. With prices detrended, we can thus interpret the coefficient as the percentage points by which prices will change above trend given a one percentage point change in the stock market level. By detrending we focus on the cyclicality of prices and wealth through the stock market channel.

Crime Elasticities

Studying the effect of changing crime rates proves to be a much more difficult task. Because we use a crime variable that varies across both neighborhood and year, we risk the problem of overcontrolling if we include both year and neighborhood fixed effects. If we were to include both year and neighborhood fixed effects, the only variation that would remain is the differing rates of change of crime across each neighborhood. However, crime almost uniformly declines across the entire borough. In fact we were able to explain 80% of the variation in the crime variable by neighborhood and year fixed effects. We show three specifications for examining the effect of crime on amenity prices. The first includes neighborhood effects but excludes year effects. The second includes year effects but excludes neighborhood effects. Finally, we show a third that includes both time and neighborhood fixed effects. Omitting either the neighborhood or year fixed effects is a cause for concern over possibilities of omitted variable bias. Crime may be a proxy for a host of other neighborhood level characteristics which may also have changed over time. However, the lack of data on other neighborhood level characteristics is inhibiting. We use log rate of violent crimes per 10,000 individuals as our crime variable. Again the dependent variable is log of real condominium price. Furthermore, we interact the crime variable with subway proximity to measure the effect of changes in crime on the hedonic price of subway proximity.

VII. Empirical Results

A. Basic pooled regressions

Table 8 shows the results of the initial pooled regressions. Both regressions account for spatial autocorrelation by clustering standard errors for each neighborhood.

Table 8: Long Term Pooled Regressions

	Year Range	
Variable	1986 - 1990	1998 - 2002
ROOMS	0.27	0.151
	(0.024)**	(0.027)**
FLOOR	0.011	0.017
	(0.002)**	(0.003)**
STORIES	0.01	0.003
	(0.002)**	-0.002
CENPARKBIN	0.469	0.464
	(0.053)**	(0.193)*
SUBBLOCK	0.106	0.277
	-0.177	(0.144)+
WALLPROX (2500<x<4500)	-0.31	0.161
	(0.158)+	(0.036)**
Year Fixed	Yes	Yes
Neighborhood Fixed	Yes	Yes
Clustered Errors	Yes	Yes
Adjusted R^2	0.58	0.47
Number of Obs.	6,124	6,785

*Note: + p<0.10, * p<0.05, ** p<0.01*

The first variable of interest is ROOMS. In the early period regression, the coefficient of 0.27 indicates that implicit price of an additional room was 27%. By the later period regression however, we see that this coefficient on ROOMS has changed. The price impact of ROOMS is nearly halved to only approximately 15%. In other words, we can state the following: the marginal utility gained from an additional room declines more quickly in the later period than in the early period. Additional rooms are less valued in the second period.

The coefficient on CENPARKBIN has remained the same. In both periods, living in an apartment on a street directly bordering Central Park, holding all other attributes equal will increase the condominium price by approximately 50%. While this percentage seems large, it is reasonable to think that homebuyers are willing to pay a substantial premium for condominium on Central Park. There are several possible reasons for paying more to live on Central Park such as recreational access, prestige, and views.[4] Nevertheless, it does seem surprising that the implicit price for this amenity has not substantively changed between the two time periods.

The next variable SUBBLOCK is a binary variable which indicates whether the condominium's address is within 100 meters of a subway station. We choose one hundred meters because it is approximately two street blocks in Manhattan and we assume this distance is a reasonable measure of convenience to public transportation. During the years between 1986 and 1990, the coefficient on SUBBLOCK is .106, implying that living within a 100 meter radius of a station is equal to a ~11% premium. However, the coefficient is statistically insignificant. In the later period regression, the coefficient more than doubles implying a premium of 28% on those

[4] We also ran additional regressions to study the effect of increasing distance from Central Park. We create zones ranging from 100 meters to 500 meters. As expected, each zone exhibited a decreasing coefficient. Living directly on Central Park versus simply near it can affect price significantly. Please refer to Figure # found in the Appendix A.

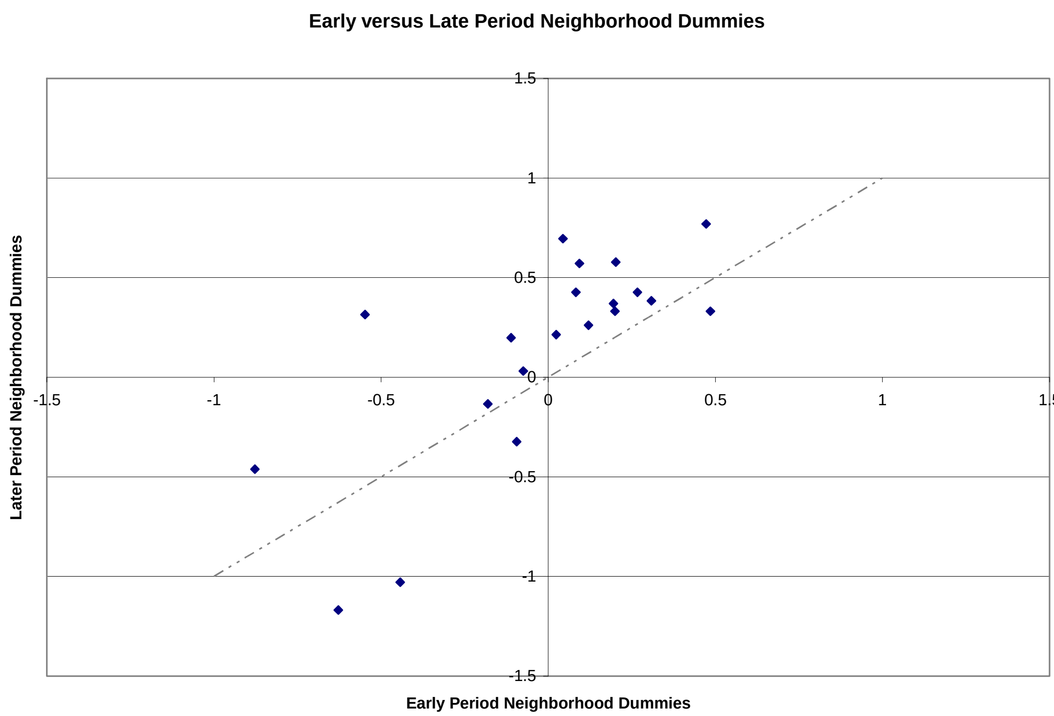
condominiums near subway stations. Moreover, this coefficient is now statistically significant at the 10% level. The difference in magnitude and significance with regards to SUBBLOCK between the two time periods suggests that there has been a considerable change in the homebuyer's perception and valuation of public transportation proximity.[5]

