What Explains Manhattan's Declining Share of Residential Construction?

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Abstract

Dense, expensive, litigious, and highly regulated, Manhattan typifies coastal US housing markets. Manhattan has lost share of US residential construction over the last 45 years. Some attribute this trend to tightening local regulation, but the decline of public housing construction and the decreasing national share of construction that is multifamily jointly explain away Manhattan's decline. Across US counties, negative correlations between supply growth and both coastal status and regulations disappear conditional on population density.

JEL Keywords: Housing Supply and Markets; Regulatory Policies; Land Use Patterns.

1 Introduction

Why is Manhattan so expensive? For that matter, why have coastal metropolitan areas gotten so expensive? A prominent explanation relies on the familiar fact that residential development is more heavily regulated in coastal areas than elsewhere.[1] If mobility across metropolitan areas is inelastic with respect to housing prices, then a common increase in demand growth will lead to greatly increased supply and limited price appreciation in most of the country, but greatly increased prices and limited supply growth on the coasts.

Glaeser et al. (2005b) extend this argument and claim that tightening regulations have caused price appreciation to accelerate on the coasts. Glaeser et al. (2005a) use Manhattan as a case study, showing that construction volume and sensitivity to price have fallen with

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[1] See, e.g. Green et al. (2005).

time. While there is almost no vacant land in Manhattan, there are certainly buildings that could be redeveloped profitably if floor area ratios were unconstrained.

National trends driven largely by federal policy provide an alternative explanation for Manhattan's reduced share of national housing supply, and for reduced relative coastal housing supply generally. Because Manhattan land is too expensive for all but a small number of extremely rich people to build single family homes, almost all residential construction in Manhattan is multifamily (2 out of 113 newly permitted buildings and 8,790 new units were single family in 2006).[2] Multifamily housing construction in the US been buffeted by at least two types of shocks in the post-war period. First, in the 1950s through the 1970s, a large quantity of public and subsidized housing was financed by the federal government, triggered by the Housing Act of 1949. Direct federal housing assistance was sharply cut back starting around 1980.[3]

The second set of changes to federal policy relate to the tax treatment of rental housing, which is typically multifamily.[4] Federal tax laws became more generous and then much less generous to rental housing construction in the 1980s through treatment of depreciation and losses. Complementary to these tax law changes were changes in the regulation of savings and loan institutions that sharply increased and then reduced credit available to developers of rental real estate. The reductions in tax support were offset somewhat by the introduction of affordable housing tax credits.[5]

Whatever the cause, the share of new housing units that were multifamily declined substantially between the 1980s and today. Between 1959 and 1986, the fraction of permits

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[2] That construction in Manhattan is almost exclusively restricted to buildings with multiple units is consistent with predictions from the basic theory of housing production. The structure to land ratio increases with the price of land, so tall buildings with many units are restricted to expensive land while low density structures dominate where land is inexpensive. This basic insight provides the foundation for recent advances in the estimation of housing production and supply functions. Empirically, Sieg et al. (2010) find that housing supply per unit land is highly price elastic.

[3] von Hoffman (2000) and Quigley (2000) provide histories.

[4] In the 2000 US Census, 86% of owner occupied units were single family homes. Only 30% of rental units were single family homes.

[5] See Poterba (1992).

that were multifamily closely tracked total supply, with a correlation of .44.[6] At the peak of the 1980s housing boom, 33% of permits in the US were issued to units in buildings with at least five units. At the peak of the recently ended boom, despite far higher real housing prices and greater total residential construction, the fraction was 18%. The bottom panel of Figure 1 illustrates this drop.

Section 2 of this paper shows empirically that a negative time trend in Manhattan's share of US multifamily building permits over the past five decades can be explained away by the end of the boom in publicly owned and subsidized housing projects. Almost equivalently, Manhattan's declining share of all US building permits can be explained away by a combination of the end of New York City's urban renewal and public housing boom and cycles in the share of all US building permits issued in multifamily housing developments. These results are interesting because Manhattan is the quintessential highly regulated, densely populated, and expensive US coastal housing market. A natural question is thus whether similar markets' historical supply performance may relate importantly to the density and reliance on multifamily housing prevalent on the coasts.

Section 3 verifies that coastal and highly regulated counties in the US generally have seen relatively weaker supply growth than other counties since the 1940s. However, consistent with the results for Manhattan, neither coastal status nor regulations are associated with weak growth conditional on population density (and hence reliance on multifamily housing).

In both sections 2 and 3, regressions are estimated both with and without controls for changing relative rents on the coasts. Rents and supply are determined simultaneously, so I make some effort at providing exogenous proxies for rent. If the proxies for rent are exogenous to supply choices, then regressions can determine if regulations are associated with inward shifts in supply given different demand movements along different regions' supply curves.[7]

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[6] Authors' calculation based on US Census building permit data.

[7] Given data limitations and the likelihood that regions' supply elasticities would vary with factors such as price volatility likely correlated with all of the right hand side variables, I do not try to estimate or decompose differences in elasticities. If a regression of log quantity on log rent, it were found that regulations were associated with a higher constant but a lower interactive relationship with log rents, the implications for regulations' effect on prices would be ambiguous.

Section 4 summarizes and lists some important caveats to the major results. Given that regulations may reflect growth pressures, the results of Section 3 highlight the need for quasi-experimental analysis of changes in supply and regulations in individual markets and should be seen as suggestive.

