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"LOCATION, LOCATION, LOCATION!" THE MARKET FOR VACANT URBAN LAND: NEW YORK 1835-1900

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ABSTRACT

We present new archival evidence on the price of vacant land in New York City between 1835 and 1900. Before the Civil War, the price of land per square foot fell steeply with distance from New York's City Hall located in the central business district. After the Civil War, the distance gradient flattened and the fit of a simple regression of land price on distance from the CBD declined markedly. Average nominal land prices at the CBD increased at an average annual rate of over 3 percent per year between 1835 and 1895 before declining as the century came to an end.

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"Location, Location, Location!" The Market for Vacant Urban Land: New York, 1835-1900*

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Introduction

A number of properties distinguish land from other factors of production. Specifically, land is absolutely immobile and cannot be perfectly replicated since two or more pieces of land cannot occupy the same space. As a result while "location, location, location" may be the quintessential cliché in the real estate business, it is nevertheless true. Location is a key determinant of the value of real estate:—location with respect to remunerative economic opportunities, location relative to scenic or otherwise desirable and attractive living areas; location convenient to the transportation network so as to minimize transportation costs whether with respect to time or out-of-pocket expenses in the movement of goods or people. In short, virtually every attribute of a piece of land beyond its physical dimensions and any improvements made to it such as drainage or structures can be reduced to location. Consequently, the relationship between the price of land and location figures prominently in urban economics.

By definition, however, urban areas are densely settled and thus the majority of the land there is already developed. Consequently, most studies of land urban land values, including much

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of Homer Hoyt's [1933] seminal study of the Chicago land market, involve land that has already been improved. To the extent that the range of possible improvements, particularly structures, is potentially infinite and are difficult to model either quantitatively or qualitatively, improvements obscure the fundamental relationship between the price of land and its location.

In this paper, we examine the relationship between land price and location by studying the price of vacant land in the nation's leading commercial center in the nineteenth century, New York City, relative to the city's central business district (CBD). Not only do these data represent new observations of historical land price trends at benchmark dates over a long period of time, but they can potentially cast new light upon various technological changes—the street car, the subway, the automobile and the skyscraper—which altered the urban landscape, although at present our temporal coverage is too limited for such analysis.

While other studies have typically used tax assessments as their measure of land value or have relied upon average prices in a specific area, our study instead relies upon actual sales data for individual lots. Consequently, we believe that our data offer a better measure of the price of the land itself and thus of the relationship between land price and location.

In addition to providing new historical evidence on land value gradients, our paper extends the previous literature in two ways. First, unlike the published figures in Homer Hoyt's seminal study of 100 years of Chicago land prices [1933] which are averages of transactions, our data pertain to individual vacant lots. As a result we can control for characteristics that Hoyt, in particular, thought were important in the pricing of vacant land (for example, a corner lot) but which cannot be done using Hoyt's data. Second, so far as we are aware, ours is the first study of land prices in New York city though there are numerous studies for Chicago (for example, Mills [1969]; MacDonald and Bowman [1979]; Kau and Sirmans [1979]; Kau, Lee and Sirmans [1986]) typically using Hoyt's data from Olcott as well as studies for other cities such as Boston (Edel and Sclar, [1975]) and Philadelphia (Gin and Sonstelie, [1992]).[1]

[1] Hurd (1905) makes numerous references to the New York city market including two maps showing the value per square foot of residential and business real estate in Manhattan.

Other Studies of the Relationship between the Price of Land and Location

With 15 percent of the nation's population living in urban areas by 1850 and more than half living in cities by 1920, it is remarkable how little empirical evidence exists on secular trends in land value gradients given the numbers of people affected by them. Perhaps the best known study of land value gradients is by Edwin Mills [1969]. Using the data originally collected by Hoyt [1933] for Chicago, Mills estimated semi-log univariate regressions of land value on distance over the period 1838 to 1930. Before the Civil War, land value declined by approximately 40-50 percent per mile from the central business district. By the late nineteenth century, the gradient had flattened to approximately 25-33 percent per mile from the Civil War to World War I. By 1970 the rate has fallen to 5 percent or less per mile. The fit of the regression (indicated by the R^2) also eroded, suggesting that the explanatory power of the standard mononcentric urban model (that is a city with a single CBD) declined over time (Table 1). Early on, distance from the CBD explained more than two-thirds of the variation in price. By the end of the century it was explaining perhaps half of the variation but by the 1930s, distance from the CBD was explaining less than 10 percent of the variation in price from lot to lot. These provide a benchmark against which to compare the New York experience.

Although subsequent re-analysis of the Hoyt data has raised questions about the functional form (McDonald and Bowman [1979]), selection bias (McMillen, Jarmin and Thorsnes [1992]), and estimation technique (Kau and Sirmans [1979]), the flattening of the gradient and the decline in the fit of a univariate regression of land value on distance from the CBD appear to be robust findings.

Location and the Price of Land

According to the standard monocentric model of urban spatial structure, firms and households are willing to bid more for land that is closer to the Central Business District because transport costs whether in terms of out-of-pocket expenses or travel times to the CBD will be lower. For firms to be in equilibrium the price of land will be bid up to the point where the excess profits from a specific location are driven to zero thus leaving the entrepreneur indifferent between that location and all other possible locations.

For individuals consider the following simple model of the consumer budget constraint in the presence of space with positive transport costs:

$$y = P(t)q + k(t) + p_z z, \qquad [1]$$

where y is income, $P(t)$ is the price per unit of land t miles from the location of the economic activity generating y, q is the quantity of land, $k(t)$ are commuting costs for t miles, p_z is the price of the composite good z (that is all other goods and services) and z is the quantity of the composite good.

Table 1
Chicago Land Value Gradients, 1836-1970
(t-statistic)

Year (data source)	Constant	Distance Coefficient	R^2
1836 (Hoyt/Mills)	5.632 (44.832)	-.403 (27.168)	.78
1857 (Hoyt/Mills)	8.748 (70.886)	-.513 (35.742)	.86
1873 (Hoyt/Mills)	9.980 (71.655)	-.344 (21.011)	.68
1892 (Hoyt/Mills)	10.043 (52.558)	-.246 (11.169)	.42
1910 (Hoyt/Mills)	10.584 (52.018)	-.319 (12.678)	.57
1910 (Olcott)	4.841 (35.29)	-.263 (10.81)	.42
1920 (Olcott)	4.965 (35.49)	-.205 (10.81)	.29
1928 (Hoyt/Mills)	11.736 (72.390)	-.220 (11.735)	.50
1930 (Olcott)	5.303 (36.33)	-.107 (5.41)	.09
1940 (Olcott)	4.242 (35.55)	-.085 (5.25)	.09
1950 (Olcott)	4.176 (36.72)	-.053 (3.42)	.04
1960 (Olcott)	4.536 (44.11)	-.005 (0.38)	.00
1970 (Olcott)	5.468 (52.54)	-.047 (3.31)	.04

Source: Kau, Lee and Sirmans [1986], 165 and 172.

This equation encompasses all possible ways in which the individual can allocate their income. Rearranging terms, we see that

$$P(t) = \frac{y - p_z z - k(t)}{q} \qquad [2]$$

That is, the price of land falls as commuting costs rise and thus falls with distance from the CBD. Moreover, because land is an input in the production of housing, the price of housing per square foot declines as well as distance from the CBD rises. Per capita housing consumption is correspondingly greater as distance from the CBD increases, and thus population density is also lower at more distant locations.

Over time, changes in transportation technology and per capita incomes may alter the land value gradient. In particular, under reasonable assumptions, a decrease in the cost of intraurban transport or an increase in income will flatten the rent gradient (Figure 1). As a result, households were able to live at greater distances from lower Manhattan. As the century progressed, residential development moved northwards towards (and eventually past) modern day Central Park. In addition, the rapid growth in demand of the city's port permitted business users to outbid residential users for central locations.