The variable WALLPROX indicates whether the condominium is between 2500 and 4500 meters away from Wall Street. We choose this particular region because it is an area approximately midway between the two primary central business districts in Manhattan: the financial district and midtown. The financial district comprises the southernmost section of the Manhattan borough. The midtown commercial section generally comprises the region between 31st street and 59th street between 3rd and 9th Avenues. Landmarks such as Grand Central Station, Rockefeller Center, and the Empire state building are located throughout the midtown business district. Hence, we believed that the condominiums located in WALLPROX might have appreciated considerably due to their convenient proximity to both business districts. We see a drastic difference between the coefficients on WALLPROX in each period. During the first period, living in this region implied a discount on condominium price. Yet by the later period, this coefficient turns into a significant positive premium. Thus, this reversal from discount to premium indicates that this region has experienced significant appreciation during the period of interest.

[5] The effect of subway proximity was also observed to vary spatially. SUBDIS was interacted with each neighborhood and then plotted by average distance to Wall Street by neighborhood. The coefficients exhibited a negative trend, implying that the further away the neighborhood from the central business district, the more valued was the close proximity to a subway station. Please refer to Figure #

Table 9 shows the neighborhood dummies in each of the time periods. Most neighborhoods have significantly increased in value. Figure 5 (shown below) plots the coefficients for each of these dummies where the X axis represents the coefficients in the earlier period and the Y axis represents the coefficients in the later period. For the most part, the plotted points lie above the 45 degree line, implying that most neighborhoods have appreciated in value. A few neighborhoods stand out. Chinatown is one of the few neighborhood's whose discount actually worsens during the period. The West Village, Chelsea, Upper East Side, and Upper West Side all see major positive increases in their premiums.

Figure 5



The West Village dummy increases from just a 4% premium in the early period to a 70% premium in the later period. Chelsea also demonstrates a similar exponential jump in prices.

To ensure that the differences in the hedonic amenity prices that we observe between these two periods are statistically significant, we interact each of these amenities with the linear trend variable. We can look at the coefficients on the interaction terms on each of these amenities to confirm the general patterns observed from the basic pooled regressions. Table 10 shows the results of this regression.

Table 10: Amenity – Trend Interactions

Variable	
ROOMS	0.263
	(0.007)**
FLOOR	0.014
	(0.001)**
STORIES	0.007
	(0.000)**
CENPARKBIN	0.542
	(0.053)**
SUBBLOCK	0.156
	(0.035)**
WALLPROX	-0.396
	(0.050)**
TREND	0.026
	(0.002)**
TREND_ROOMS	-0.008
	(0.001)**
TREND_CENPARKBIN	-0.006
	-0.005
TREND_SUBBLOCK	0.005
	-0.003
TREND_WALLPROX	0.035
	(0.003)**
Neighborhood Fixed	Yes
Adjusted R^2	0.44
Number of Obs.	15,941

*Note: + p<0.10, * p<0.05, ** p<0.01*

The sign of the coefficients on the interaction terms all act in the way we would expect after seeing the long term pooled regressions. The coefficient on TREND_ROOMS is negative and significant, coinciding with the observation that we see earlier with the decline in the implicit price of ROOMS between the two periods. The interaction term on CENPARKBIN is negative and insignificant, coinciding with the fact that we observe no change in the hedonic price. The interaction term on SUBBLOCK is positive, coinciding with the observation that we see earlier with the increase in the implicit price of subway proximity; however the T-statistic of 1.51 is just below the threshold required for a 10% level of significance. The interaction term on WALLPROX is both positive and significant, coinciding with the observation that the coefficient on WALLPROX reversed from discount to premium between the two time periods. In this way, the trends that we observe in our pooled regressions of Table 8 are for the most part reflected by the magnitude, signs, and statistical significance of our coefficients in the amenity – trend regressions of Table 10.

B. The Role of Increasing Wealth

The results from the above basic pooled regressions thus serve as motivation for further analysis. What were some of the factors behind the price changes of these amenities and neighborhoods? Figure 4 shows the immense growth of the stock market during the late 1990s and early 2000s. This next section will engage each amenity in separate regressions to more closely examine the effect of the stock market on the prices of these amenities. First, Table 11 shows the regression studying the effect of increasing wealth on overall condominium price. The coefficient of the lagged stock market variable implies that for every 1% change in the stock market level of the previous year, prices would have changed by approximately .70% in the same direction above trend.

Table 11: The Effect of Changes in Income on Price

Variable	
ROOMS	0.197
	(0.031)**
FLOOR	0.015
	(0.003)**
STORIES	0.006
	(0.002)**
TREND	-0.082
	(0.011)**
LOGSTOCKLAG	0.702
	(0.081)**
Neighborhood Fixed	Yes
Clustered Errors	Yes
Adjusted R^2	0.43
Number of Obs	15,939

*Note: + p<0.10, * p<0.05, ** p<0.01*

The result of this basic regression demonstrates that residential condominium prices are very sensitive to changes in the previous year's stock market level.

Effect of S&P 500 on ROOMS

Table 9 shows three different specifications. In all three regressions, we include a trend variable. As discussed earlier, the trend variable allows us to control for other unobserved factors which may affect prices over time in a linear fashion.

