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01. March 2006

Online at <http://mpra.ub.uni-muenchen.de/13316/>

MPRA Paper No. 13316, posted 10. February 2009 / 14:34

The aftermath of the 9/11 attack in the New York City office market: A review of key figures and developments

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Abstract

Although almost eight years have passed since the terrorist attacks of September 11, 2001, researchers continue to investigate the consequences of this far-reaching event in a variety of scientific disciplines and subject areas. In economic research, a number of more recent publications have added to existing body of literature by elucidating the medium- and long-term impact of the attacks using new methods and/or data.

This paper is more modest in scope in that it reviews the impact of the attacks on the Manhattan's office inventory, employment and rents. Overall, there is scant evidence that the attack have had a long-lasting impact on the Manhattan office market. Of the companies that decided not to return to Lower Manhattan after 9/11, the majority relocated to Midtown Manhattan. Taken together, the core markets of Midtown and Downtown Manhattan captured about 80 percent of the stream of displaced tenants after 9/11, while areas outside of these two core clusters captured only 20 percent, which bodes well for Manhattan's ability to remain a prime office location even in the face of a severe crisis. The majority of businesses directly affected by the attack have opted to remain in the Downtown area or have returned there after the damaged buildings were restored. Moreover, the set of so-called "trophy" buildings proved to be less affected by the recession than the general market, a finding that runs counter to initial assumptions about the future of office high-rises. In addition to a drastic reduction in leased space, accommodation of displaced tenants within the existing office space portfolio of large companies contributed further to lower occupancy rates than had been expected after the destruction of 10 percent of the inventory. This phenomenon, also known as backfill, caused overall absorption to be negative in the quarters following 9/11, since the positive demand created by displaced tenants was more than offset by losses incurred in the accelerated recession.

Introduction

The September 11 attack obliterated 13.4 million square feet of office space in the World Trade Center (WTC) complex and seriously damaged at least another 17.8 million square feet in 23 surrounding buildings, affecting approximately 31.2 million square feet, or 10 percent of the total stock of Manhattan office space. Nearly 100,000 office workers were subsequently dispersed to over 1000 different destinations, many of them within Manhattan and a few as far away as London and Tokyo. The secondary consequences and potential economic ripple effects of the attack on Lower Manhattan and New York City as a whole are more difficult to grasp than the immediate impact. Over the years since 9/11, it has become evident that initial speculation about a mass exodus of office companies from Manhattan has been unfounded. There are concerns nevertheless that the long-term effects of 9/11 will pose a continuing threat to Lower Manhattan's economic health. The principal objective of this paper is to elucidate the impact of the September 11 attack on the New York office market by using exploratory data analysis.

In the immediate aftermath of the September 11 attack, a number of important studies have been published, documenting the damage and giving detailed accounts of the whereabouts of displaced tenants (see, for example, Kelly 2002). This paper presents a reevaluation of the impact of 9/11 on the New York office market more than seven years after the recovery process began. It describes the immediate impact of 9/11 on office inventory, absorption, vacancy rates, rent and office employment by means of an exploratory data analysis.

The immediate impact of 9/11

Beyond the tragic loss of three thousand human lives, it is the physical destruction of the World Trade Center buildings that comes to mind when we think about the impact of the 9/11 attack. The New York City comptroller estimates the property damage at \$34 billion for both the destroyed World Trade Center complex and the surrounding buildings that sustained serious damage. In a more comprehensive study conducted by NYCPC, the New York City Partnership and Chamber of Commerce (2001), a gross loss of \$83 billion through 2003 is estimated as a consequence of the 9/11 attack, consisting of \$30 billion in capital loss, \$14 billion in cleanup costs and a compound \$39 billion loss of economic output. From these gross costs we deduct insurance payments and emergency funds managed by the Federal Emergency Management Agency (FEMA) and other federal agencies to estimate the net loss to the city's economy incurred by the attack. The federal funds are intended to defray the cost of cleanup and guide the economic recovery process. Although the exact sum of all funds and compensation payments actually disbursed by insurance carriers and federal relief organizations are not fully known, the NYCPC estimates the overall net loss due to the 9/11 attack at \$16 billion (4 percent of the gross annual output of Manhattan).