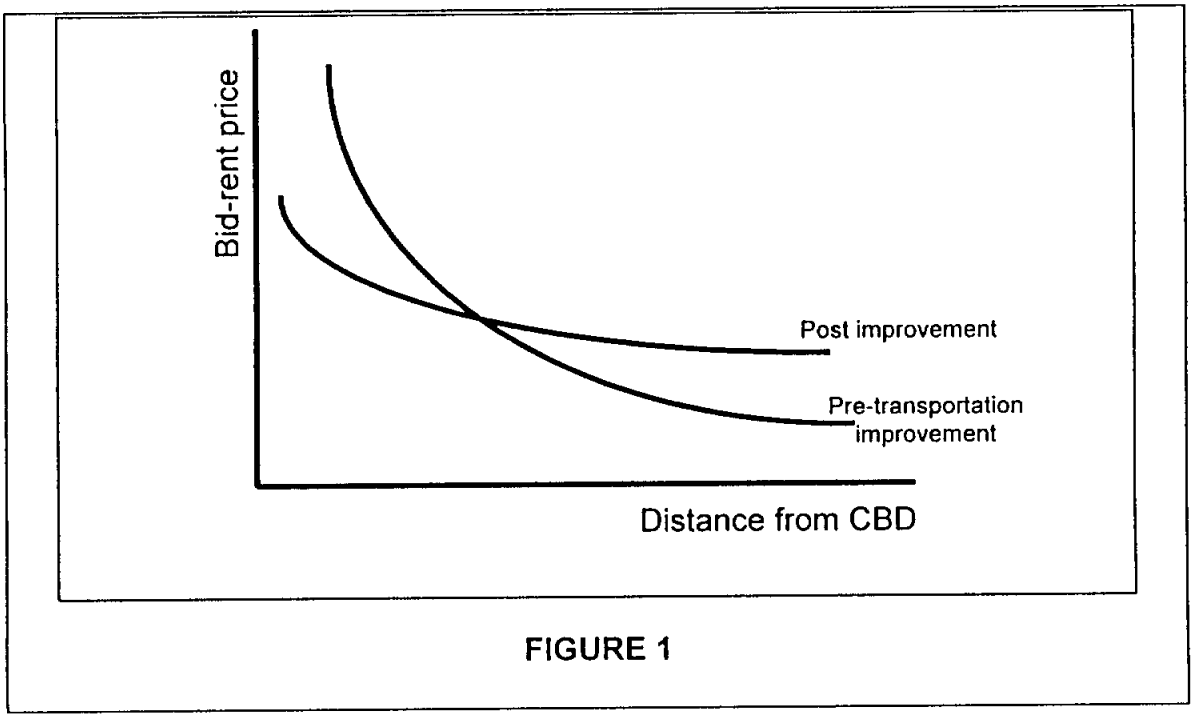

FIGURE 1

The Price of Land in New York City

Shortly before his death in 1848, John Jacob Astor is reputed to have declared "Could I begin life again, knowing what I now know, and had money to invest, I would buy every foot of

land on the island of Manhattan" (Jackson [1995], 63). Astor had begun his career as a fur trader in the Pacific Northwest but shifted his attentions increasingly to the New York real estate market beginning around 1810. His strategy was a simple one: buy and hold, investing little or nothing in improvements, while waiting for urban growth to drive up land values. It was also a successful strategy. By 1840 he was reputedly the nation's wealthiest man, owning real estate valued at $20 million or more, a more than tenfold appreciation in value since purchase while the average price level remained essentially unchanged.[2] In the years that followed the Astor real estate holdings probably appreciated even more rapidly if our data (which may well include some Astor lots) are correct.

Our study here of land value gradients in the nineteenth century draws upon newspaper listings of transactions of vacant lots. Our use of newspapers as a source is not novel. For example, Rees [1963] used newspaper advertisements to construct a rental index for urban housing over the period 1890 and 1914 and, more recently, Margo [1996] has also used advertisements to construct a rental index for antebellum New York City. So far as we are aware, however, ours is the first attempt to use newspaper listings to estimate historical trends in land value gradients.

We have collected data on the prices of vacant land as reported in four New York City daily newspapers—the *New York Daily Advertiser*, the *New York Herald*, the *New York Tribune* and the *New York Times*. These newspapers contained three distinct kinds of realty information. First, there are records of auction sales listed in the newspapers. These data ought to represent full and true market prices of real estate competitively determined (assuming that there were no organized buying rings rigging prices) but there are relatively few listings on any one day and we have not made much use of these data. Early on, however, they represent the only source of information on real estate sales and they gradually disappeared from the pages of the newspapers. Thus, for example, <u>all</u> of our 1835 data are auction sales collected from the *Daily Advertiser* while only a few of our 1845 observations are from auctions and none of our later prices are. Second, numerous newspaper advertisements offer land for sale. We have not used

[2] According to the Warren-Pearson price index (which was based primarily upon New York prices), the index for 1810 was 131 for all products. 90 for farm products, and 59 for building materials. In 1840, the indexes were 95, 65 and 65.

these data yet for the obvious reason that they represent offer prices rather than strike prices. Consequently, they are usually upper bound estimates of the market value of a piece of land. Third, and the source of most of the data for this paper, are published listings of "Transfers of Real Estate" and "Recorded Real Estate Transfers" which report real estate title transfers recorded at the county clerk's offices. These data were included in the newspapers as part of their greatly expanded coverage of financial affairs. [3]

These real estate transfers and sales were generally reported on a daily basis. The prices should represent actual sale prices and, for the most part, this seems to be true although since taxes and recording fees were based upon sales prices there was an incentive to understate actual sales prices. This seems to have been increasingly the case since towards the end of the century as more and more of the transfers reported sales prices of $1 or $100. Presumably there were other additional "valuable considerations" provided by the buyer to the seller but these are unobserved. Since the financial incentives to understate the market price increase with the value of the property, we assume that our sampling from the pool of real estate transfers has a truncated upper tail, that is it underreports the number of high-valued transfers and this bias probably increased over time.

The source and exact nature of the early data is not known as the listings are simply titled "REAL ESTATE—*Sales on (date).*" A typical notice might read:

> "1 lot on the south side of Horatio street, 110 feet 9
> inches east of Hudson street, 25x87 1450"[4]

Except in 1835 and 1845, the notices of real estate transfer rarely stated that the land was vacant and unimproved. Rather we have had to infer this fact from the wording of the notice. In particular, where a specific street address was given in the notice we have taken this as evidence of some structure on the property. Thus, for example:

> "63D ST., 231 West, 25x100.5; Rose Appel to Flora
> Hirsch and another 20,000"[5]

U.S. Department of Commerce [1975] Series E52, 53 and 59.
[3] Among the other data reported were shipping arrivals, prices for staples (both current and future), mortgages, leases and liens, bankruptcies, partnerships and their dissolution.
[4] *New York Herald*, January 10, 1845.

is assumed to include a residence or some other structure at 231 West, whereas

> "54TH ST. n(orth) s(ide) 231.3 (the ".3" is to be read as 3
> inches, not 3/10ths of a foot) e(ast) of 8th Av. 18.9x100.9;
> John D. Hass, executor and trustee, to Theresa Sommer 16,500"[6]

is assumed to be an unimproved, slightly sub-standard (in terms of size) lot.

The information provided in this last listing is typical. The notice gives the size of the lot (18' 9" by 100' 9")—in this case a regular rectangular lot (in the case of a irregularly-shaped lot, the dimensions of each side are usually given) and the location of the lot (231' 3" east of 8th Avenue on 54th Street). Earlier on, just the nearest cross-streets were listed but later listings typically reported the distance and direction from the nearest cross-street. The listing also describes the orientation of the lot (north side of the street); its selling price ($16,500); and, if appropriate, other specific details (such as whether the lot was a corner lot).

To the extent that the newspaper listings simply report real estate transactions recorded at the county clerk's office (with some non-zero risk of transcription and reporting errors), an obvious question is why we should rely upon newspaper reports rather than use the original source. First, newspapers are generally more accessible. Second, newspapers have survived where some county and city records have not. Third, because newspapers served local communities which were not always contiguous with political divisions, their coverage reflects the interests of their consumers. Depending upon those interests, they may report data from more than one jurisdiction. This was certainly the case with the New York newspapers that we use here. They had readers throughout the New York metropolitan area and so they reported transactions occurring outside Manhattan Island such as in Brooklyn, the Bronx and Williamsburg, prior to annexation. There were even some listings for Westchester County and over into Connecticut. Here, however, we have restricted our attention to land sales on Manhattan Island proper, that is the area bounded by New York Bay on the south, the Hudson River to the west, the East River to the east and Harlem River to the east and north.