Table 12: The Effect of Changing Wealth on ROOMS

Variable	I	II	III
ROOMS	0.736	1.242	1.242
	(0.053)**	(0.162)**	-0.748
FLOOR	0.017	0.017	0.017
	(0.001)**	(0.001)**	(0.003)**
STORIES	0.004	0.004	0.004
	(0.001)**	(0.001)**	(0.002)*
LOGSTOCKLAG	0.667	1.001	1.001
	(0.053)**	(0.114)**	(0.483)+
LOGSTOCKLAG_ROOMS	-0.082	-0.184	-0.184
	(0.008)**	(0.032)**	-0.141
TREND	-0.012	-0.063	-0.063
	(0.007)+	(0.017)**	-0.071
TREND_ROOMS	-	0.015	0.015
	-	(0.005)**	-0.021
Neighborhood Fixed	Yes	Yes	Yes
Clustered Errors	No	No	Yes
Adjusted R^2	0.42	0.42	0.42
Number of Obs.	10,523	10,523	10,523

*Notes: + p<0.10, * p<0.05, ** p<0.01*

The variable of interest is LOGSTOCKLAG_ROOMS which represents the interaction between the level of the lagged S&P 500 and the number of rooms. Regression I shows a negative coefficient on the interaction term, implying that the effect of the stock market on condominiums which have greater numbers of rooms is lower than on condominiums with fewer numbers of rooms. While this regression includes a trend variable, it does not allow the trend to affect the amenity of interest, ROOMS. Hence in the middle regression, we allow the trend to vary by number of rooms by including an additional interaction term TREND_ROOMS. The introduction of this interaction between trend and rooms changes the magnitude of the interaction term, yet the sign continues to be negative and statistically significant at the 5% level. The final specification includes an adjustment for the possibility of spatial autocorrelation by using neighborhood clustered errors. The adjustment to neighborhood clustered errors nullifies all statistical significance. Despite this, it is worth noting that the negative coefficient on this interaction term does seem to follow the results from the basic pooled regressions which stated that the hedonic price of rooms had declined over the period of study. The wealth elasticity regressions suggest a similar surprisingly unintuitive result: increases in wealth through stock market growth affect the lower end condominiums with fewer rooms more than the higher end condominiums with more rooms. We might expect the opposite: that the increase in wealth would lead to an increase in the hedonic price for ROOMS since it would reasonably follow that as we become wealthier, we also might want more space.

This counterintuitive result is further supported by Anthon J. Blackburn in his Housing New York City report produced for the Department of Housing Preservation and Development in 1995. He writes "…among single person households, the size of the unit was inversely related to household income, with high income singles being more likely to live in studios and one bedroom units and less likely to live in units with 2+ bedrooms." He goes on to explain that this phenomenon is most likely to be a result that smaller units tend to be in more desirable locations. Testing Blackburn's hypothesis would require a triple interaction variable between wealth, rooms and some measure of location desirability and is thus outside the scope of this paper. However, it does point to potential future research regarding the nature of a New Yorker homebuyer's response to changes in income. When New Yorkers become richer, do they upgrade by buying apartments with more rooms? Or is the old real estate adage "Location, Location, Location!" so important to preference that they would rather pay more for a desirable location rather pay more for additional space.

A possible counterargument is that we do not control for the actual size of the apartment in the regressions since we omitted square footage for lack of data. Thus, we have made the implicit assumption that the number of square feet per room has remained relatively constant over time. It could be argued that the increase in demand for condominiums with fewer rooms might be driven by an increase in the size of each room. With the minimal square footage data we do have in this data set, we completed rough calculations of mean square footage per room by year and find that the room size remains flat, fluctuating around 400 square feet per room from 1986 to 2002. These rough calculations give us relatively more confidence that the greater wealth elasticity for condominiums with fewer rooms is not being driven by an increase in the square footage of the condominium.

We must also note that the statistical significance of our results is called into question with the addition of clustered errors. Given the statistical weakness of this explanation, we hence explore other possible reasons for the decrease in the implicit price of rooms later in this paper.

Effect of S&P 500 on SUBBLOCK

Table 13 shows regressions with reference to the binary variable SUBBLOCK which indicates whether the condominium is located within 100 meters of a subway station. As in the previous amenity, the variable of interest is the interaction between LOGSTOCKLAG and SUBBLOCK.

Table 13: The Effect of Changing Wealth on SUBBLOCK

Variable	I	II	III
ROOMS	0.193	0.193	0.193
	(0.003)**	(0.003)**	(0.030)**
FLOOR	0.014	0.014	0.014
	(0.001)**	(0.001)**	(0.003)**
STORIES	0.006	0.006	0.006
	(0.000)**	(0.000)**	(0.002)**
SUBBLOCK	-0.756	-0.436	-0.436
	(0.172)**	-0.834	-1.309
LOGSTOCKLAG	0.702	0.706	0.706
	(0.037)**	(0.038)**	(0.080)**
LOGSTOCKLAG_SUBBLOCK	0.151	0.09	0.09
	(0.027)**	-0.157	-0.229
TREND	-0.083	-0.084	-0.084
	(0.005)**	(0.005)**	(0.011)**
TREND_SUBBLOCK	-	0.008	0.008
	-	-0.02	-0.033
Neighborhood Fixed Effects	Yes	Yes	Yes
Clustered Errors	No	No	Yes
Adjusted R^2	0.43	0.43	0.43
Number of Obs.	15,939	15,939	15,939

*Notes: + p<0.10, * p<0.05, ** p<0.01*

Regression I shows a coefficient of .151 on the interaction term, implying that the effect of a change in wealth is higher for those condominiums which are located near subway stops. This conclusion seems reasonable if we believe that when people grow wealthier, they are perhaps more willing to pay more to live closer to public transportation, allowing them better accessibility and convenience to the rest of the city. However, when we allow the trend to interact with SUBBLOCK, the magnitude of the coefficient is greatly diminished and the statistical significance has vanished. Hence, although the overall long term trend of the price of proximity to subways has increased as indicated by the pooled regressions, this general increase in the implicit price does not particularly correlate well with fluctuations in the stock market. It is possible that there are other temporal changes that have caused the implicit price to increase. We hypothesize these additional potential explanations later in this paper.