2 Manhattan

There is no question that Manhattan's share of all US residential construction has fallen from a peak around 1960. The top panel of Figure 1 shows this by plotting the annual ratio of building permits issued in Manhattan to the number of building permits issued in the United States against time between 1959 and 2005. The Census Bureau collects this information from local permitting authorities.[8] In this data, the number of permits is the number of units permitted, so a building with ten apartments counts as ten permits. Only new construction counts; permits issued to renovate existing structures are supposed to be excluded.

Glaeser et al. (2005a) argue that increasing regulation has caused the supply trend and show that the elasticity of building permits with respect to rents and prices has fallen in Manhattan since the 1960s. Manhattan has had zoning since the early 20th century, but regulation may have intensified around 1960. Restrictions on demolition of existing structures tightened after a preservation movement arose in response to extensive urban renewal, and a newly restrictive zoning code was instituted in 1961.[9] Whether or not obstacles to private development in Manhattan and elsewhere have grown close to monotonically since the 1960s has not been established.

The bottom panel of Figure 1 plots two time series from 1959 through 2005. The first

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[8] Joseph Gyourko and Raven Molloy generously shared the Manhattan Census data, which they collected by hand.

[9] In the authors' words: "there has been a reallocation of property rights over the past 30 years. In the 1960s, landowners were generally free to develop their property in the manner they desired. However, neighbors have become increasingly effective in opposing new construction in more recent decades." That the 1960s were largely regulation-free is inconsistent with the notion that 1961's rezoning was pivotal.

is the annual fraction of all US residential permits issued for units in buildings with five or more units. The multifamily series looks like a smoothed version of the analogous Manhattan share plotted in the top panel, except for a failure to match the Manhattan share's sharp decrease between 1960 and 1964. After 1964, there is no trend toward Manhattan having a diminished share of multifamily construction. Perusal of Glaeser et al. (2005a) supports a non-market interpretation for the initial spike and decline, because Consumer Price Index estimates of housing costs in New York indicate no unusual changes around 1950-1964.

Part of the initial spike in Manhattan's share of US construction could have been a reaction to the City's 1961 zoning resolution, a major reform in New York City's regulatory environment. DeSalvo (1970) argues that in anticipation of the change, a large number of property owners sought to build at pre-zoning allowable levels.[10] The facts that high permitting persisted in 1962 and 1963, and that Manhattan construction rose sharply after 1964 cast doubt on this interpretation, however. Moreover, the New York City Department of City Planning (2008) states that the increased rigidity in the 1961 zoning regulations applied primarily outside of Manhattan. Still, an announcement of reduced construction possibilities outside of Manhattan may have led to a jump in Manhattan and hence increased construction intensity. It is also conceivable that projects with pre-development started prior to passage of the zoning resolution might have been grandfathered for building permits under new zoning, sustaining high permitting levels through 1963.

Whatever the precise role of the 1961 zoning law change, the very high Manhattan share of US construction around 1959-1963 did not reflect a steady state under the old zoning regulations. According to data compiled by Glaeser et al. (2005a), Manhattan's average construction volume over this period was three times the annual level from 1950 to 1959 and construction in 1965 (8,245 units) exceeded the average for 1950 to 1959 (5,644 units).

An alternative explanation for the spike in construction in the years 1959 to 1963 is a fact noted by von Hoffman (2000): during the late 1950s and early 1960s, New York's

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[10] This reference was suggested by Edgar Olsen

redevelopment czar, Robert Moses, was able to capture a large share of urban renewal funding from the federal government for New York City and hence Manhattan.[11]

To test whether the initial spike in Manhattan construction relates to a temporarily very high level of federally and locally subsidized urban renewal projects, I construct a time series of the annual number of public housing projects permitted in Manhattan in this period. This series, plotted along with the national multifamily share in the bottom panel of Figure 1 fits the early spike in Manhattan's share of all US residential construction with remarkable precision.[12]

The building permit data plotted in Figure 1 may be meant to exclude public housing,[13] but includes subsidized privately owned and not-for-profit urban renewal projects. Either way, public housing projects may be a good proxy for federally subsidized non-public housing, in that Moses spurred construction of both during the same time period. Inspection of the micro Manhattan permit data from 1959 through the mid-1960s reveals that much of the permitting volume was from large urban renewal projects not undertaken by the New York City Housing Authority ("NYCHA") e.g. Manhattantown, Chatham Green, and the ILGWU houses, all in 1959, that should be included in the US permit data.

Public housing, perhaps proxying for urban renewal, also explains a jump in Manhattan permitting before 1959. Total permits were 5,286; 9,371; and 15,140 for the years 1957, 1958, and 1959. Housing Authority projects in Manhattan for those years numbered 10, 11, and 23. Between 1951 and 1955, permits averaged less than 5,000 per year and the project data lists no more than five separate NYCHA projects in any single year. Part of the jump in permitting could have reflected anticipation on the part of Moses and NYCHA that rezoning and a general change in the political atmosphere would limit future opportunities for large

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[11] For a history of Moses' role, see Caro (1974).

[12] Raw data is available online from a non-profit group in New York City, the Office for Metropolitan History. This group has a database of building permits issued in Manhattan, with project level detail: `http://www.metrohistory.com/dbpages/NBsearch.lasso`. The time series Projects is my own hand count of projects (not units) from that list.

[13] The current permitting series excludes public housing, but in earlier years aggregate and private totals were provided. Staff at New York's department of building permits were unsure if public housing units were included in historical data sent to the Census Department.

project development; likewise, the rezoning may have reflected distaste for urban renewal.

Quantifying the plots in Figure 1, Table 2 reports results from the following regression:

$$\text{Manhattan Ratio}_t = \beta_0 + \beta_1\text{Projects}_t + \beta_2\text{Year}_t + \gamma\text{Rent Ratio}_t + u_t. \tag{1}$$

Associated summary statistics are presented in Table 1.