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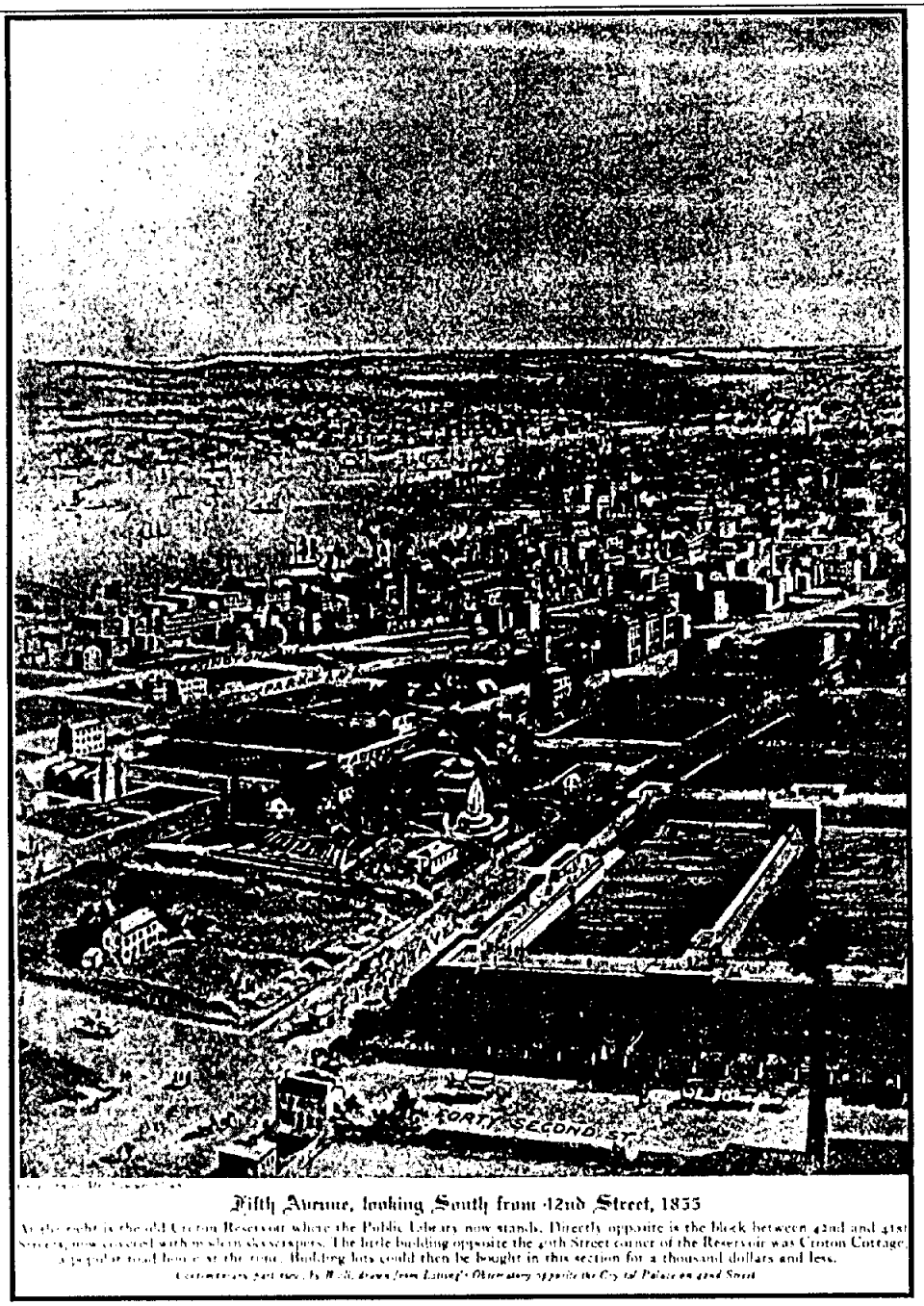
[5] *New York Times*, Jan. 12, 1900.
[6] Ibid.

Since our purpose in this paper is primarily to benchmark the New York data as part of a larger study of the change in land prices over time, we collected samples of transactions for a number of benchmark dates: 1835, 1845, 1860, 1870, 1875, 1880, 1885, 1890, 1895 and 1900. For reasons that we do not yet understand, very few transactions were recorded before 1835, around 1840 and during the 1850s. However, we feel that we have enough observations to be confident about the broad trends.

Vacant Land in New York City

For a late twentieth century observer, it is difficult to imagine a New York City in which there were extensive tracts of vacant and undeveloped land. Until late in the nineteenth century, however, large areas of Manhattan remained essentially rural in character and unsettled even where intersected by streets. These can be seen in numerous contemporary views and photographs of the city. For example, a view southwards down Fifth Avenue from just above 42nd Street in 1855 shows many city blocks in the area between 6th Avenue and Lexington and 42nd Street and 37th Street occupied by a single residence and some blocks without any buildings whatsoever visible (Figure 2). A few years later, another lithograph looking southward down along Fifth Avenue from around 63rd Street shows empty city blocks on the east side of what is now Central Park as far south as 49th Street (Brown [1922], unpaged). These large unsettled tracts receded northwards over time as the city grew but there remained unsettled individual lots in blocks that were otherwise built up. For example, a lithograph from mid-century with a view down Fifth Avenue from just above 36th Street shows a largely unsettled block between 36th and 37th Streets on the east side of the Avenue, plus at least one empty lot on the south side of 36th Street (Longstreet [1975], 54). In addition, there often remained buildable land in the interior of blocks plus odd-shaped, particularly triangular, pieces of land, referred to in the advertisements and sales notices as "gore."



Fifth Avenue, looking South from 42nd Street, 1855

At the right is the old Croton Reservoir where the Public Library now stands. Directly opposite is the block between 42nd and 41st Streets, now covered with modern skyscrapers. The little building opposite the 42nd Street corner of the Reservoir was Croton Cottage, a popular road house of the time. Building lots could then be bought in this section for a thousand dollars and less.

Contemporary sketch by Wall, drawn from Lanagi's Observatory opposite the City Hall Palace on 42nd Street

FIGURE 2

Source: Henry Collins Brown, *Old New York: Yesterday & Today* (New York: privately printed for Valentine's Manual, 1922), unpaged.

Not all of the vacant, buildable land that came on the market had always been vacant. Random lots of land almost certainly came on the market as a result of fires which had destroyed any existing structures. Some of these fires even damaged large numbers of buildings. For example, the Great Fire of 1835 destroyed 674 buildings in the Wall Street area. Another fire in

1839 destroyed perhaps 100 buildings around Pearl Street and another great fire in 1845 destroyed more than three hundred buildings around Broad and William Streets. The devastation from fires lessened over time as water supplies improved, as brick and stone replaced wood as a building material, and as fire protection became professionalized but it could never be toally eliminated (Jackson [1996], 408-12).

Executors and trustees often appeared as the sellers of these properties suggesting that their sale was perhaps unanticipated. Most owners, however, sold presumably because they felt that the time was now ripe. Interestingly, we also frequently encountered insider trades where the same piece of land changed hands twice in the space of a day or two. For example, the *New York Times* for Wednesday, January 9, 1895 reported the sale of a lot on 74th Street 200 feet east of 5th Avenue by Urania Welling to Joseph Thompson for $39,000 and Mr. Thompson's resale of the property the same day to John Bronson for $50,000—a transaction that would raise some eyebrows today (New York Times [1/9/1895], 15).

The Growth of New York City, 1820-1900

The growth of the New York metropolitan area was but one example of a wider phenomenon of rapid urbanization, the consequence of improvements in internal transportation and technical progress in manufacturing. Chicago, for example, grew even more rapidly. In New York's case, the initial catalyst was the opening of the Erie Canal in the 1820s, which greatly expanded internal trade to and from the city.[7] To manage the explosion in commerce, the tertiary sector in New York grew enormously as the city exploited its comparative advantage as a port. Fueled by lower transportation costs and falling prices due to technological progress, demand for urban-produced goods in the hinterland also grew, leading in turn to further city growth, particularly in manufacturing.

With essentially a fixed potential supply of land (ignoring the possibility of landfill such as along what is now FDR Drive along the Lower East Side), the market for Manhattan land was driven by changes in the demand for land which in turn was a function of population growth and the growth of economic activity in the area. With a population of 312,710 in 1840, New York City

[7] See, for example, Condit [1980]

(defined here as Manhattan and excluding such areas as Brooklyn (annexed 1898) and the Bronx (annexed 1874)) was already the largest city in the United States, and it remained so in 1900, by which time population had swelled to more than 1.8 million (Table 2). At times, particularly during period of mass immigration such as the late 1840s, its population grew at more than 6 percent per year. At other times, such as during the Civil War decade, population growth averaged less than 2 percent per year. In 1840, the population of Manhattan averaged 13,837 persons per square mile or about one and a quarter persons per standard building lot measuring 25 feet by 100 feet. By the end of the century, population density exceeded 81,000 per square mile or about seven and one-third people per standard building lot.

Table 2
Population Growth and Population Density in New York City (Manhattan), 1820-1900

	Population	Growth rate (percent/year)	Density per square mile	Density per lot
1820	123,706		5,474	0.49
1825	166,086	6.1%	7,349	0.66
1830	202,589	4.1%	8,964	0.8
1835	270,089	5.9%	11,951	1.07
1840	312,710	3.0%	13,837	1.24
1845	371,223	3.5%	16,426	1.47
1850	515,547	6.8%	22,812	2.05
1855	629,904	4.1%	27,872	2.5
1860	813,669	5.3%	36,003	3.23
1870	942,292	1.5%	41,694	3.74
1880	1,164,673	2.1%	51,534	4.62
1890	1,441,216	2.2%	63,771	5.72
1900	1,850,093	2.5%	81,863	7.34
Notes: Manhattan island occupies 22.6 square miles (Jackson [1995, 718]). Under the grid plan of 1811, the standard lot dimensions were 100'x25'. Sources: Rosenwaike [1972, 36, 63, 133]; Jackson [1995, 920-3]				

Nor was growth confined to Manhattan Island—it spilled over into nearby areas in New Jersey, and into Kings, Richmond and Westchester counties. By 1890, for example, the population of Kings County—Brooklyn—just before it was annexed by New York City was 806,373, compared with only 36,233 in 1840. Indeed, for almost half a century before it was annexed, Brooklyn was the nation's third largest city (Jackson [1995], 148-53).