Effect of S&P 500 on WALLPROX

Table 14 shows the results of the regressions focused on WALLPROX. As we observed earlier with the pooled regressions, the implicit price of the variable WALLPROX has increased significantly from the earlier to the later periods. The coefficient changed from a substantial discount to a substantial premium with statistical significance at the 5% level. We now test the hypothesis that the drastic transformation of prices in this region was a function of the rising wealth as proxied by the S&P 500.

Table 14: Effect of Changing Wealth on WALLPROX

Variable	I	II	III
ROOMS	0.193	0.193	0.193
	(0.003)**	(0.003)**	(0.030)**
FLOOR	0.015	0.015	0.015
	(0.001)**	(0.001)**	(0.003)**
STORIES	0.006	0.006	0.006
	(0.000)**	(0.000)**	(0.002)**
WALLPROX	-2.06	-2.495	-2.495
	(0.141)**	(0.678)**	-1.726
LOGSTOCKLAG	0.681	0.674	0.674
	(0.037)**	(0.039)**	(0.079)**
LOGSTOCKLAG_WALLPROX	0.308	0.391	0.391
	(0.021)**	(0.128)**	-0.343
TREND	-0.083	-0.082	-0.082
	(0.005)**	(0.005)**	(0.011)**
TREND_WALLPROX	-	-0.01	-0.01
	-	-0.016	-0.05
Neighborhood Fixed	Yes	Yes	Yes
Clustered Errors	No	No	Yes
Adjusted R^2	0.43	0.43	0.43
Number of Obs.	15,941	15,941	15,941

*Notes: + $p<0.10$, * $p<0.05$, ** $p<0.01$*

The first regression shows that the interaction term between the stock market and the binary WALLPROX is positive and statistically significant. The second regression which allows the trend's effect to vary by this amenity also shows a positive and statistically significant interaction term. These results imply that the impact of the stock market on price is greater for those condominiums which are located within this particular region in Manhattan. With the addition of clustered errors however, statistical significance again vanishes. Nevertheless, the positive and relatively large magnitude of this coefficient does tell us something interesting about this particular region. The condominiums in this area which cover parts of the neighborhoods Gramercy Park, Chelsea, Union Square, West Village, and the East Village saw a much greater appreciation than other regions in Manhattan during the stock market boom. This area demonstrated a high sensitivity to changes in wealth through the S&P 500.

Effect of the S&P 500 on select neighborhoods

The results of our regressions looking at WALLPROX motivate us to ask whether this phenomenon is observed in other regions in Manhattan. We now look at the impact of changing wealth in select neighborhoods of Manhattan. It is well known that Manhattan's residential real estate market is heavily segmented. Each neighborhood differs across such abstract characteristics like prestige, trendiness, culture or such concrete attributes such as crime, retail/restaurant agglomeration and congestion. We observed earlier in the pooled regressions that that the price premiums/discounts associated with each neighborhood have each responded differently to the temporal changes that occurred from 1986 to 2002. We now test the hypothesis that the changes in these premiums might be correlated with changing wealth through the channel of the stock market. Table 15 shows these wealth elasticities with respect to each neighborhood. The first specification shows the elasticities with a common trend in condominium prices forced across all neighborhoods. The second regression on the right shows the elasticities, allowing each neighborhood to have a different linear trend.

Table 15: Effect of Changing Wealth on Neighborhoods

Neighborhood	I	II
BatteryParkCity-LowerManhattan	0.52	0.27
Chinatown	0.45	-0.17
Clinton **	0.68	1.31
East Harlem North	-0.26	0.27
East Harlem South **	0.66	1.73
East Village	1.13	0.81
Gramercy	0.83	-0.33
Hamilton Heights	0.21	0.36
HudsnYds-Chelsea-Flatirn-UnionSq **	0.86	1.58
Lenox Hill - Roosevelt Island **	0.66	0.94
Lincoln Square	0.84	0.56
Lower East Side	0.64	1.28
Marble Hill - Inwood	0.25	-0.38
Midtown - Midtown South	0.59	0.60
Murray Hill - Kips Bay	0.73	0.39
SoHo-Tribeca-CivcCentr-LittleItaly	0.57	0.25
Turtle Bay - East Midtown	0.66	0.54
Upper West Side **	0.81	0.98
UpperEastSide - CarnegieHill **	0.71	0.94
Washington Heights North **	1.04	2.55
West Village	1.01	0.43
Yorkville **	0.64	0.83

*Note: **Indicates statistical significance at the 5% level.*

The neighborhoods which show the greatest wealth elasticities are the neighborhoods Chelsea, Union Square, and Clinton. One surprising result is the West Village's lack of significance and low magnitude. In the basic pooled regressions, the West Village had been one of the neighborhoods which had experienced the most appreciation during the period. Indeed it exhibits one of the highest income elasticities when assuming only a common trend across all of Manhattan. However, once we allow the trend to vary by neighborhood, the income elasticity halves, implying that while the West Village did see significant appreciation from 1986 to 2002, it does not seem to be well correlated with fluctuations in the stock market.

The results of these regressions show that certain neighborhoods were very sensitive to changes in the wealth. Chinatown stands out as one of the neighborhoods that saw a negative elasticity, implying that increases in the stock market and income actually lead to decreasing condominium prices. While the coefficient shows no statistical significance, the magnitude and direction does convey how radically different some neighborhoods in Manhattan can respond to changes in wealth. Indeed, the neighborhoods which comprise WALLPROX, namely Chelsea, Union Square, and the East Village are the regions that saw the highest wealth elasticities. Thus the following question arises: why this particular region over other areas? It should be noted that we do not attempt to offer a definitive answer to this question. The prediction of how neighborhoods change over time is difficult and often arbitrary. Nevertheless, we believe that we can attribute part of this region's sensitivity to changes in wealth to its convenient proximity to the two major business districts in Manhattan. It seems reasonable that living in these neighborhoods allowed individuals to live close enough to work for convenience but far enough away for relief from the potential disamenities which often plague business districts such as congestion, noise, and the stigma attached to lacking a life beyond work. On the other hand, other unobserved characteristics such as trendiness, nightlife, restaurants, and cultural amenities inevitably have also contributed to the results found in Table 15.