The dependent variable Manhattan Ratio represents the percentage of all US residential building permits issued in Manhattan in columns (1) and (2). In columns (3) through (7), the denominator of Manhattan Ratio is the number of all US residential building permits that were in multifamily buildings with five or more units, but the numerator is still all units permitted in Manhattan. β_2 is the estimated effect of the passage of one year on the dependent ratio. Specification (7) is estimated in first differences, so that β_2 disappears and the coefficient β_0 represents an estimate of a trend. I measure growth in levels rather than logs as logs are heavily driven by negative outliers in 1975 and 1976 (perhaps corresponding to New York City's fiscal crisis); there is no significant negative time trend in the log ratio of Manhattan to all US permits, even unconditionally.

Specifications (1) through (6) of equation (1) are in levels; specification (7) is in first differences. Given these are time series regressions, if the dependent variable and one or more right hand side variables are random walks, then standard errors are incorrect. Dickey Fuller tests fail to reject the null hypothesis of a random walk for either Manhattan Ratio for the full sample, but reject for both ratios at the one percent level for the period after the urban renewal years (1965-2006). The one year difference in the ratio of Manhattan to multifamily is rejected at the five percent but not one percent level for the entire sample, and is rejected for the post-1965 period at the one percent level. All of the regressions that include a variable that could have a spuriously significant coefficient estimate thus either condition on permits (approximately controlling for being in a year prior to 1965, specifications (2) through (4)) or exclude the years prior to 1965 (specifications (5) through (7)).

In the absence of a measure of relative prices or demand, the regression (1) asks if Manhattan has seen shrinking total or multifamily supply relative to the rest of the United states. If β_2 is not significantly negative then there is no support for the claim that Manhattan has become more expensive than other markets due to shrinking relative supply of multifamily housing in the face of common demand shocks.

Tightening supply restrictions in Manhattan could have played a role in rent and price appreciation even if relative supply of multifamily housing has not fallen over time. As observed by Van Nieuwerburgh and Weill (2006) and Gyourko et al. (2004), expansion of the financial services sector and increasing concentration of wealth should have increased demand for living in Manhattan relative to other parts of the US. If the right hand side includes a valid measure of the ratio of willingness to pay to live in Manhattan versus the rest of the country that is not itself a function of supply, then β_2 measures whether supply has decreased over time relative to markets experiencing similar demand pressures.[14] Rent Ratio, the ratio of rental housing costs in the New York metropolitan area to those in the US as a whole, as measured by the Consumer Price Index, is included in specification (5) and a proxy that is plausibly exogenous to supply is included in specification (6).

Column (1) of Table 2 illustrates the point of Glaeser et al. (2005a) seen in the top panel of Figure 1: building activity in Manhattan has fallen significantly over time relative to construction in the US as a whole. The coefficient of -.017 on the year variable implies a reduction in Manhattan's share of US residential permits of .017% per year. Including the number of NYCHA projects permitted in Manhattan in column (2) reduces the magnitude of the estimated time effect β_2 by more than half and eliminates statistical significance. That is, we can not reject the null hypothesis that conditional on a proxy for the extent of urban renewal activity, there is no trend towards a reduction in Manhattan's share of US residential permitting.

Column (3) of Table 2 shows that conditional on the number of projects, Manhattan's share of US multifamily housing is trending upward, although the effect is insignificantly

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[14] In unreported regressions, I find a positive interactive effect between time and rent, suggesting that elasticity has not fallen over time.

different from zero. Column (4) shows that an indicator for the year being after passage of the 1961 rezoning has no effect on the regression estimated in specification (3), other than to increase the standard error on the estimated effect of projects. The coefficient of -.017 on the post-1961 dummy is the equivalent of the loss of 2/3rds of a housing project per year, small relative to the standard deviation of the Projects variable of approximately 6.

An alternative way to check if there is any time trend in Manhattan's share of all US construction is to maintain the denominator used in columns (1) and (2) and to then add the Projects variable and the multifamily share plotted in Figure 1 as controls. Table 2 does not report this essentially redundant result, but the coefficient on Year falls in magnitude from a significant -.017 with no controls, to an insignificant -.007 with only Projects as a control, to an insignificant -.003 with both Projects and the multifamily share as controls.

Specification (7) of Table 2 verifies that there is no trend in a different way. This specification regresses the annual change in the ratio of Manhattan to US multifamily permits on only a constant for the period after 1964. The constant term is insignificantly positive (that is, the mean annual change is positive).[15]

A nondecreasing share of national multifamily construction for Manhattan could reflect tightening regulation if demand for apartment space in Manhattan has increased due to a shift in US production towards financial services and other industries that tend to locate in Manhattan or a relative increase in wealth at the high end of the income distribution.[16] Including either price or actual employment as a measure of demand on the right hand side of regression (1) would create a severe endogeneity problem, as both are directly influenced by present and future Manhattan supply.

The ratio of rents in Manhattan to average rents in the US may be both a reasonable proxy for demand and not caused by contemporaneous permitting in either market. Construction on multifamily housing is not generally completed within the same calendar year

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[15] If the full sample is included and differences in projects included on the right hand side, then there is a negative point estimate for the intercept, but standard errors are very large. Oddly, in that specification, the intercept falls in half if the ratio of Manhattan to all US permitting is on the left hand side.

[16] See Van Nieuwerburgh and Weill (2006) and Gyourko et al. (2004).

as the permit is issued.[17] In specification (5) of Table 2, there is an insignificantly positive relationship between Rent Ratio on the dependent permitting ratio. More importantly, conditional on this demand measure, the coefficient β_2 on year remains insignificantly positive.