As one of the oldest European settlements in America, much of the early development of New York city (that is in the Financial District, the Lower East Side and Greenwich Village) had

been haphazard, characterized by winding streets of varying widths, irregularly-shaped building lots and variable street frontages. In response to the perceived deficiencies of this developmental pattern, the state legislature approved a grid plan for the city's future development in 1811 (otherwise known as the Commissioner's Plan). Covering the area north of 14th Street to Washington Heights (around 169th Street), the plan provided for the orderly sale and development of lots by establishing a rectangular grid of streets and property boundaries without regard to topography. There were to be twelve numbered avenues each 100 feet wide running north-south with 3rd, 4th, 5th and 6th Avenues 920 feet apart and those closer to the rivers more narrowly spaced to allow for more dense settlement in the expectation of more intensive development. These avenues were then to be connected by 155 cross street placed 200 feet apart in the expectation that most commerce and travel would take place crosstown between the two rivers rather than between uptown and downtown (Spann, [1988]).

Various modifications were made to the plan (such as the angled path of Broadway) but the grid plan of 1811 laid down the basic pattern for much of the subsequent settlement and development of New York City. In particular it was responsible for the standard building lot of 25 feet in street frontage by 100 feet deep although not all lots conformed to this norm.

The growing concentration of humanity on Manhattan Island created an ever-increasing demand for city services such as water, sanitation and public transportation. The conflict between pure water and sewage disposal created by ever more dense settlement was heightened by periodic outbreaks of public hygiene diseases such typhoid fever and cholera and spurred the search for solutions to the problem. By 1842, abundant fresh water began to flow to the city from Westchester county via the Croton Aqueduct to reservoirs in Central Park and at 42nd Street and 5th Avenue and this system (expanded numerous times) served the city's needs for the rest of the century before New York was forced to move further afield to the Catskills to meet its ever growing demand (Weidner [1974]).

The ready-availability of water paradoxically increased sanitation problems by encouraging the more rapid adoption of the water closet and more profligate use of water in cleaning. As a result, in 1849 the Croton Aqueduct Department was given responsibility for

constructing a sewer system for the city. By 1855 some 70 miles had been built yet the Association for Improving the Condition of the Poor estimated that at least three quarters of the city's street lacked sewers. By the early 1890s, the city had 464 miles of sewers and about half of the tenement dwellers had access to flush toilets. Coverage expanded rapidly in the years following so that by 1902 the city had more than 1,400 miles of sewers and most new construction incorporated private flush toilets (Duffy [1974]).

Housing New York's growing population was a major challenge to its construction industry. Increasing population pressures and the influx of poor immigrants in lower Manhattan led to the conversion of many structures, residential and commercial as well as industrial, into low-rent, cramped, often windowless, high-density housing known as rookeries. So successful were these in housing the masses that they quickly became the model for new construction of inexpensive multistory utilitarian housing in the Lower East Side which replaced single family dwellings as the dominant new dwelling type and led to various public health regulations, particularly the Tenement Laws of 1867, 1879 and 1901 (Jackson [1976]).

Single family housing continued to be built in the 1840s and 1850s, however, particularly in "uptown" neighborhoods catering to middle-class residents escaping more densely populated centrally-located neighborhoods, where they lived in the relative comfort of brownstones and, eventually, later in the century into luxury apartments such as the Dakota built in 1884 (Lockwood [1972]). "Filtering" occurred, as buildings formerly occupied by the middle and upper classes were converted to rental housing for the working class. High land costs put home ownership out of reach of the vast majority of workers and, indeed, much of the middle class.

The other advance in construction is the one synonymous with New York—the development of the high-rise skyscraper made possible by the perfection of the passenger elevator and new construction methods allowed multiple use of the same space and led to vertical filtering. The Equitable Building, constructed between 1868 and 1870 which rose 7½ stories was the first to incorporate the elevator as part of its design and by 1875 there were several 10 story buildings in the city. None, however, really qualified for the title "skyscraper" which strictly speaking applies only to buildings with a full skeleton frame carrying the walls and the floors first

used in the Tower Building at 50 Broadway in 1888-89 (Jackson [1995, 1073-75]). One result of the elevator was to reverse the relative desirability of upper versus lower floors as living quaters.

While the tenement and the skyscraper permitted more intensive, higher density, use of lots close in to the central business district, transportation improvements made it economical for people to live at greater distance from the CBD. Horse-drawn omnibuses were operating in New York as early as 1831 but were relatively inefficient people-carriers as a result of the sad state of the city's streets. As a result, in 1832, the New York & Harlem Railroad opened a street railroad operating along 4th Avenue. Another street railroad opened on 6th Avenue in 1851 followed by 2nd and 3rd Avenues in 1853, 8th Avenue in 1855, 9th in 1859, 7th in 1864 and Broadway beginning 1863 (Jackson [1995, 1127-8]). All suffered from the same disadvantage—they competed with the burgeoning private traffic for space on the city's streets. One solution to the problem was the construction of elevated track, the first of which opened in 1868 and operated along Greenwich and 9th Avenue to 30th Street. The other solution, the subway, postdates by a few years, the period we study here. First route opened in 1904 and ran from City Hall to 42nd Street then west to Times Square, north on Broadway to 96th Street where it divided with one branch running up to 242nd Street while the other branch went to the Bronx (Condit [1980]).

As an island, Manhattan was critically dependent upon waterborne traffic from both far and near until bridges could be built. Numerous ferries were granted charters and as traffic grew at the more important crossing points these increasingly operated on fixed schedules. In the 1850s, for example, the Union Ferry Company was making 1,250 crossings a day to Brooklyn for a standard fare of 2 cents, and ferries were departing every five or ten minutes during the working day. By 1860, passenger traffic across the East River was averaging about 100,000 persons per working day. A decade later perhaps 50 million passages a year were being made and the folk wisdom held that a fog in the harbor would make half the working population late to work that day. The opening of the Brooklyn Bridge in 1883 dealt a severe blow to the commuter ferry system and New York was soon thereafter connected with the Bronx and Queens (Jackson [1995, 397-401]).

The Price of Vacant Land

We have designated City Hall at the corner of Broadway and Park Row as the central business district rather than some place further downtown, say South Street or Wall Street and we have measured the distance to each lot from this point. While this choice is somewhat arbitrary, it is not capricious. According to Kenneth Scherzer [1992], the CBD began at City Hall, encompassing the area between Broadway and the Bowery. Perhaps more important than our identification of City Hall as synonymous with the CBD, is our implicit assumption that there was a single immovable CBD throughout the period. We will return to this point later.

FIGURE 3
Approximate Location of Sample Vacant Lots in Manhattan, 1870
(Note: symbols sometimes overlay one another)

After dropping a few isolated outliers, some basic summary statistics about the price of land per square foot at our benchmark dates are shown in Table 3. These data reveal what we consider to be our most startling (in the sense of "unexpected") finding: the extraordinary increase in the price of land in New York City between 1860 and 1870. In the 1830s, vacant land averaged between 75 and 80 cents a square foot and was located an average of 2.4 miles from City Hall.[8]

[8] We managed to collect 13 observations from 1831. The average price per square foot for these lots was $0.792

These prices were as high or higher than they were to be for perhaps a generation, consistent with qualitative accounts (see for example, Blackmar [1989]). Subsequently, it appears that New York city land went through a prolonged bust period, probably beginning in the wake of the 1837 Panic and lasting well into the 1840s. Certainly, in 1845 vacant land was selling for an average price of just 48 cents per square foot and was located, on average, at about the same distance from City Hall.