C. The Role of Declining Crime

Manhattan experienced many social and cultural transformations during this period. All types of crime including both property and violent crimes declined rapidly from 1990 onwards. We now examine the impact of declining crime on residential condominium prices during the period from 1990 to 2002. Table 16 shows three regressions which attempt to tease out the effect of changes in crime on price. In all three cases, we again use the dependent variable, log real price. Regression I includes year fixed effects but omits neighborhood fixed effects. The coefficient is negative and significant, implying that increases in crime lead to declining prices. Of course, it can easily be argued that this specification can suffer from omitted variable bias. Crime proxies for many other neighborhood level characteristics that change over time. Regression II includes neighborhood fixed effects but omits year fixed effects. This regression gives a substantially greater magnitude on the crime variable. Similar to Regression I, this specification also is subject to a great amount of omitted variable bias. In this case, we do not control for overall yearly changes in residential real estate prices across all of Manhattan. Omitting year effects will overestimate the coefficient on the crime variable because we have not controlled things like rising income. Given the possibilities of omitted variable bias in each case, we now include both time and state fixed effects. The result is just as unpromising: the coefficient on crime is close to zero and statistically insignificant.

Table 16: Effect of Changing Crime Rates on Price

Variable	I	II	III
ROOMS	0.185	0.176	0.175
	(0.004)**	(0.004)**	(0.004)**
FLOOR	0.017	0.017	0.017
	(0.001)**	(0.001)**	(0.001)**
STORIES	0.004	0.003	0.004
	(0.001)**	(0.001)**	(0.001)**
LOGRVIOL	-0.066	-0.185	0.012
	(0.009)**	(0.010)**	-0.016
Year Fixed	Yes	No	Yes
Neighborhod Fixed	No	Yes	Yes
Adjusted R^2	0.36	0.39	0.44
Number of Obs.	10,523	10,523	10,523

*Notes: + p<0.10, * p<0.05, ** p<0.01*

Because over 80% of the variation in LOGRVIOL can be explained by year and neighborhood fixed effects, we conclude that it would be impossible with our current data set to get a clean estimate that would be reasonably unbiased.

Effect of declining crime on SUBBLOCK

However, we can still measure the effect of crime on the hedonic prices of amenities since this interaction should be unaffected if strong and robust enough. Earlier, the wealth elasticities with respect to crime implied that it was unlikely that changes in wealth were the primary drivers for the long term changes in SUBBLOCK. We now test the hypothesis that the long term increasing trend of

SUBBLOCK may have been driven by declining crime. During the late 1980s, Manhattan was a crime ridden city. The New York Subway system was a target for thefts, muggings, and graffiti. Vandalism and broken windows were common occurrences on subway trains. New York Subway historian Mark S. Feinman wrote on the subway during this decade: “The 1980s made a very indelible impression on potential passengers of the subway: use the subway and you’re guaranteed to be a crime victim. Perception became a reality… the subway became a symbol of New York City’s inability to control crime.”[6] During the 1990s, as the New York City Police Department began to enforce crime more strictly in an attempt to curb record crime rates, part of their strategy involved focusing on cleaning up and patrolling the subway system. Their justification for this approach came from the “broken window theory” which states that serious crimes only develop if minor crimes are left unchecked.[7] In other words, safer subways became a beacon for declining crime in the rest of the city. We regress log of real condominium price on log of rate of violent crimes and then include an interaction term between LNRVIOL and SUBBLOCK. This interaction term will tell us if and how the price of condominiums close subway stations reacted to changes in crime. The negative coefficient on the interaction term in all four regressions confirms our suspicions about the relationship between subway proximity and crime. It implies that proximity to subway stations is less appealing during times of higher crime. An increase in crime has a greater negative impact on those condominiums within a block of a subway station. Conversely, a decrease in

[6] Feinman, Mark S. “The New York City Transit Authority in the 1980s.” Accessed on 3/15/2008 URL: http://www.nycsubway.org/articles/history-nycta1980s.html
[7] Kelling, George L. and James Q. Wilson. “Broken Windows,” The Atlantic Monthly March 1982: 29-38.

crime has a greater positive impact on the price for those condominiums closer to the subway.

Table 17: Effect of Changes in Crime on SUBBLOCK

Variable	I	II	III	IV
ROOMS	0.181	0.185	0.175	0.174
	(0.004)**	(0.004)**	(0.004)**	(0.004)**
FLOOR	0.016	0.015	0.016	0.016
	(0.001)**	(0.001)**	(0.001)**	(0.001)**
STORIES	0.005	0.005	0.004	0.004
	(0.001)**	(0.001)**	(0.001)**	(0.001)**
SUBBLOCK	0.635	0.619	0.551	0.425
	(0.092)**	(0.089)**	(0.091)**	(0.087)**
LOGRVIOL	-0.14	-0.074	-0.178	0.021
	(0.008)**	(0.009)**	(0.010)**	-0.016
SUBBLOCK_LOGRVIOL	-0.119	-0.116	-0.127	-0.059
	(0.036)**	(0.035)**	(0.036)**	(0.034)+
Year Fixed	No	Yes	No	Yes
Neighborhood Fixed	No	No	Yes	Yes
Adjusted R^2	0.32	0.37	0.39	0.45
Number of Obs.	10,523	10,523	10,523	10,523

*Note: + p<0.10, * p<0.05, ** p<0.01*

Regression I shows a simple regression with LOGRVIOL, SUBBLOCK and the interaction term. We have omitted both year and neighborhood fixed effects here. In regressions II and III, we include either neighborhood or year fixed effects. In both cases, the coefficient on the interaction term continues to be negative. In regression IV, we include both neighborhood and year fixed effects. Although the coefficient on the crime variable itself becomes insignificant, the interaction term still shows moderate statistical significance at the 10% level, although the magnitude is significantly lower than those found in regressions I, II, and III. The persistence of the negative sign and moderate statistical significance in all four regressions is consistent with long term trends. The basic pooled regressions saw an increase in the hedonic price of subway proximity from the earlier to the later period. The results of these crime interaction regressions shed light on a possible reason for this trend. As crime rates declined across Manhattan, homebuyers' perceptions of subways improved. People were no longer afraid to use public transportation and were hence willing to pay premiums to live within close proximity of these outlets. Still, it must be noted that the inclusion of neighborhood clustered errors for regression IV, nullifies all statistical significance. Thus, we consider other possible explanations for the increase in the SUBBLOCK later in this paper.