Estimating the effects of 9/11 on the office market

Any attempt to measure the impact of 9/11 on the job market, on the stock market, or on fiscal revenues is faced with the difficulty of separating the effects of 9/11 from the impact of a wider economic recession and other simultaneous events influencing the market. In the case of the office market, disentangling and isolating the effects of 9/11 seems easier because of certain inherent characteristics of real estate markets. Among others, Fuerst (2005) and Dermisi (2007) present empirical analyses of the impact on the New York and Chicago office markets respectively and find that the impact on rents was significant but limited to certain types of buildings and locations. In an analysis of indirect real estate investments, Kallberg et al (2008) examine the impact of the attacks on REIT prices and returns and find that initial abnormal returns of New York-related REITs disappeared within two months as analysts and investors revised their expectations.

As pointed out in the introduction, this paper does not provide an econometric analysis that attempts to isolate the impact of the attacks but rather focuses on exploratory data analysis drawing together data from a variety of sources. The impact on the supply of office space is clearly discernable thanks to available data on the World Trade Center buildings themselves and on the damaged buildings that were gradually returned to the market after restoration.

To aid the analysis, it is useful to recall some of the general facts on how office markets operate. The office market is typically conceived of as a system of at least three interlinked markets: a space market (also called 'user market'), a financial asset market, and a development market. The space market incorporates the demand for office space by tenants and the determination of rents. The amount of occupied space as the principal measure of demand for office space is a function of the number of office workers, the average space per office worker in a given market, and output of office firms. While employment and output are major determinants of the absolute amount of required office space, the space per office worker depends on the level of rental rates (price elasticity of demand), in the sense that higher rents entail a more efficient space use and hence less space per worker. Typically, rental rates are a lagged variable, however, since short-run demand is relatively inelastic to changes in rental rates. Most equilibrium models of the office market assume that only a certain proportion of the adjustment towards the hypothetical steady state takes place each period. The net change in occupied space from one period to the next (called space absorption) is another example of only partial adjustment to a hypothetical equilibrium value caused by imperfections inherent in the office market. Rental rates are determined in the space market as a function of the occupancy rate or its inverse, the vacancy rate. Similar to labor market economics and its concept of a 'natural unemployment rate', real estate economics defines a 'natural vacancy rate' as market equilibrium at which rents remain stable. If the actual vacancy rate falls below the natural vacancy rate, rents will rise and vice versa. Despite a number of theoretical problems associated with it, this concept proved useful in many empirical studies (Rosen 1984; Shilling, Sirmans, and Corgel 1987). It originates from the observation that real estate markets do not conform to the basic economic theorem that equilibrium is reached when supply equals demand and markets clear completely. Frictions and imperfections as well as the need for a sufficiently large fluctuation reserve are frequently cited as factors that impede complete market clearing. The magnitude of the

natural vacancy rate is not fixed, however, but varies across markets - owing to local market characteristics, and within a market over time, owing to long-run changes in local market characteristics (Wheaton and Torto 1994).

The stock of office space, albeit fixed in the short run, can be expanded in response to increasing demand for office space, thus linking the space market with the development market and in turn also with the financial asset market. According to investment theory, construction of new office space at a particular site becomes feasible when the expected asset price of the building exceeds its replacement cost. The asset price of the building is a function of the net operating income (NOI) of a building, or more accurately, the present discounted value of the expected future income stream (net of tax and expenses), which is mainly a function of rental rates. The three main components to use in estimating the asset price of a building are thus rent, vacancy and the capitalization rate, which is determined by dividing the property's NOI by its purchase price. New construction is determined by all the factors making up the expected asset price as well as additional measures for estimating replacement cost. Variables used to estimate costs are typically the cost of capital (interest rates) and construction costs. Construction of new space is subject with particularly long lags, however, because assembling, financing and permitting along with actual construction are all extremely time-consuming processes.

The effects of the 9/11 attack enter into this system simultaneously at various points: first, by reducing the total stock of office space; and second, by reducing the number of office workers and the amount of occupied space through movements of displaced tenants. These changes affect in turn the long-run equilibrium rent level (through the changed vacancy rate) and the overall feasibility of new space construction (through changes in rental rates and arguably also through higher construction costs because of additional security requirements for office buildings). The following sections analyze the effects of 9/11 on the various parts of the office market in more detail.