Table 3
The Price of Vacant Land in Manhattan, 1835-1900

Year	Average Price/square foot	Minimum distance to City Hall (miles)	Maximum distance to City Hall (miles)	Average Distance to City Hall (miles)	Percentage of corner lots	Number of observations in sample (number of outliers dropped)
Price/square foot < $100.00						
1835	$ 0.763	0.25	7.08	2.42	0.132	190 (0)
1845	$ 0.476	0.41	4.91	2.44	0.092	207 (1)
1860	$ 0.790	1.59	12.10	5.65	0.393	117 (2)
1870	$ 6.654	0.27	7.30	3.09	0.081	74 (7)
1875	$ 10.756	0.20	7.98	3.61	0.156	77 (0)
1880	$ 7.385	0.50	7.88	4.55	0.111	72 (1)
1885	$ 8.675	0.85	7.28	4.34	0.143	77 (0)
1890	$ 8.735	0.20	10.2	4.53	0.102	98 (0)
1895	$11.264	0.92	9.56	4.63	0.145	69 (2)
1900	$ 7.024	1.40	10.70	5.80	0.076	79 (0)
Price/square foot < $100.00 and Distance from City Hall < 4 miles						
1835	$ 0.773	0.25	3.89	2.26	0.138	181
1845	$ 0.494	0.41	3.72	2.43	0.088	193
1860	$ 1.392	1.59	3.97	3.17	0.268	41
1870	$ 7.161	0.27	3.93	2.48	0.082	61
1875	$12.230	0.20	3.94	2.44	0.104	48
1880	$ 8.613	0.50	3.99	3.07	0.083	36
1885	$ 8.441	0.85	3.99	2.60	0.037	27
1890	$10.803	0.20	3.98	2.43	0.089	45
1895	$13.124	0.92	3.95	2.66	0.148	27
1900	$ 5.849	1.40	3.94	2.85	0	19

Various issues of *New York Daily Advertiser*, the *New York Herald*, the *New York Tribune* and the *New York Times*. See text.

By 1860, the average price per square foot had increased to 79 cents (an increase of more than 60 percent) or about the same as in the 1830s but, since the average distance from the CBD had more than doubled, land at a constant distance from the CBD appreciated more rapidly. This rate of growth exceeds the rate of growth of general prices between the same dates but

pales by comparison with the apparent eight-fold price increase between 1860 and 1870. Our initial reaction was to dismiss the result as an artifact of Civil War inflation but high land prices persist thereafter. This price increase during the Civil War decade exceeds, by orders of magnitude, any commonly accepted estimate of inflation during the period and we interpret this as indicating a particularly sharp increase in demand for land in New York City.

Over the course of the nineteenth century, the average distance of vacant lots from city hall more than doubled as the city grew northwards. Dropping the more distant lots, for example, those more than four miles from city hall—essentially those lots from Central Park northwards, does not alter the basic pattern. Vacant land located within 2 or 3 miles of City Hall increased dramatically in price between 1860 and 1870 and these high prices were generally maintained thereafter.

While we were greatly surprised by this finding, land prices in Chicago reported by Hoyt [1933] also show some dramatic increases. We (and probably other researchers as well) had assumed that those prices increases for Chicago lots simply reflected their development but they may also reflect dramatic increases in the price of the lots themselves independent of their state of development. For example, a lot on West Wacker Drive, overlooking the Chicago River, sold in 1830 for $42. It sold again in the mid-1850s for $32,000; in the early 1870s for $40,000; was appraised in 1896 at $160,000 and a part of the lot was valued at $932,000 in the late 1920s. A lot further up the street (towards the Lake) sold for $78 in 1830, $14,300 in 1836 and was appraised at $209,000 in 1896 (Hoyt [1933, 338-9]).

Econometric Analysis

Despite the premise of the Commissioner's Plan of 1811 that development would proceed in an orderly, sequential fashion northwards up Manhattan island, there remained undeveloped plots of land kept vacant either by the speculative greed of their owner or some less than desirable characteristic of the piece of land. The longer such plots of land remained undeveloped as the settlement wave pushed on, the more unusual must be the piece of land in question and thus the more variable its price, *ceteris paribus*, when it is eventually sold. Scattergrams of price by distance clearly show this to be the case (Figure 4). The distribution of price by distance is

tight in 1835 and 1845. It is somewhat less tight in 1860 but still conforms to the predictions of the monocentric urban model. It becomes diffuse from 1870 onwards.

As might be expected from the scattergrams, estimation of a simple monocentric urban model in semilog form yields fairly precise estimates for 1835 and 1845, less so for 1860 and fairly imprecise to very imprecise estimates later on (Table 4). For each year we have estimated the following simple Mills-style exponential gradient model:

$$\log (\text{Price/square foot}) = \alpha + \beta_1 (\text{miles from CBD}) + \beta_2 (\text{corner lot})$$

Table 4
A Simple Monocentric Urban Model of the Price of Vacant Land in Manhattan, 1835-1900

Year	Price per square foot at City Hall	Gradient	Corner Premium	R^2
1835	0.9272 **	-0.6541 **	0.4586 **	0.719
	(0.0882)	(0.0322)	(0.1016)	
1845	1.4083 **	-1.0756 **	0.4346 **	0.804
	(0.0979)	(0.0382)	(0.1120)	
1860	0.9801 **	-0.3239 **	0.5086 **	0.695
	(0.1157)	(0.0199)	(0.1013)	
1870	1.6470 **	-0.0987	0.5695	0.030
	(0.2838)	(0.0780)	(0.4764)	
1875	2.5792 **	-0.1421 **	0.5596 **	0.175
	(0.1585)	(0.0395)	(0.2012)	
1880	2.5939 **	-0.2038 **	0.3260	0.203
	(0.2345)	(0.0473)	(0.2822)	
1885	2.1358 **	-0.0402	0.1308	-0.016
	(0.2258)	(0.0492)	(0.2312)	
1890	2.6686 **	-0.1698 **	0.1056	0.281
	(0.1387)	(0.0271)	(0.2228)	
1895	2.7562 **	-0.1150 **	0.0437	0.075
	(0.2148)	(0.0425)	(0.2329)	
1900	2.0341 **	-0.1467 *	0.9365	0.058
	(0.4225)	(0.0686)	(0.5549)	

Standard errors in parentheses. ** Significant at better than the 99% level. * Significant at better than the 95% level.

More elaborate models such as the addition of higher order distance terms as suggested by MacDonald and Bowman [1979] or the use of maximum likelihood estimators such as suggested by Kau and Sirmans [1979] bring little or no benefit over this simpler model. For example, second order and higher terms were rarely statistically significant and would not materially change our conclusions.

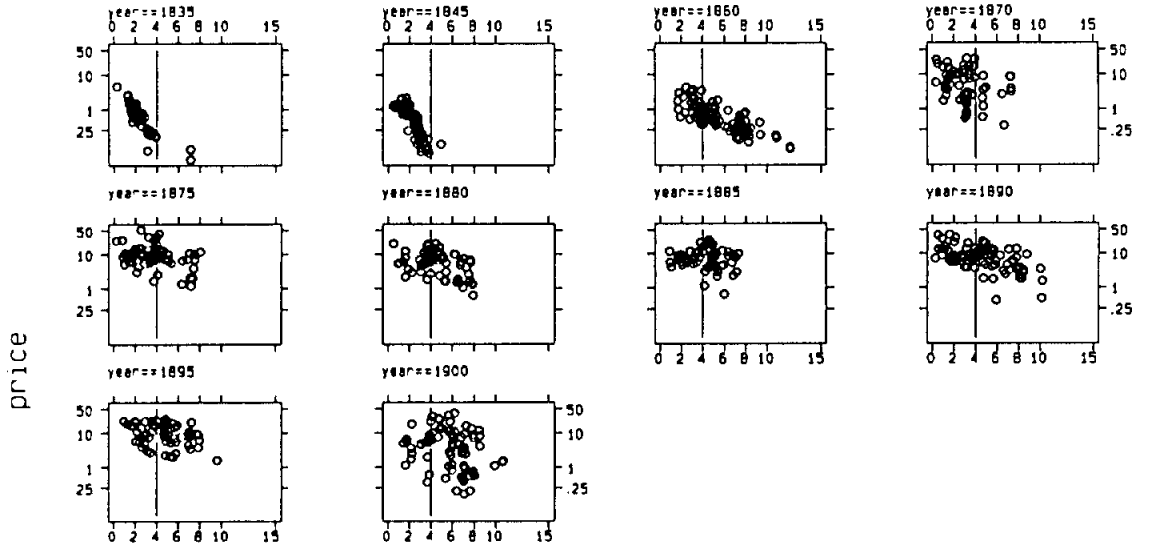


FIGURE 4

Scattergrams of the (log) Price of Vacant Land per Square Foot in Manhattan by Distance from City Hall, 1835-1900

(Note: Prices over $100/square foot excluded. The southern boundary of present-day Central Park is approximately 4 miles from City Hall, Columbia University is approximately 7 airline miles from City Hall, and the Washington Bridge is about 10 airline miles distant)

The constant term represents an estimate of the (log) price of land located in the CBD. This was higher post Civil War than pre-Civil War. In 1835, for example, the price for land located adjacent to city hall was a little over $2.50 per square foot and by 1845 it was selling for about $4 a square foot (Table 4).[9] Between 1845 and 1860, streetcars were added to 2nd, 3rd, 6th, 8th and

[9] The steepness of the 1845 gradient confirms results from Margo's (1996) study of the rental price of housing in antebellum New York city. According to Margo's hedonic regressions the rental price of housing declined by 0.169 (in logs) per mile from the CBD in the 1840s. Assuming that land was about 20 percent of the value of housing, that the cost of non-land inputs into housing production was independent of location as were discount rates, then the implied land gradient is -0.845 per mile. Allowing for some impression in Margo's estimates and the fact that the bulk of his observations are from the late 1840s, the two data sets yield remarkably consistent results.
However, while Margo's regressions imply that the land gradient should have flattened by 1860, the implied gradient is considerably steeper (approximately -0.6 in logs per mile). This suggests that changes in rents may have lagged behind

9th Avenues, opening up more distant locations to the CBD. This relatively sudden increase in the area of the city with relatively quick and easy access to the CBD may well explain the lower land values around city hall in 1860. Thereafter, land prices around city hall rose to about 1880, drifted lower in the 1880s before rising again in the 1890s. They appear to have fallen quite sharply around 1900, declining by about half to $7.60 per square foot in 1900.