D. The Role of other "street level" changes

On the declining price of rooms

The wealth elasticity regressions show that increasing wealth is a possible explanation for the observed change in price of rooms between the earlier and later period regressions. Blackburn's commentary on Manhattan dwellers' counterintuitive reaction to increasing income furthers this hypothesis. However the lack of statistical significance when clustered errors are included suggests that we must consider additional explanations that could affect demand for ROOMS. The one that comes to mind first is a change in tastes driven by a change in population demographics in Manhattan. We observe that the implicit price of ROOMS has decreased over time. Condominium owners seem to value additional space less in the later period. This dynamic could easily be justified if we observed an increase in the number of smaller households during the period of interest. During the late nineties technology and Wall Street boom, it could be possible that Manhattan's population demographics shifted as a younger, educated, and more technologically savvy population was drawn to the city. The influx of this younger population could have pushed up demand for condominiums with fewer rooms and decreased demand for condominiums with greater numbers of rooms. This change is exactly what we see during this period. Again, we refer to the U.S. Census and the New York City Housing and Vacancy Survey. The U.S. Census states that the total number of households from 1990 to 2000 increases by just over three percent in Manhattan. A majority of the change in households during this period is in the 1 - 3 person households category. Overall, Manhattan saw an increase of 3.1% in the number of households. However, the rate specific to the increase in two person households was nearly twice as high, 5.31%. The increase in the number of households of this size could have resulted in an increase in the demand for condominiums with fewer rooms. This conclusion is confirmed by the New York Housing and Vacancy Survey's finding that between 1993 and 2002, the average household size in Manhattan declined 10% from an average of 2 persons per household to only 1.8 persons per household. Table 18 breaks down Manhattan's population into types of household: single elderly, single adult, single with minor children, elderly household, adult household, and adult household with children. The data which spans from 1984 to 1999 demonstrates that the single adult and single elderly owner occupied households have increased the most proportionally to the rest of the population in New York City. In fact the proportion of households accounted by adult households and adult households with children has declined by -3.5 and -2.0 percentage points, respectively.

Table 18: Household type proportions by year (Owner households only)

Household Type	1984	1987	1991	1993	1996	1999	Total Change
Single Elderly	9.8%	10.7%	12.0%	11.9%	13.2%	13.5%	3.7%
Single Adult	9.4%	11.5%	12.9%	13.7%	13.8%	14.0%	4.6%
Single with Minor Children	1.9%	1.6%	1.8%	2.0%	2.3%	3.0%	1.1%
Elderly Household	20.6%	19.9%	20.5%	19.7%	17.9%	16.7%	-3.9%
Adult Household	28.0%	28.2%	25.1%	25.3%	25.5%	24.5%	-3.5%
Adult Household with Children	30.3%	28.1%	27.7%	27.4%	27.3%	28.3%	-2.0%
Total	100%	100%	100%	100%	100%	100%	

Notes: This table is a reproduction of Table 2.34 from Housing New York City, 1999

Hence, we suggest that it is possible that a change in the demographics towards a relatively smaller household size population resulted in a change in tastes towards condominium apartments with fewer rooms.

On the increasing price of subway proximity

We also have not found a clear reason for the increase in the price of proximity to subway stations. Granted, the statistical significance of this long term trend as we see in Table 10 is only minimal. However, anecdotal evidence from several New Yorkers confirms that subway proximity has indeed become more valued. Earlier we argue that the decline in crime convinced people to use and value public transportation more, the statistical significance of this result is only moderate. Hence, the increasing value of subway stations is also likely to be an outcome of other changes during the time period such the city's large investment in improving and modernizing the city's aging subway stations and trains. In 1993, the New York State Legislature approved a five year renovation package of over nine billion dollars which included a substantial sum for improving the subway trains and stations. In 1994, the Metropolitan Transit Authority introduced the MetroCard and began phasing out the previously used tokens.[8] By 2000, the capital improvements were having a major effect. Trains broke down less often and the automated fare collection system was more efficient. Subway rider ship reached record high levels.[9] Another possible reason for the increasing popularity and valuation of subway proximity is the increasing amount of traffic congestion that has affected Manhattan's streets. The New York Department of Motor Vehicles publishes statistics on the number of registered vehicles. The change in the number of registered vehicles between 1990 and 2000 was 9.4% while the population percent change in Manhattan during the same period was only 3.3%. Thus, it is likely that the rising price of subway proximity was the result of a combination of factors including declining crime, capital infrastructure improvements, and increasing congestion which made using public transportation safer, cleaner, and more convenient.

On the static price of direct access to Central Park

One surprising fact we learned was that the hedonic price of living directly on Central Park has remained largely unchanged. It is surprising that in light of the stock market boom of the late 1990s the hedonic price did not increase. It is even more surprising given the fact that the supply of condominiums facing Central Park is very limited. However, in the larger context of the entire residential real estate market in

[8] New York City Transit – History and Chronology. Accessed on 3/15/2008. URL: http://www.mta.info/nyct/facts/ffhist.htm

[9] McCall, Carl H. "A Guide for Evaluating the Metropolitan Transportation Authority's Proposed Capital Program for 2000 through 2004." Prepared by the Office of the State Deputy Comptroller for the City of New York.