Specification (6) of Table 2 includes a control for Manhattan's predicted employment as a share of national employment based on 1975 industry shares and subsequent growth by industry as an alternative measure of demand. Specifically, using Bureau of Labor Statistics data from firm unemployment insurance payments, I calculate for each year t between 1975 and 2002 a predicted Manhattan share of national employment as:

$$\text{Employment}_t = \frac{\sum_i m_{i1975} \frac{n_{it}}{n_{i1975}}}{\sum_i n_{i1975} \frac{n_{it}}{n_{i1975}}}, \tag{2}$$

m_{it} is employment in 2 digit SIC code industry i in year t in Manhattan and n_{it} is similar employment in the entire US. Conditional on this industrial growth proxy for demand, there is again no evidence of a time trend in the ratio of Manhattan permitting to all US multifamily permitting, as β_2 is insignificantly positive. Instrumental variables regression is not a possibility as there are too few observations (and the two demand proxies are negatively correlated). A more plausible instrumental variables approach is described in Section 3; Manhattan has positive residuals in those regressions, confirming that Manhattan has not had abnormally slow supply growth, even conditional on demand.

There is thus no significant time trend in Manhattan for tightening regulations to explain, conditional on urban renewal in Manhattan and the time series of national multifamily permitting. Conditioning on available measures of demand does not alter this conclusion. Local regulation explains the drop in Manhattan's share only if one believes that both: (a) the spike in Manhattan residential construction from 1959 to 1963 was driven by steady state private sector considerations, not either subsidized urban renewal (despite the nearly

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[17] That absence of reverse causality becomes implausible when serial correlation in permitting is considered. Prices are not a suitable measure of demand because they may incorporate expectations about future supply. Actual rent levels do not belong in a differenced specification, because lagged permits directly affect current rents.

perfect correlation with public housing projects that were driven by urban renewal funding) or one-time reactions to the 1961 zoning law change; and (b) the trend towards restrictive regulation in Manhattan ended in 1964.

A more appealing explanation grounded in policy is that federal redevelopment subsidies and tax treatment of rental housing have been important and changing drivers of residential construction in Manhattan, where almost all housing is multifamily. These phenomena clearly explain the early spike (urban renewal) and the spike and collapse between 1982 and 1990 (the rise and fall of favorable treatment of rental housing) in Manhattan's share of all US construction.

I offer an empirical focus on Manhattan because Glaeser et al. (2005a) have raised the profile of this case and unearthed a long time series of Census building permit counts for Manhattan. However, Manhattan typically accounts for less than one percent of all US residential construction and is not even the dominant source of supply in the New York metropolitan area. Moreover, one might argue as Glaeser et al. (2005a) do, that permitting is becoming more difficult nationally. The results for Manhattan might thus reflect a nationally shared local policy trend against multifamily housing as much as they do the changes in urban renewal tax policy. A slow trend, though, does a very poor job of characterizing the highly volatile multifamily share series plotted in the bottom panel of Figure 1. Notably, the national multifamily share was roughly the same in 2006 as in 1959. Alternatively, the decline of multifamily housing might also relate to a general postwar trend towards suburbanization and movement of population to the less densely settled South. These possibilities are considered in Section 3.

3 Coastal America Generally

The analysis of Manhattan suggests that density and its attendant reliance on multifamily housing may better explain reduced coastal supply generally than do regulations or other characteristics of coastal areas. To explore this possibility, I consider a panel of supply and other characteristics of US counties described below and summarized in Table 3.

The dependent variable of interest is long-run changes in housing supply. I use decennial census county-level estimates of the number of homes built since the prior census year, based on surveys of existing homes. These estimates are available by county from 1950 through 2000.[18] These counts are entirely consistent with the annual building permit data described above. At the county level, there is a correlation of .99 between the 1990 census count of homes built since 1980 and the sum of census building permit counts from 1980 through 1989 based on surveys of permitting entities. For the 2000 census, the correlation is .97. I calculate decade-to-decade log changes in this supply measure, e.g. $\log \frac{\text{units built 1990-1999}}{\text{units built 1980 to 1989}}$. Table 3 shows a mean of .21 for this variable for each of 216 counties times five years of differenced data.[19]

I measure an initial population density as log county population divided by land area in square kilometers in 1940. The relationship between this initial condition and future multifamily share is remarkably strong. The correlation is .53 between 1940 population density and the fraction of units built between 1980 and 2006. The correlation between 1940 multifamily share and subsequent multifamily share, by contrast, is almost zero.

I define counties as "coastal" if they lie within metropolitan areas with at least one county that (a) borders an ocean or major bay and (b) is within the states of California, Oregon, Washington, Massachusetts, Rhode Island, Connecticut, New York, or New Jersey. These definitions are based on my understanding of common meaning. The results presented below do not change meaningfully if the West Coast (California) is excluded. Given the availability of regulatory data described below, the coastal metropolitan areas (cbsas) are: Boston, Hartford, Los Angeles, New York, Norwich-New London, Providence, San Diego, San Francisco, and San Jose.

I borrow an estimate of regulatory levels by county from the survey of local governments

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[18] Historical census data comes from the ICPSR.