In the monocentric urban model, the coefficient on distance should be negative. It was at each benchmark date, although it was not statistically significantly different from zero in either 1870 or 1885. It was also very small in those two years. This coefficient measures the percentage change in price per mile distance from the CBD. In 1835 and 1845, the gradient was very steep. Moreover, there is reason to believe that the 1835 estimate of the gradient is biased downward by the inclusion of six lots located north of what is now Central Park and which then was far beyond the boundaries of the city.[10] Restricting the 1835 estimate to locations within 4 miles of city hall sharply increases the slope of the estimated gradient for 1835 to -0.966, or to a level approximately the same as that estimated for 1845. In contrast, truncating the 1845 and 1860 distributions has only marginal effects upon our estimate of the gradients in those years.[11] These steep gradients mean that, in 1835, land just one mile from city hall sold for between about a third and a half of their price per square foot at city hall, while in 1845 land a mile distant from city hall sold for about a third of what it would have cost at city hall. The price gradient was less steep in later years (Figure 5). Prices fell by less than a third per mile distance to the CBD in 1860 and between 4% and 20% per mile from 1870 onwards.

This flattening of the price gradient is consistent with a story of improving transportation which led most of the interior avenues to be served by street cars by 1870 and with the spread of economic activity beyond a narrowly defined geographic area. One might speculate whether the changes in construction technology—first the introduction of the passenger elevator and later the use of skeleton framing to build taller buildings--offset these reductions in transport costs

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changes in land values or that in the wake of recent transportation improvements there may have been an upsurge in land speculation at more distant locations.

[10] See Figure 4. The six lots were located some 7 miles north of City Hall around 118th Street and they overlay one another in the graphs so only two are seen in the scattergrams.

[11] For example, restricting the 1845 and 1860 regressions to lots within 4 miles of city hall produces estimates for the price gradient of -1.095 and -0.362. At five miles the gradients would be -1.076 and -0.323 which are virtually identical with the unconstrained estimates.

permitting greater substitution of capital for land which might have had an offsetting effect on the gradient.

Corner lots were generally more valuable than interior lots, especially in commercial use. Consequently, they commanded a premium of around $1.50-$1.75 per square foot until about 1880 when the premium fell to about $1 per square foot. In 1900, they were much more highly valued, commanding a premium of over $2.50 per square foot. We suspect that these variations have much to do with the specific locations of corner lots in our benchmark year samples.

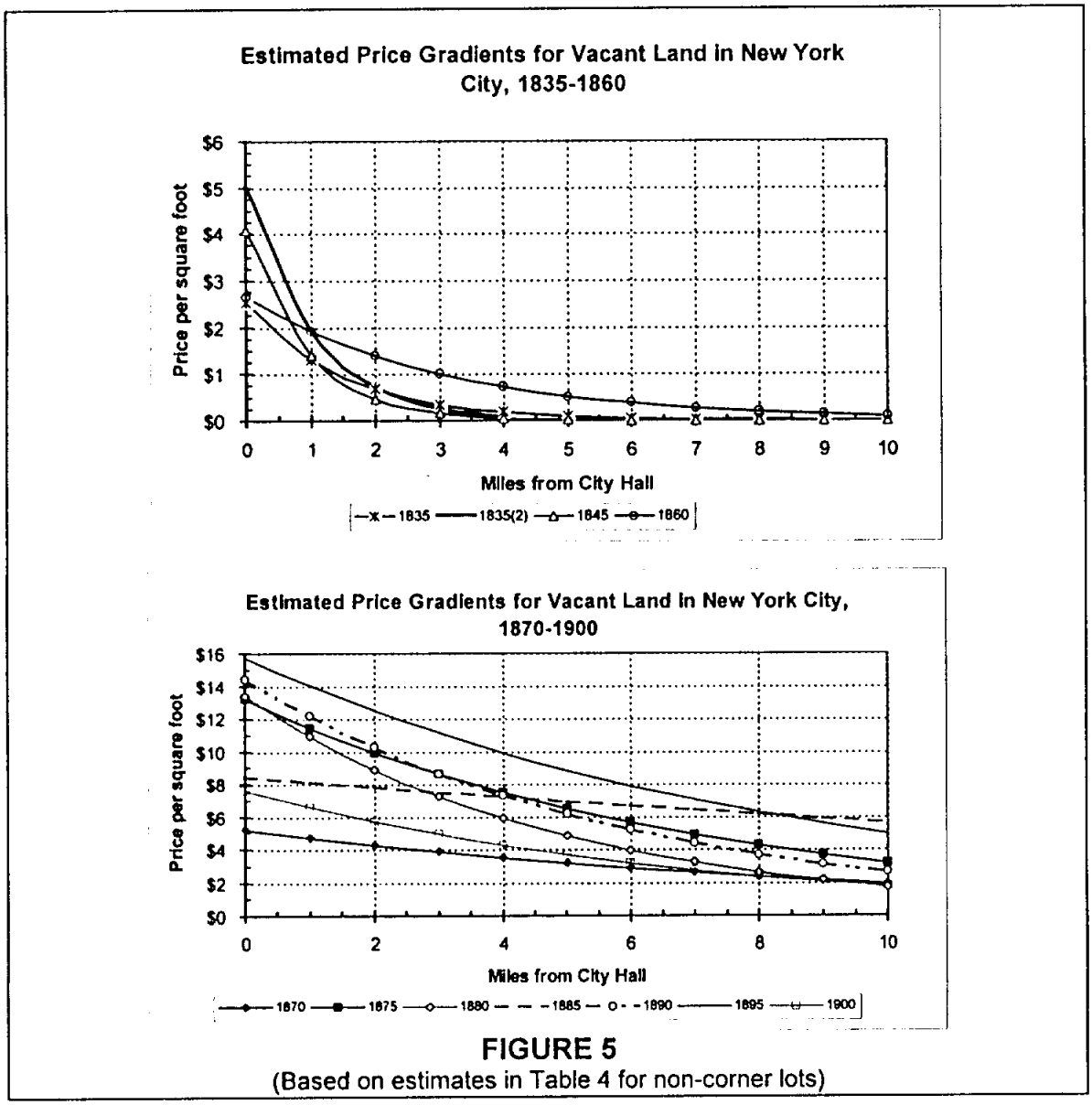

FIGURE 5
(Based on estimates in Table 4 for non-corner lots)

Fit, as measured by R^2 declines markedly between 1835 and 1900. In 1860 and earlier, we are able to explain 70 percent or more of the variation in price per square foot by distance from city hall and whether or not a particular lot was located on a street corner. Consequently, we estimate the price of land in the CBD, the price gradient, and the incremental value of a corner lot with a fairly high degree of precision. Towards the end of the century our estimates have little or no precision.

Comparing our estimates for New York city with those for Chicago reveals price gradients in New York city that are not radically different from those estimated for Chicago at about the same dates (see Table 1 above), except in 1835 and 1845 when the price gradients were much steeper. Thereafter, the price gradients in New York city were somewhat flatter than those in Chicago at about the same time. The big difference between our estimates for New York city and those for Chicago is in the magnitude of the constant term which is much higher in Chicago than in New York. This is consistent with our argument that our New York city lots were unimproved, vacant land whereas the land in the Chicago studies was more likely to be developed, especially later on and closer into the CBD. One other important similarity between our results and those for Chicago is the marked decline in fit as measured by the R^2. This is consistent with the growing heterogeneity of land and the state of its development. In our case it is also consistent with our selection of vacant lots. On average, the longer a lot stays undeveloped in a densely settled area, the less suitable for development that lot is likely to be.