Manhattan, this result is not as unexpected. We most likely are observing a substitution effect resulting from a change in tastes. As overall wealth increased and overall crime decreased, other areas of Manhattan such as the West Village and Chelsea became attractive places to live in for the rich. We see that this effect is especially prominent for the region approximately midway between the financial district and midtown. It could be argued that the “new wealth” actually wanted to move away from the stodgy and conservative Central Park residential population. Furthermore, it follows that the demographic shift towards relatively younger and smaller households might increase the demand for the bustle of downtown living.

VIII. Limitations and Potential Biases (to be completed)

The potential problems of this paper have been introduced throughout the text of this paper. In the following section, we briefly summarize them and proceed to describe a few key additional limitations of this initial study. Spatial autocorrelation was a consistent problem throughout all empirical analysis. The problems of omitted variable bias were especially apparent when attempting to estimate the effect of changing crime on price.

IX. Conclusion and Discussion

Although the ride was no smooth one, there is no question that Manhattan has experienced an extraordinary appreciation in its residential real estate market over the last 20 years. This appreciation however was not uniform across neighborhoods, amenities, or structural characteristics. Basic pooled regressions divided between the earlier and later ends of our study period demonstrate that the hedonic prices of certain amenities and characteristics have changed. We further show that for the most part these changes were statistically significant.

Although the implicit price of Central Park has remained essentially flat, the prices of other residential amenities have not. Motivated by these facts, this paper has attempted to shed light on the following drivers of the residential real estate market in Manhattan: Changes in supply, changes in wealth, and changes at the level of the street. We find that fluctuations in wealth are very correlated with changes in overall residential real estate prices. Our lagged stock market variable captures the trends in real estate prices with statistical significance and high sensitivity. Furthermore, we find that this sensitivity varies significantly by neighborhood. However, while fluctuations in wealth seem to correlate well with general real estate patterns, we do not observe this same phenomenon as strongly with the hedonic prices of the residential amenities. Our pooled regressions demonstrate a decrease in the price of additional rooms over the period of our study, implying that the prices of smaller apartments grew at a quicker pace than larger apartments. Changes in wealth however only show moderate statistical significance as a driver for the observed long term result. Instead, we look to systematic demographic changes in the population of Manhattan inhabitants towards a younger population with smaller households. This shift in population characteristics may have increased the demand for smaller condominiums and decreased demand for larger condominiums.

Our pooled regressions also demonstrate an increase in the price of subway proximity although this difference showed less statistical significance. Changing wealth again was not a particularly good determinant of this long term trend. Instead we looked to declining crime as a possible reason for the long term increase. Regressions interacting crime and subway distance demonstrated that condominiums closer to subway stations appreciated relatively more than those condominiums further away as crime rates dropped across the city. Other additional explanations for the improving perception of subways were the capital campaigns to modernize the fleet and the increasing traffic congestion which clogged the roads.

Finally, we examine the particular region WALLPROX which is approximately midway between the financial district and midtown. We find that this region showed a particularly high appreciation in our pooled regressions. Furthermore, we find that the reversal from discount to premium is statistically significant at the 1% level. We then interact the stock market with this region and find that its wealth elasticity is high and statistically significant. We follow up our analysis to examine more closely which neighborhoods drive this result and discover that the Chelsea, Union Square, and East Village neighborhoods are the culprits. The results suggest that this region's real estate experienced abnormally high correlation with the stock market and we suggest that it is perhaps due to its unique and convenient location to the two major business districts of Manhattan.

The time span from 1986 to 2002 has been both an interesting and challenging period to study because of the multiple changes which occurred simultaneously. The economy experienced both economic boom and bust. Both violent and properties crimes dropped to record low levels. Public institutions invested millions into neighborhood and public infrastructure improvement projects. All of this led to

Manhattan's resurgence as one of world's most desirable places to live. However, a critical problem of this study was the lack of neighborhood level data. Manhattan's residential real estate market is disparate enough to act as several different distinct markets. The initial results of this study show the substantial regional variation with Manhattan. Future studies should attempt to decompose the pricing dynamics of these neighborhood level changes. They should tackle the question of why certain neighborhoods reached the tipping point and why others did not. More research should also focus on the increasing valuation of subways in Manhattan. Anecdotal evidence and public perception suggest that public transportation really has become more valued with the decline in crime.

Works Cited

Abelson, P. W. (1979). "Property Prices and the Value of Amenities." *Journal of Environmental Economics and Management,* 6, 11-28.

Adair et al (2000). "House prices and Accessibility: The Testing of Relationships within the Belfast Urban Area." *Housing Studies,* 15, 699-716.

Asabere, Paul and Forest Huffman (1984). "Historic Districts and Land Values." *Journal of Real Estate Research,*6, 1-8.

Basu, Sabyasachi and Thomas G. Thibodeau (1998). "Analysis of Spatial Autocorrelation in Housing Prices." *Journal of Real Estate Finance and Economics,* 17, 61-85.

Benson, Earl D., Julia L. Hansen, Arthur L. Schwartz, Jr., and Greg T. Smersh. "Pricing Residential Amenities: The Value of a View." *The Journal of Real Estate Finance and Economics,* 16, 55-73.

Blackburn, Anthony J. Housing New York City 1993. New York: Department of Housing Preservation and Development, 1995.

Blomquist, G. C. and Worley, L. (1981). "Hedonic prices, demand for urban housing amenities, and benefit estimates. *Journal of Urban Economics,* 9, 212-221.

Blomquist, G. C., Mark C. Berger, and John P Hoehn (1988). "New Estimates of Quality of Life in Urban Areas." *American Economic Review*, 78, 89-107.

Boyle, Melissa A. and Katherine A Kiel (2001). "A Survey of House Price hedonic Studies of the Impact of Environmental Externalities." *Journal of Real Estate Literature*, 9, 117-144.

Brasington, David (1999). "Which Measures of School Quality Does the Housing Market Value?" *Journal of Real Estate Research,* 18, 395-414.

Brookshire, David S., Mark A. Thayer, John Tschirhart, and William D. Schulze (1985). "A Test of the Expected Utility Model: Evidence from Earthquake Risks." *The Journal of Political Economy,* 93, 369-389.