[19] Treating the five differences as separate observations could make a difference when rent is introduced.

described in Gyourko et al. (2006). This survey asked planning and political officials in jurisdictions throughout the US to report a large number of characteristics of the development process in their community. The authors derive a single score for regulatory intensity through factor analysis, with a higher score reflecting more regulation. I calculate GSS as the simple average of the index across jurisdictions in a metropolitan area. This aggregation allows imputation of metropolitan average values to counties with no jurisdictions reporting. Approximately 45 percent of the variation in GSS is absorbed by metropolitan area fixed effects, so the aggregation is meaningful. The national mean of the GSS index is zero, with a standard deviation of one. The sample here has a slightly higher mean as metropolitan counties are more highly regulated than non-metropolitan areas.

Another commonly used regulatory index is Linneman et al. (1990) (LSBB). Notably this latter measure is highly correlated with GSS at the metropolitan area level (at which LSBB is calculated), but the correlation is close to zero conditional on coastal status. There is no evidence that differences in the two measures reflect recent changes in relative regulation across markets. This suggests that almost all meaningful variation in regulations may be captured by coastal status, so that regressions with both coastal status and regulations on the right hand side must be interpreted with caution. The correlation between GSS and coastal status is .51 (as opposed to .43 with the LSBB regulatory index). The correlation between GSS and density is .29, and between coastal and density is .45. Unfortunately, a panel of regulations is not available, so there is no way to determine if time series changes in regulations are associated with changes in supply.

It may be of interest to know not only whether coastal supply has fallen relative to supply in non-coastal counties, but also relative to demand. Changes in county level rent is included in some specifications, but with decade to decade changes there is a severe endogeneity problem. A lagged increase in supply may cause a decrease in rents, biasing up the estimated coefficient on changes in rent. As in the case of Manhattan, I proxy for changes in log real local rents "Δ rent" with changes in log mean rent in a similar metropolitan area "Δ neighbor's rent". This instrument should not be correlated with supply in the metropolitan area of interest when year dummies are included. I calculate a "similar" metropolitan area based on minimal distance. Distance between metropolitan areas i and j is calculated as:

$$d_{ij} = \sqrt{\sum_k \frac{(k_j - k_i)^2}{\text{var}(k)}}. \tag{3}$$

In (3) k are the characteristics latitude, longitude, median rent in 1940 and population density in 1940. The rent instrument neighbor's rent in census year t for all counties in metropolitan area i is set equal to the mean median rent in year t for the counties in the metropolitan area j that minimizes the distance in (3). To avoid the problem of spatial correlation in regulations, I only impute rents from non-coastal metropolitan areas to any county.

To get an idea of the relative roles of density, coastal status, and regulation I estimate six versions of the following equation:

$$\Delta\text{supply}_{it} = \alpha + \beta_c\text{coastal}_i + \beta_g\text{GSS}_i + \beta_d\text{density}_{i,1940} + \gamma\Delta\text{rent}_{it} + \sum_t \eta_t \text{I}_t + \epsilon_{it}. \tag{4}$$

In equation (4), Δ supply_{it} is as described above. Δ rent_{it} refers to the log ratio of rents in t to $t-10$.[20] The characteristics GSS regulations, coastal, and density as of 1940 are time invariant.[21] With the differencing in (4), the coefficient on GSS will be biased if regulations have arisen in response to an upward trend in growth pressures, but not if regulations are caused by constant differences in growth pressures.

Table 4 presents results of estimating equations of the form (4). In the first four specifica-

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[20] When rent is included on the right hand side, it is implicitly assumed that rents were constant from $t-20$ to $t-10$ and then jumped after the census in $t-10$ and were constant until measured in t. The coefficient on rent switches sign if lagged log rent changes are used, but other results are essentially unchanged.

[21] I use the 1940 density baseline only, as changes in density are mechanically correlated with changes in supply.

tions, the coefficients of interest are invariant to the presence or absence of the year dummies d_{it} for 1960, 1970...2000 because coastal, density, and GSS are time invariant. With standard errors clustered at the cbsa level to allow for serial correlation and shared characteristics, the d_{it} do not affect standard errors either, so they are excluded. Mean changes in real rent are different by decade, so the last two specifications include year dummies.

Specification (1) of Table 4 shows that there is a significantly negative unconditional relationship between GSS regulations and historical supply growth. Specification (2) shows that this relationship becomes insignificantly positive conditional on log 1940 county density. The elasticity of ten year permitting growth with respect to 1940 density is approximately 9%.

Specification (3) and (4) of Table 4 repeat the results of (1) and (2), but with coastal status taking the place of regulations on the right hand side. Unconditionally, coastal metropolitan areas have seen growth rates of approximately 20 percent less per decade than other US counties. However, conditional on density, coastal metropolitan areas have not seen significantly slower growth than other areas.

The last two specifications presented in Table 4 include log change in rent uninstrumented (5) and instrumented with change in neighbor's rent (6) as well as GSS regulations, coastal status, density, and year fixed effects. The first stage relationship between own rent change and neighboring rent change is very strong, with a t-statistic of 8. Year dummies absorb almost all residual variation, though, casting some doubt on the IV results. Rent has a significantly positive coefficient in OLS, and insignificantly positive in IV, consistent with an upward bias in OLS from the effect of lagged permits on current rent. The inclusion of rent on the right hand side does not affect the main results. Coastal status has a marginally significant negative relationship with growth conditional on density and instrumented rent, with the coefficient less than half of the unconditional coefficient. The coefficient on GSS remains insignificantly positive, and the magnitude of the negative coefficient on density falls slightly and insignificantly. Notably, across five decades, the average residual for Manhattan is positive in all specifications.

Regulations could have arisen starting around the 1960s in reaction to heavy post-war demand pressures, in which case the panel would ideally start later than 1940. The results that density reverses the sign of the coefficient on GSS regulations and reduces the coastal coefficient by more than half continue to hold if the starting point for regressions of the form (4) is 1950, 1960, or 1970.