The impact on office inventory

The total amount of office space affected by the 9/11 terrorist attack is estimated at 31.1 million square feet of which 13.4 million were completely destroyed and 17.7 million were found to be severely damaged (Table 1). Destroyed were the seven buildings of the World Trade Center, which included the two landmark towers with a total square footage of 4.7

million square feet of office space each, and five other buildings ranging from 600,000 to 2 million square feet in size. Also destroyed was the Deutsche Bank building at 130 Liberty Street. To put the numbers in perspective, the destroyed space equals roughly the entire office stock of the city of Detroit. When the comparison is limited to prime office space, the damaged and destroyed space equals the inventory of major office locations such as Atlanta and Miami (Jones Lang Lasalle 2001). In the New York City office market, however, because of its vast size, the affected space makes up approximately 10 percent of the total inventory of New York City though roughly 60 percent of Downtown's Class A space.¹

Table 1: Destroyed and damaged office space by quality class. Data: Grubb & Ellis 2001

<i>Destroyed Buildings</i>	<i>Size (Square feet)</i>	<i>Occupied (Square feet)</i>	<i>Class</i>
1 WTC	4,761,416	4,507,467	A
2 WTC	4,761,416	4,576,215	A
7 WTC	2,000,000	2,000,000	A
1 Bankers Trust Plaza	1,415,086	1,415,086	A
5 WTC	783,520	780,873	A
4 WTC	576,000	561,491	A
6 WTC	537,694	537,694	A
DESTROYED TOTAL	13,420,046	12,963,740	
<i>Damaged Buildings</i>	<i>Size (Square feet)</i>	<i>Occupied (Square feet)</i>	<i>Class</i>
2 WFC	2,591,244	2,006,577	A
3 WFC	2,263,855	2,167,611	A
1 Liberty Plaza	2,121,437	1,874,584	A
4 WFC	2,083,555	2,073,615	A
1 WFC	1,461,365	702,999	A
101 Barclay	1,226,000	1,226,000	A
140 West	1,171,540	1,171,540	B
100 Church	1,032,000	822,642	B
90 Church	950,000	950,000	B
22 Cortland	668,110	625,282	B
90 West	350,000	350,000	A
125 Barclay	273,900	273,900	C
130 Cedar	135,000	135,000	C
DAMAGED TOTAL	17,743,092	15,794,836	
OVERALL TOTAL	31,163,138	28,758,576	

¹ Figures of the total inventory of office space differ widely among providers of market data because of diverging definitions of geographic areas and types of buildings. Total inventory figures used in this study are based on the definition and data by Grubb & Ellis.



Figure 1: Map of World Trade Center area. (Source: City of New York)

Often criticized as a white elephant of an office complex whose construction was clearly not justified by the demands of the marketplace, the World Trade Center remained largely vacant and unprofitable in the first years of its existence. The largest portion of space was occupied by the Port Authority of New York and New Jersey and by various governmental institutions. Deriving its economic rationale from the principle known as Say's Law (supply creates its own demand), the World Trade Center was constructed with the intention of boosting the economic development of New York in a time of economic recession, weakening demand, and high vacancy rates. Because it was delivered to the market at an unfavorable time, however, the addition of more than 10 million square feet of office space to the existing inventory served to depress the market further. It took more than six years for the office market to adjust to the supply shock induced by the

World Trade Center. During the 1980s, when the business climate in New York City became more favorable, the WTC complex developed a reputation as an attractive location for financial services companies with a need for large floor plates. Eventually it achieved an estimated ratio of 90 percent to 10 percent of private- versus public- sector tenants. The stock market crash of 1987 initiated a protracted period of decline for the Lower Manhattan office market; vacancies soared to 25 percent and higher. By the end of the 1990s, however, the combined effect of a tech boom and exceptionally strong growth in the finance, insurance and real estate (FIRE) industries had helped Lower Manhattan to once again overcome the crisis and achieve historically high office occupancy rates and rents. At the end of 2000 the market began to soften gradually, but it was not until after September 11, 2001 that Lower Manhattan experienced large-scale job losses and a severe office market recession.