Can, Ayse (1990). "The Measurement of Neighborhood Dynamics in Urban House Prices." *Economic Geography,* 66, 254-272.

Cheshire, P. and Sheppard, Stephen (1995). "On the Price of Land and the Value of Amenities." *Economic,* 62, 247-267.

Clark, David E. and James R. Kahn (1998). “The Social Benefits of Urban Cultural Amenities.” *Journal of Regional Science,* 28, 363-377.

Costa, Dora L. and Matthew E. Kahn (2003). “The Rising Price of Nonmarket Goods.” *The American Economic Review,* 93, 227-232.

Cragg, Michael I. And Kahn, Matthew E. (1999). “New Estimates of Climate Demand: Evidence from Location choice.” *Journal of Urban Economics,* 42, 261-284.

Diamond, D. B. (1980). “The Relationship between Amenities and Urban Land Prices.” *Land Economics,* 56, 21-31.

Dubin, Robin A (1992). “Spatial autocorrelation and neighborhood quality.” *Regional Science and Urban Economics,* 22, 433-452.

Edmonds , Radcliffe G. (1985). “Some Evidence on the Intertemporal Stability of Hedonic Price Functions.” *Land Economics,* 61, 445-451.

Follain, James R. and Jimenez, Emmanuel (1985). “Estimating the Demand for Housing Characteristics: A Survey and Critique.” *Regional Science and Urban Economics,* 15, 77-107.

Follain, James R. and Malpezzi, Stephen (1981). “Another look at Racial Differences in Housing Prices.” *Urban Studies*, 18, 195-203.

Freeman, A. Myrick. The Measurement of Environmental and Resource Values: Theory and Methods, 2^{nd} Ed. Washington D.C.: Resources for the Future, 2003.

Glaeser, Edward L. et al. (2005). “Why is Manhattan so expensive? Regulation and the Rise in Housing Prices.” *Journal of Law and Economics,* 48, 331-369.

Gyourko, J. and Tracy, J. (1991). “The Structure of Local Public Finance and the Quality of Life.” *Journal of Political Economy,* 91, 774-806.

Irwin, Elena G. “The Effects of Open Space on Residential Property Values.” *Land Economics,* 78, 465-480.

Kain, John F. and Quickley, John M. (1970). “Measuring the Value of Housing Quality.” *Journal of the American Statistical Association,* 65, 532-548.

Lake, Iain R. et al. (2000). “Using GIS and Large-Scale Digital Data to Implement Hedonic Pricing Studies.” *International Journal of Geographical Information Science,* 14, 521-541.

Lee, Moon Wha. Housing New York City 1996. New York: Department of Housing Preservation and Development, 1999.

Lee, Moon Wha. Housing New York City 1999. New York: Department of Housing Preservation and Development, 2001.

Leichenko, R. M., N. E. Coulson, and D. Listokin. “Historic Preservation and Residential Property Values: An Analysis of Texas Cities.” *Urban Studies,* 38, 1973-1987.

Leggett, Christopher G. and Nancy E. Bockstael (1998). “Evidence of the Effects of Water Quality on Residential Land Prices.” *Journal of Environmental Economics and Management,* 39, 121-144.

Linneman, P. (1980). “Some Empirical Results on the Nature of Hedonic Price Function for the Urban Housing Market.” *Journal of Urban Ecnomics,* 8, 47-68.

Linneman, P. (1981). “The Demand for Residence Site Characteristics.” *Journal of Urban Economics,* 9, 129-148.

Maclennan, Duncan (1977). “Some Thoughts on the Nature and Purpose of Hedonic Price Functions.” *Urban Studies,* 14, 59-71.

Malprezzi, Stephen (2002). “Hedonic Pricing Models: A Selective and Applied Review.” In Kenneith Gibb and Anthony O’Sullivan (eds) *Housing Economics: Essays* in Honor of Duncan Maclennan.

McMillan, Melville L., Bradford G. Reid, and David W. Gillen (1980). “An Extension of the Hedonic Approach for Estimating the Value of Quiet.” *Land Economics,* 56, 315-328.

Nelson, J. P. (1981). Three Mile Island and Residential Property Values: Empirical Analysis and Policy Implications.” *Land Economics,* 57, 363-372.

Paterson, Robert W. and Kevin J. Boyle (2002). “Out of Sight, Out of Mind? Using GIS to Incorporate Visibility in Hedonic Property Value Models.” *Land Economics,* 78, 417-425.

Schwartz, Amy Ellen et al. “Has Falling Crime Driven New York City’s Real Estate Boom?” *Journal of Housing Research,* 14, 101-135.

Sheppard, Stephen (1999). “Hedonic Analysis of Housing Markets. In Paul C. Cheshire and Edwin S. Mills (eds), *Handbook of Regional and Urban Economics,* 3.

Shilton, Leon and Zaccaria, Anthony (1994). “The Avenue Effect, Landmark Externalities, and Cubic Transformation: Manhattan Office Valuation.” *Journal of Real Estate Finance and Economics*, 8, 151-165.

Smith, V. Kerry and Huang, Ju-Chin (1995). “Can Markets Value Air Quality? A Meta-Analysis of Hedonic Property Value Models.” *The Journal of Political Economy*, 103, 209-227.

Vandell, Kerry D. (1995). “Market Factors Affecting Spatial Heterogeneity of Urban neighborhoods.” *Housing Policy debate,* 6, 103-139.

Vandell, Kerry D. and Lane, Jonathan S. (1989). “The Economics of Architecture and Urban Design: Some Preliminary Findings,” *AREUEA Journal*, 17, 235-260.

Witte, Ann D., Sumka, H., and J. Erekson (1979). “An Estimate of a Structural Hedonic Price Model of the Housing Market: An Application of Rosen’s Theory of Implicit Markets.” *Econometrica*, 47, 1151-1172.

Wilkinson, R. K. (1973). “House prices and the measurement of externalities.” *Economic Journal*, 83, 72-86.

Yaro, Robert D. and Tony Hiss. Region at Risk: The Third Plan for the New York – New Jersey Connecticut Metropolitan Area. New York: Island Press, 1996.