A further bit of evidence that demonstrates a relatively important role for population density is provided in Figure 2. This figure plots the decade by decade unconditional correlation between changes in log supply and regulations, coastal status, and density at the county level. These different correlations not only follow the same downward trend, but they exhibit highly correlated patterns, with each experiencing an upward spike in the multifamily housing boom of the 1980s. Unless the 1980s boom was caused by a brief reversal of trends towards increasing regulation on the coasts, it is difficult to reconcile the results of Figure 2 with a dominant role in supply for regulation. Based on census building permit data through 2008 compared with permit data from the 1990s, each of these correlations will be more positive in the 2000s than they were in the 1990s.

The Population Census figures do not break out units between single and multifamily, but the Census of Construction does. Consistent with a crucial role of coastal density and reliance on multifamily homes since the 1980s, the permitting decrease in coastal counties has been only for single family homes. The share of multifamily housing construction in coastal areas has not fallen significantly.

4 Conclusion

Like other heavily regulated and coastal areas, Manhattan grew less rapidly than other parts of the county over the second half of the twentieth century. This slow growth is consistent with a pervasive view that local regulations have become increasingly burdensome, and have significantly reduced coastal supply, exerting upward pressure on prices.

There is, however, no downward trend in Manhattan's share of US housing construction after accounting for the fact that construction in Manhattan is almost exclusively multifamily and for the boom and bust in publicly subsidized urban renewal projects in the 1950s and 1960s. Indeed, the early boom in housing projects explains more than three quarters of the time series variation in Manhattan's share of all US multifamily housing. Manhattan's share of US multifamily housing permits was higher in 2005 than it was in 1965. The relative decline of construction in Manhattan thus appears to relate more to the end of federal intervention through slum clearance and generous depreciation rules than to any steady rise of local regulation.

A long panel of new housing units from the US census for all US counties shows that conditional on population density, neither regulations nor coastal status are associated with diminished housing supply growth in the post-war period. Part of this decline appears to relate to the decline in multifamily housing between the 1980s and 1990s, but changes in the multifamily share do not explain the time series pattern prior to the 1980s. Together with the results from Manhattan, these cross sectional facts cast serious doubt on the importance of regulations in raising prices through reduced supply.

Three important caveats are in order. First, while the rise and fall of Robert Moses's urban renewal empire appears to explain most of the variation in Manhattan's share of US multifamily construction, it is difficult to rule out a role for the 1961 New York City rezoning. Regression estimates suggest that urban renewal was a much more significant factor, but some of the surge in urban renewal may have come in anticipation of rezoning, and rezoning may have been a product of urban renewal. It is clear that any case study approach to even plausibly exogenous change to zoning regulations must deal with the problems of temporary versus permanent supply reactions. Second, regulations measured in the 2000s may not have been constant through the sample period. Regulations are directly associated with past and current demand pressures (see Wallace (1998)), and indirectly through amenity (see Kolko

(2008) and Saiz (2008)) and characteristics of residents (see Kahn (2007)). These difficult to measure covariates may bias up or down the estimated effect of regulation on permitting.[22] Third, as demonstrated by the correlations between the GSS and LSBB measures, it is not clear that there is meaningful variation in regulations once the coastal versus non-coastal dichotomy is accounted for, and coastal areas are different from the rest of the US on many dimensions.

While the data limitations are serious, the absence of a negative trend in coastal supply, even unconditional on rent but conditional on density or US multifamily share, is important. It can not be true that the coasts became relatively expensive merely because they are relatively regulated. Rather, consistent with any model that allows for population mobility, increased relative demand for the coasts must have played a critical role.

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Figure 1: Top panel: annual ratio of private residential building permits issued in Manhattan to all private building permits issued in the US. Bottom panel: annual ratio of all US private residential building permits located in buildings with five or more homes to total US private residential permits (dark line, left scale) and number of permits issued to the New York City Housing Authority in Manhattan (dashed light line). Data from the US Census Bureau and the Office for Metropolitan History.