In the wake of the 9/11 attack, a number of market analysts, predicting that the reduction in space would lead to extremely low vacancy rates, saw landlords as being "in the driver's seat" (Grubb & Ellis 2001) in the lease negotiation process. To the surprise of most market observers, however, demand for office space weakened significantly despite the large-scale loss of office space. Three reasons for the unexpected drop in demand can be identified: a pronounced decline in office jobs owing to the combined effects of 9/11 and economic recession; the availability of large amounts of unused space at various locations throughout Manhattan not reported as vacant in the market statistics ("shadow space"); and reduced space per worker in higher-priced target submarkets and revised expectations for the future growth and space needs of office tenants.

The impact on leasing activity and absorption

The relocation patterns of larger private companies occupying at least 20,000 square feet of office space in the buildings destroyed or damaged on 9/11 have been recorded by the real estate services and brokerage firm Grubb & Ellis. This subset of displaced tenants accounts for roughly one third of the total occupied space of the affected buildings. The remaining two thirds of occupied space comprise large private companies with missing data, smaller private tenants and government institutions. Hugh Kelly (2002, 26) tracked the movements of displaced public-sector tenants occupying 1.7 million square feet in all affected buildings and found that only 30 percent remained downtown; the rest relocated

to Midtown. Data are scarce on the approximately 500 small companies occupying less than 10,000 square feet and public tenants accounted for about 8 million square feet in the WTC. Kelly who was able to obtain and analyze a limited dataset of the smaller tenants, found that small companies displaced by the 9/11 attack were far more likely to remain in the downtown area than the large companies, thus accounting for about half of the overall space leased downtown to displaced tenants. This pattern could be explained by the fact that larger tenants typically require large floor plates and sizable amounts of contiguous space, which only a few buildings in Lower Manhattan could provide on short notice after the destruction of the World Trade Center. The search process for suitable office space was arguably shorter for smaller companies since more matching possibilities existed within a short distance from the original location.

Kelly (2002, 25-29) reports that Lower Manhattan retained about 50 percent of the large private-sector tenants. Taken together, the core markets of midtown and downtown Manhattan captured about 80 percent of the stream of displaced tenants through reoccupation of restored buildings, backfill and new leases. The nearby office agglomerations along the New Jersey waterfront, which had been developing into a back office market for Wall Street and Lower Manhattan long before 9/11, managed to attract most of the relatively few tenants who opted to leave Manhattan. It is interesting to note that none of the other four boroughs of New York City outside of Manhattan was able to capture a significant percentage of displaced tenants especially when compared to the New Jersey waterfront.

As of September 2003, a number of large tenants of the buildings that were damaged in the 9/11 attack returned to these buildings after they were restored (Newmark and Company Real Estate 2003). The remaining portion of office space damaged in the attack thus remained either vacant or was occupied by new tenants. According to a survey of Newmark and Company, more than half of the originally displaced tenants had returned to a Downtown location during the first two years following the attack and less than one fifth of the displaced tenants had decided to lease space permanently at a non-Manhattan location. These numbers are reassuring in terms of tenant retention in the restored damaged buildings and the downtown area as a whole, but it still remains to be seen whether tenants who have returned will opt to renew leases that expire in the next few years. Since some tenants were given the opportunity to break their leases after 9/11,

owing to interruption-of-services clauses in their contracts, the percentage of tenants choosing to discontinue their lease later on is generally expected to be low. As far as the wider Downtown area is concerned, however, the large number of leases expiring in 2004 and 2005 (36 million square feet, or roughly one-third of the inventory) poses a potential problem, especially since the process of rebuilding the World Trade Center and restoring the economic potential of the area will continue well beyond 2010. Given the fact that more than half of the Downtown leases expire between 2004 and 2007 (Newmark & Company Real Estate 2003), around 200,000 jobs would be at risk of leaving the area. On the other hand, some factors work in favor of a recovery of Lower Manhattan. The restoration of transportation infrastructure, particularly of the PATH commuter train station, is expected to have a moderating impact on the potential job losses since it facilitates the movement of suburban workers into the city, thus enhancing Lower Manhattan's profile as an attractive location and giving the area the much-needed rapid access to a large pool of skilled labor. Moreover, an array of subsidies has been put in place to make the area more competitive. Tax deductions and accelerated depreciation benefits are available to businesses with fewer than 200 employees in the so-called Liberty Zone. Further support is available through the small firm attraction and retention grant program. Certain commercial buildings are eligible for real estate tax abatements and rent tax elimination or reduction for up to five years. The programs require that landlords to pass on any benefits received under the auspices of these revitalization incentives to tenants by reducing rents proportionally.