We also estimated a somewhat more elaborate, pooled model which allows for different prices of land located at the CBD in each benchmark year and for different price gradients but which constrains corner lots to the same premium per square foot in each year (Table 5). Corner lots averaged a substantial premium, $1.50 per square foot, throughout the period. Despite this additional constraint upon the estimates, the estimated price gradients are little changed from the individual cross-sectional estimates. The gradient flattens substantially between 1845 and 1860 and between 1860 and 1870 but is relatively flat thereafter. Indeed, the hypothesis that the gradient is the same in 1875, 1880 and 1900 cannot be rejected. The benchmark year dummies indicate a substantial appreciation in CBD land prices from 1870 onwards.

Table 5
A Pooled Monocentric Urban Model of the Price of Vacant Land in Manhattan, 1835-1900

Variable	Regression Coefficient	Standard Error
Premium for a corner lot	0.4123 **	0.0650
Miles from the CBD in 1835	-0.6566 **	0.0476
Miles from the CBD in 1845	-1.0747 **	0.0588
Miles from the CBD in 1860	-0.3174 **	0.0264
Miles from the CBD in 1870	-0.1061 *	0.0486
Miles from the CBD in 1875	-0.1375 **	0.0431
Miles from the CBD in 1880	-0.2039 **	0.0438
Miles from the CBD in 1885	-0.0477	0.0504
Miles from the CBD in 1890	-0.1758 **	0.0284
Miles from the CBD in 1895	-0.1182 **	0.0436
Miles from the CBD in 1900	-0.1406 **	0.0366
Land premium in the CBD in 1845 relative to 1835	0.4687 *	0.1977
Land premium in the CBD in 1860 relative to 1835	0.0425	0.2044
Land premium in the CBD in 1870 relative to 1835	0.7432 **	0.2118
Land premium in the CBD in 1875 relative to 1835	1.6466 **	0.2154
Land premium in the CBD in 1880 relative to 1835	1.6452 **	0.2496
Land premium in the CBD in 1885 relative to 1835	1.1911 **	0.2653
Land premium in the CBD in 1890 relative to 1835	1.7246 **	0.1937
Land premium in the CBD in 1895 relative to 1835	1.7765 **	0.2526
Land premium in the CBD in 1900 relative to 1835	1.0985 **	0.2593
Land premium in the CBD in 1835	0.9395 **	0.1267
** Significant at better than the 99 percent level. * Significant at better than the 95 percent level.		

Where Was the CBD?

As noted at the outset, we have measured the distance of each property from City Hall which is located on the northern edge of what is now the financial district in lower Manhattan. This area constituted the central business district prior to the Civil War, not just for financial and commercial services but also in wholesaling and retailing. Later on, however, some activities, particularly many retail activities, moved uptown first to the area around Times Square and Grand Central Station and later on closer to Central Park. The effects of these migrations can be seen in the raw data, though as yet we have made no effort to model them econometrically.

We have grouped our sample lots by benchmark year and by approximate distance (at intervals of one mile) from City Hall and calculated the average price per square foot of lots in each cell. These are plotted by benchmark date in Figure 6. The data are quite suggestive but, as yet, hardly definitive as the cell sizes are often very small. Indeed, in some cases we currently

have no observations of lots at some particular distance from city hall. For example, we have no 1860 observations within one mile of city hall and in 1835 we have no observations between 4 and 6 miles. Nevertheless, we feel that there is a pattern here worthy of mention and of further investigation: the data for 1835, 1845 and 1860 fit the monocentric urban model quite well. Price per square foot declines monotonically with increasing distance from the CBD.

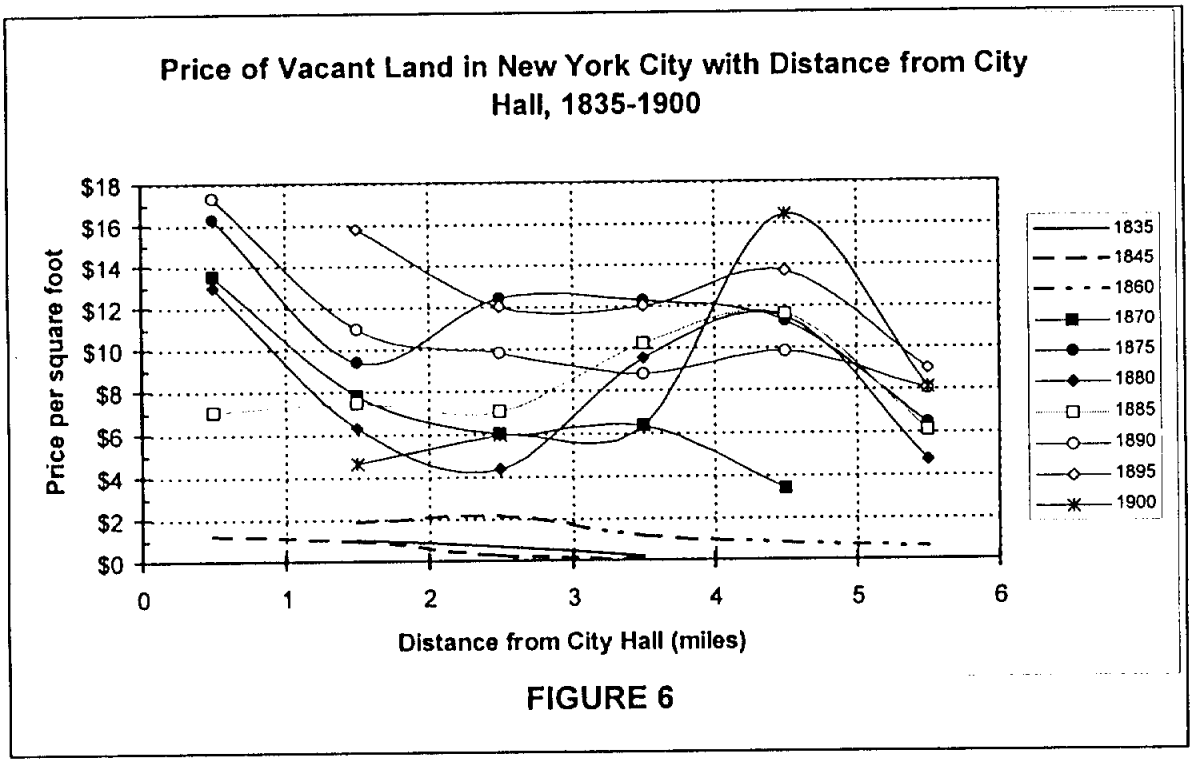

FIGURE 6

Thereafter, the average price of land per square foot initially declines with increasing distance from the CBD, but eventually price begins to increase again perhaps 3 miles or so from City Hall, reaching a local maximum about 4½ miles from the assumed CBD. Given the proximity of City Hall to the southern tip of Manhattan island, all these locations are all uptown and are in the neighborhood of the southern edge of Central Park which opened in 1859.

We have other independent check on our data and our approach: in his discussion of city land values, Hurd [1905, 157] reproduces a map showing the value per square foot of New York city real estate (Figure 7). No source or date are attached to these data but they are presumably for about 1900 and were probably based upon personal observations. According to these data, real estate at the southern edge of Central Park was valued at about $70 per square foot and

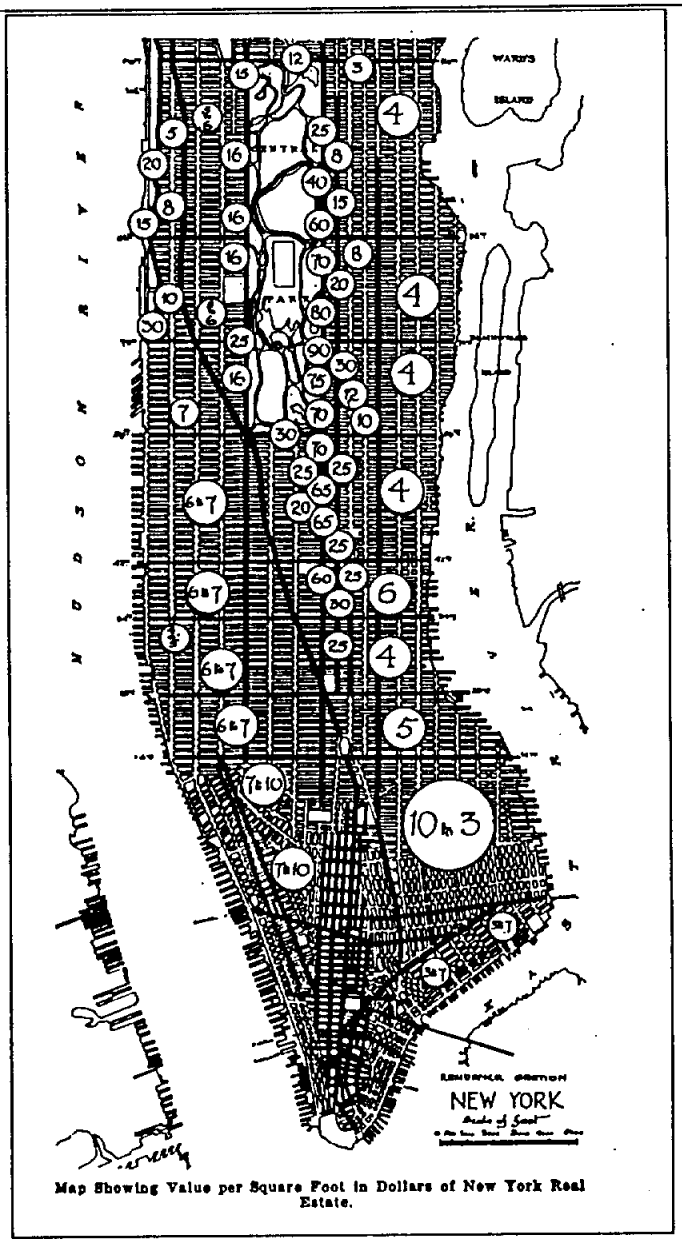

FIGURE 7
(Source: Hurd [1905, 157])