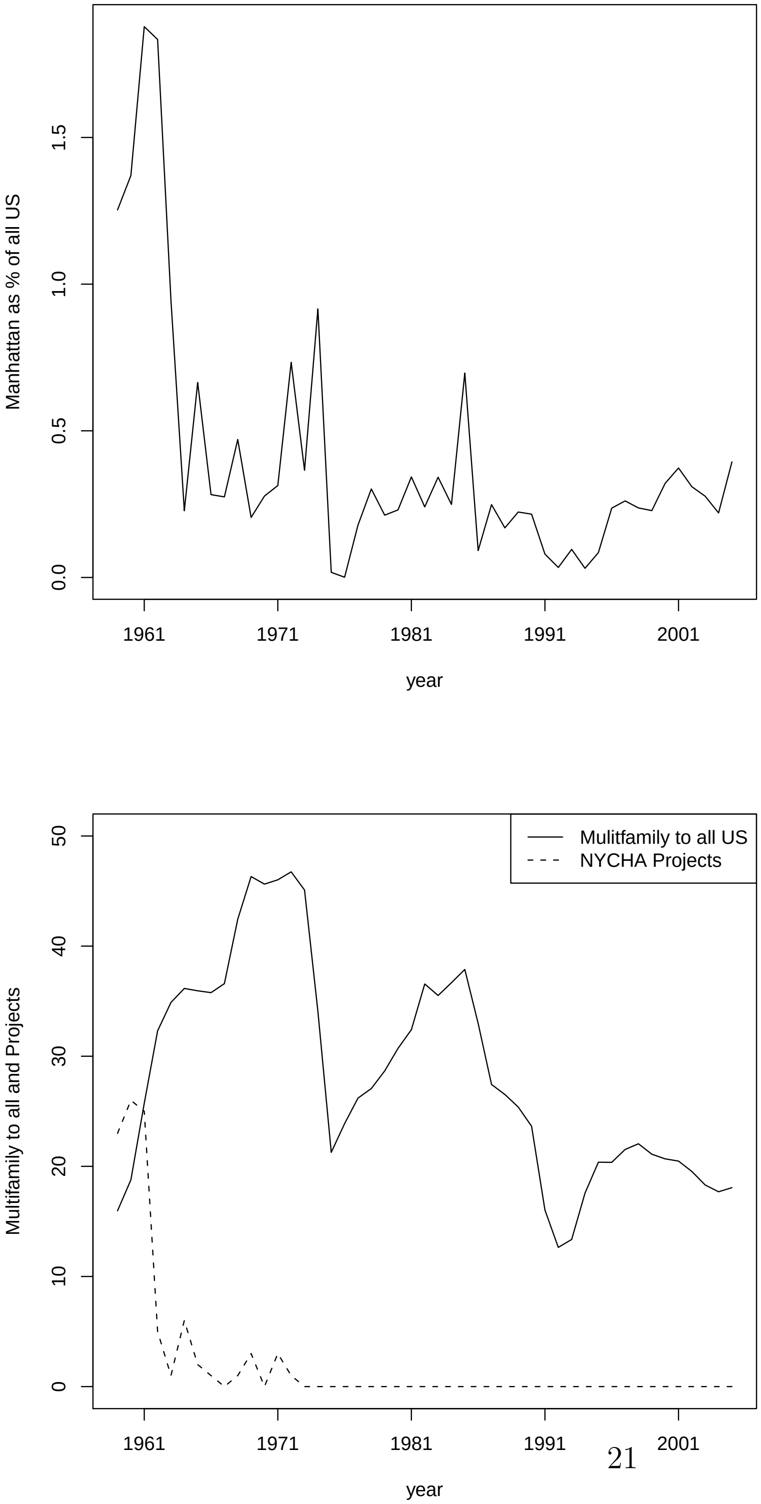

Figure 2: Correlation with decade-to-decade change in supply in the 1950s, 1960s, . . . 1990s. "G" is the correlation between Gyourko et al. (2006) (GSS) regulations and the change in log supply from the previous decade. "L" is the correlation with regulations as measured by Linneman et al. (1990). "c" is the correlation with coastal status. "D" is the correlation with metropolitan area mean density. "d" is the correlation between county deviations from metropolitan mean density and the deviation of county supply growth from metropolitan area mean supply growth.

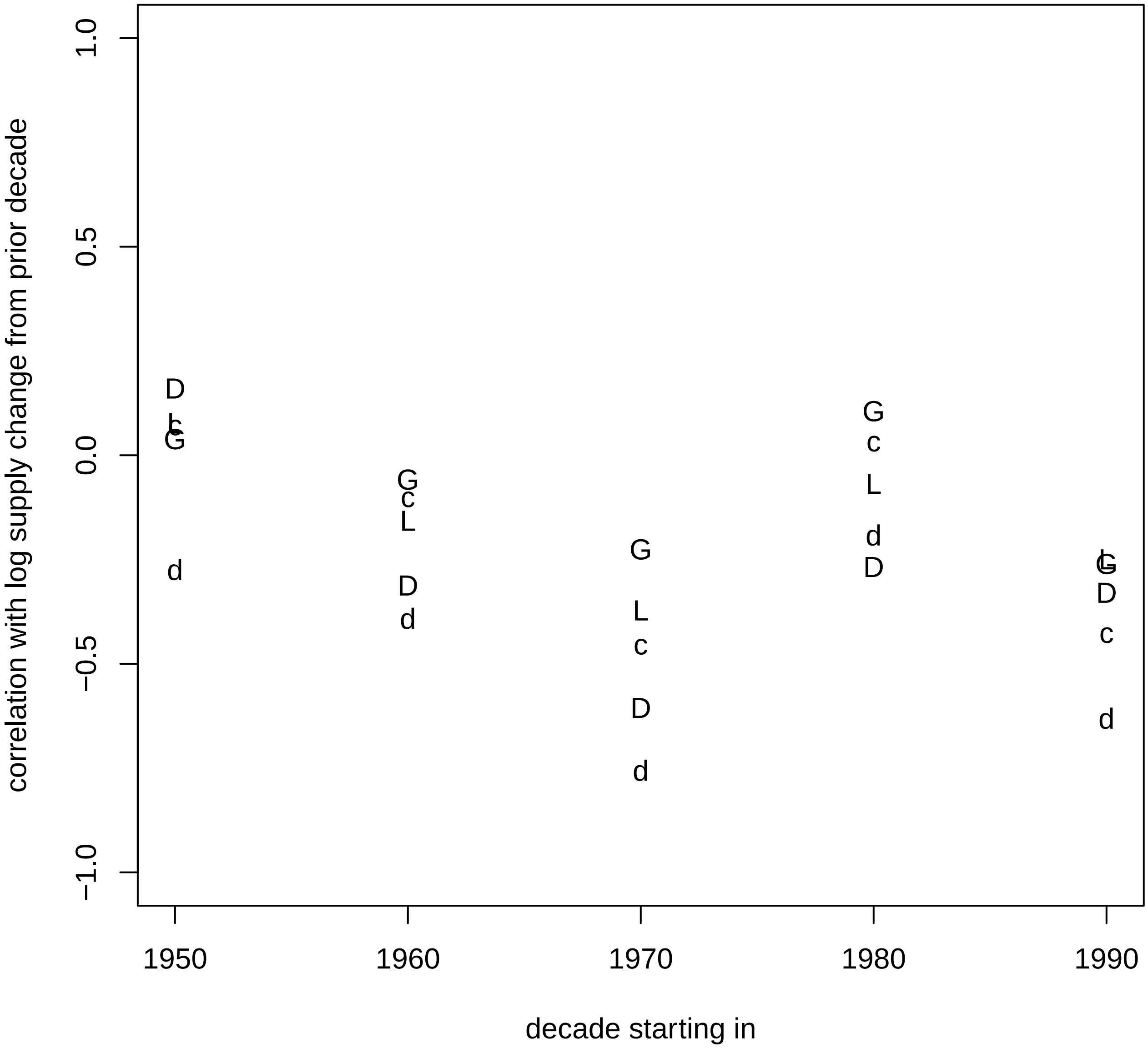

Table 1: Summary statistics for Manhattan regressions

Variable	obs	mean	s.d.	max	min
$\frac{\text{Permits Manhattan}}{\text{Permits US}} \times 100$	47	0.40	0.43	1.88	0.0008
$\frac{\text{Permits Manhattan}}{\text{Multifamily Permits US}} \times 100$	47	1.52	1.82	7.85	0.003
Manhattan Housing Projects	47	2.06	6.11	26	0
Year	47	1982	13.71	2005	1959
Predicted Manhattan Employment	29	1.08	0.07	1.19	0.96
Rent Ratio	41	1.05	0.06	1.18	0.96

Table 2: Regression of ratio of units permitted in Manhattan to all US building permits ((1) and (2)) and to all US permits in buildings with five or more units ((3) through (7)) on year, number of public housing projects permitted in Manhattan and predicted relative employment. Dependent variable is multiplied by 100.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Denominator	all US		multifamily US				
Intercept	34.461*	14.737	-9.037	-8.119	-128.872	-31.314	0.083
	(16.001)	(9.065)	(30.149)	(26.296)	(274.655)	(90.891)	(0.609)
Year	-0.017*	-0.007	0.005	0.005	0.065	0.016	
	(0.008)	(0.005)	(0.015)	(0.013)	(0.15)	(0.049)	
Projects		0.043**	0.268**	0.261			
		(0.005)	(0.018)	(0.153)			
After 1961				-0.18			
				(3.806)			
Rent Ratio					8.259		
					(28.28)		
Employment						0.239	
						(5.613)	
R-squared	0.307	0.584	0.781	0.781	0.046	0.099	0
Drop Pre-1965?	No	No	No	No	Yes	Yes	Yes
Differences?	No	No	No	No	No	No	Yes
Obs.	47	47	47	47	41	26	40

Notes: All US refers to all US private residential building permits. US Multifamily refers to all US private residential units permitted that were in projects with over 5 units. Projects refers to the number of permits issued to the New York City Housing Authority. rent is the ratio of CPI rent in New York to CPI rent in the US. Employment is the ratio of predicted Manhattan employment to predicted US employment based on 2-digit SIC code national industrial growth and the share of employment in each industry in Manhattan and nationally based on BLS data. Regressions (1) through (4) are for the years 1959 through 2005. (5) and (7) exclude the heavy urban renewal years prior to 1965. (6) starts with the BLS data in 1975 and ends in 2002. Newey West standard errors with four lags in parentheses; * significant at 5%, ** significant at 1%.

Table 3: Summary statistics for national county panel

variable	obs	mean	std. dev.	min	max
Δ log supply	1,080	0.206	0.475	-1.178	1.732
GSS regulations	1,080	0.066	0.668	-1.374	2.155
Density 1940	1,080	-3.985	1.648	-7.563	2.128
coastal	1,080	0.148	0.355	0	1
Δ log rent	1,080	-0.32	1.76	-4.195	1.31
Δ log neighbor's rent	1,080	-0.337	1.748	-4.118	1.196

Table 4: Panel regressions of log changes in 10 year new residential units on log density in 1940, coastal status, and GSS regulations.

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.21**	-0.181**	0.237**	-0.162**	-0.269*	0.087
	(0.025)	(0.045)	(0.025)	(0.042)	(0.112)	(0.182)
GSS regulations	-0.051*	0.019			0.015	0.023
	(0.023)	(0.017)			(0.02)	(0.023)
Density 1940		-0.097**		-0.093**	-0.073**	-0.085**
		(0.012)		(0.011)	(0.01)	(0.014)
Coastal			-0.209**	-0.016	-0.088*	-0.061
			(0.037)	(0.034)	(0.04)	(0.039)
Δ log rent					1.163**	.475
					(0.346)	(0.346)
obs.	1,080	1,080	1,080	1,080	1,080	1,080
R^2	0.01	0.11	0.03	0.11	0.55	NA
IV?	NA	NA	NA	NA	No	Yes
Year dummies	No	No	No	No	Yes	Yes

Notes: Unit of observation is a county, with observations in 1960, 1970, 1980, 1990, and 2000. Standard errors clustered at the level of metropolitan area. GSS is average Gyourko et al. (2006) regulatory index for the metropolitan area. Δ log rent is the contemporaneous 10 year change in log median rent at the county level. The instrument is average 10 year change in log median rent among counties in the most similar nearby non-coastal metropolitan area – see text for details. Standard errors clustered at the metropolitan level. * significant at 5%, ** significant at 1%.