declined southwards (at least for properties in residential use). Around 42nd Street and Fifth Avenue, property values averaged $25-30 while in the East Village real estate was valued at between $3 and $10 per square foot. Using the rule of thumb that land represents about 20 percent of the value of real estate, Hurd's data imply that vacant land around Central Park South should have sold for about $14 per square foot—our estimate of the price of land around this same area, $16 per square foot (see Figure 5). Similarly, while Hurd's data imply a price of

around $5 per square foot in the vicinity of 42nd Street, our data value such land at around $6 per square foot. The only marked departure between our data and Hurd's appears to be in the East Village but our figures are still consistent with the implicit value of land in Hurd's estimate of the value of commercial and business real estate in the same area (Hurd, [1905, 158]).

Concluding Remarks

Notwithstanding differences between urban areas and differences in the nature and developmental state of land, our findings with respect to the price gradient on land and with respect to the simple univariate monocentric urban model mirror those of others. In New York, like elsewhere, the price gradient with respect to distance from the central business district flattens over time and the fit of the regression equation erodes. Our results also imply that vacant land on Manhattan was price elastic with respect to distance from the CBD in 1835 and 1845 but becomes price inelastic in the post Civil War period. One interpretation of this is that land located at a distance from the CBD becomes less of a substitute for land closer in to the CBD over time. This is consistent with the growing segregation in land use between commerce, manufacturing and residential housing in New York (Alonso [1964]). Commerce increasingly reigned supreme downtown while housing was pushed uptown and industry departed Manhattan for other boroughs.

Our results also yield interesting implications in light of Margo's [1996] work on the residential rental market. His hedonic regressions imply that, circa 1845, a single "room" (size not known) in the vicinity of the CBD rented for about 20 cents a night when leased on an annual basis, or about $75 per year or $6.25 per month. Our estimates imply that land within a half mile or so of city hall sold for about $2.40 per square foot at about the same time. Assuming that land costs represent about 20 percent of housing costs, this implies that housing in the same vicinity should have cost about $12 per square foot. We do not know the precise relationship between annual rental values and sales price but the few advertisements found by Margo quoting both suggest a factor of proportionality of about 0.05 to 0.06. If so then housing should have rented for between 60 and 72 cents per square foot per year, implying that the average "room" was between about 100 and 125 square feet—say 10'x10' or 10'x12'. This, to us, seems quite plausible.

If our results hold up as we add more observations for each year, additional years, and other cities then they have some potentially importantly implications for the cost of living and the standard of living for Americans during the nineteenth century. Unless land costs early in the nineteenth century were a dramatically smaller share of the cost of housing than in more modern times, then the spectacular increase in the price of land implies a proportionately similar rise in the cost of housing, or a sharp downward adjustment in living space, or a budgetary reallocation in favor of more commuting cost, none of which is adequately factored into existing price and real wage indexes.

Our results also embody implications about people's expectations regarding urban growth in the North after the Civil War. The 1860s are known to have been a decade of very slow economic growth and very high rates of inflation (Engerman [1966]; Gallman [1960]; Long [1960]). However, even adjusting for changes in the general price level, average land prices in New York City were, according to our sample, 5.8 times higher in 1870 than 1860—and, as we have noted, these price increases were sustained for the rest of the century. Because the distance gradient evidently flattened between 1860 and 1870, the average increase in the price of land was much smaller at the CBD. Clearly, investors in New York City real estate in the immediate postbellum period must have felt enormous confidence about the prospects for growth "uptown" to have been willing to pay what were—by antebellum standards—extraordinarily high prices for land several miles from City Hall. Given the outcome of the Civil War, an interesting extension of this paper would be to collect similar land price data for some Southern cities, where expectations of future growth circa 1870 may have been rather different than in New York.

References

Alonso, William. *Location and Land Use: Toward a General Theory of Land Rent* (Cambridge: Harvard University Press, 1964)

Blackmar, Elizabeth. *Manhattan for Rent, 1785-1850* (Ithaca, New York: Cornell University Press, 1989).

Brown, Henry Collins. *Old New York: Yesterday & Today* (New York: privately printed for Valentine's Manual, 1922),

Condit, Carl W.. *The Port of New York* (Chicago: University of Chicago Press, 1980, 1981)

Duffy, John. *A History of Public Health in New York City* (New York: Russell Sage Foundation, 1968).

Edel, Matthew and Elliott Sclar. "The Distribution of Real Estate Value Changes: Metro Boston, 1870-1970," *Journal of Urban Economics* 2 (1975): 366-87.

Engerman, Stanley. "The Economic Impact of the Civil War," *Explorations in Economic History* 3 (1966): 176-99.

Gallman, Robert. "Commodity Output, 1839-1899," in NBER Studies in Income and Wealth Volume 24, *Trends in the American Economy in the Nineteenth Century*, (Princeton: Princeton University Press, 1960): 13-67

Gin, Alan and Jon Sonstelie. The Streetcar and Residential Location in Nineteenth Century Philadelphia," *Journal of Urban Economics* 22 (1992):92-107.

Hoyt, Homer. *One Hundred Years of Land Value in Chicago* (Chicago: University of Chicago Press, 1933)

Hurd, Richard M. *Principles of City Land Values* (New York: The Record and Guide, 1905), second edition.

Jackson, Anthony. *A Place Called Home: A History of Low Cost Housing in Manhattan* (Cambridge: MIT Press, 1976).

Jackson, Kenneth T. *Encyclopedia of New York City*, (New Haven: Yale University Press, 1995)

Kau, James B. and C. F. Sirmans, "Urban Land Value Functions and the Price Elasticity of Demand for Housing," *Journal of Urban Economics*, 6 (1979): 112-121.

Kau, James B., C. F. Lee and C. F. Sirmans, "Urban Econometrics," in *Research in Urban Economics*, 6 (1986)

Lockwood, Charles. *Bricks and Brownstones: The New York Row House, 1783-1929. An Archetectural and Social History.* (New York: McGraw-Hill, 1972)

Long, Clarence. *Wages and Earnings in the United States, 1860-1890.* (Princeton: Princeton University Press, 1960).

Longstreet, Stephan, *City on Two Rivers: Profiles of New York—Yesterday and Today* (New York: Hawthorn Books, 1975)

McDonald, John and H. Woods Bowman. "Land Value Functions: A Reevaluation," *Journal of Urban Economics* 6 (1979): 25-41.

McMillan, Daniel P.. Ronald Jarmin and Paul Thorsnes. "Selection Bias and Land Development in the Monocentric City Model," *Journal of Urban Economics* 22 (1992): 273-84.

Margo, Robert A. "The Rental Price of Housing in New York City, 1830-1860," *Journal Of Economic History*, forthcoming.

Mills, Edwin. "The Value of Urban Land," in Harvey Perloff (ed.) *The Quality of the Urban Environment*, (Baltimore: Johns Hopkins University Press, 1969): 231-53.

New York Daily Advertiser, various issues 1835.

New York Herald, various issues 1845-.

New York Times, various issues 1860-..

New York Tribune, various issues 1845-.

Olcott, George C. *Land Values Blue Book of Chicago.*

Rees, Albert. *Real Wages In Manufacturing, 1890-1914.* Princeton: Princeton University Press, 1961.

Rosenwaike, Ira. *Population History of New York City,* (Syracuse: Syracuse University Press, 1972).

Scherzer, Kenneth. *The Unbounded Community: Neighborhood life and Social Community in New York City, 1830-1875* (Durham: Duke University Press, 1992).

Spann, Edward K. "The Greatest Grid: The New York Plan of 1811" in D. Schaffer (ed.) *Two Centuries of American Planning*, (Baltimore: Johns Hopkins University Press, 1988): 11-39.

Weidner, Charles H. *Water for a City: A History of New York City's Problem from the Beginning to the Delaware River System*, (New Brunswick: Rutgers University Press, 1974)