Besides those tenants who chose to reoccupy previously damaged buildings, a number of new leases were signed in Manhattan, and in some cases in other locations, by tenants of destroyed buildings or tenants of restored buildings who were unwilling to return. Moreover, a considerable proportion of larger tenants of the space affected by 9/11 could be accommodated in excess space available at other locations of the same company. An estimated \$341 million of rental income is lost due to backfilling displaced tenants into unused space at a different location (DRI-WEFA 2002, 37). The high percentage of unused space or shadow space among the larger multi-location tenants not accounted for in any market statistics revealed that vacancy and availability rates were generally understated. Therefore, displaced tenants who were accommodated within space that was rented but previously not used by the same company did not contribute to positive absorption in the market statistics.

Shadow space is widespread in office markets and is generally attributed to inflexibilities arising from the long-term nature of office leases. Shadow space builds up when companies incorrectly estimate the number of employees and their space usage over the time of the lease term. Estimates of the amount of shadow space in Manhattan differ greatly since there are no reliable measurement methods available. Mitchell Stier, chairman of Julien Studley Inc. estimates 10 million to 14 million square feet of shadow office space in Manhattan in the fall of 2003 (quoted in Realtors Commercial Alliance 2003) while other sources claim that if shadow space were accounted for, reported vacancy rates would have to be adjusted upwards by 20 to 37 percent in some Manhattan submarkets (Holusha 2003).

Although more transparency is typically associated with a higher degree of market efficiency, some argue that the existence of shadow space generates positive effects as well. By being kept off the market, goes the argument, the vacant space does not exacerbate the downturn phase in the market cycle. Since this space is in fact excluded from the ratio of supply to demand that determines price, shadow space should work towards stabilizing the market. In other words, since shadow space is rented out and typically not offered on the market, such space -although de facto vacant, should not affect market conditions in a negative way. Two points have to be considered, however, regarding the validity of this argument. First, companies will fill up their shadow space before they lease any additional space. Consequently, shadow space does affect the office market indirectly by potentially delaying market recovery after a recession. Second, some of the unused space may indeed be available for sublease, even though it is not officially listed. Transactions of this kind are typically made when brokers possess insider knowledge of unofficially vacant space and approach the main tenant to find out whether the vacant space would be suitable for sublease to other companies.

More recently, changes to the generally accepted accounting principles (GAAP) adopted in 2003 strictly require companies to record the write-off of unused space once a company has formally acknowledged that a certain percentage of its leased space is not being used. The unintended consequence of this change is that office tenants have an additional incentive to keep unoccupied space off the market. Under previous regulations, office tenants were flexible with regard to both the definition of what constitutes unused space and the timing of the write-off in their accounting reports. While the previous accounting

principles stipulated that companies do not have to take a charge against their earnings for rent payments made for unused space unless they adopt a formal 'facility exit plan', the new regulations require a company to write off the cost of unused or underutilized office space as soon as the company terminates the lease or physically 'ceases using' the space (Rich 2003). Offering space for sublease on the market is a clear indication of unused space in the definition of the GAAP. It is thus expected that many companies will avoid recording the write-offs thereby aggravating the general problem of understated vacancy in office market space accounting. A quantitative analysis of the expected effect of the new GAAP is not, however, available to date.

Since there are no direct measures of the volume of shadow space, estimates must be inferred from other indicators. Typically, a large percentage of sublet space in a market is indicative of a related amount of shadow space, even though it is not possible to quantify the relationship accurately. Figure 2 illustrates that the share of sublet space rose dramatically in the second half of 2000 at a time when the direct vacancy rate was relatively low and asking rents still growing, indicating an impending shift in overall vacancy and rents. The progression of the indicators over time reveals that sublet space is a leading market indicator that captures the turning point in the market cycle three to four quarters prior to a change in rental rates.

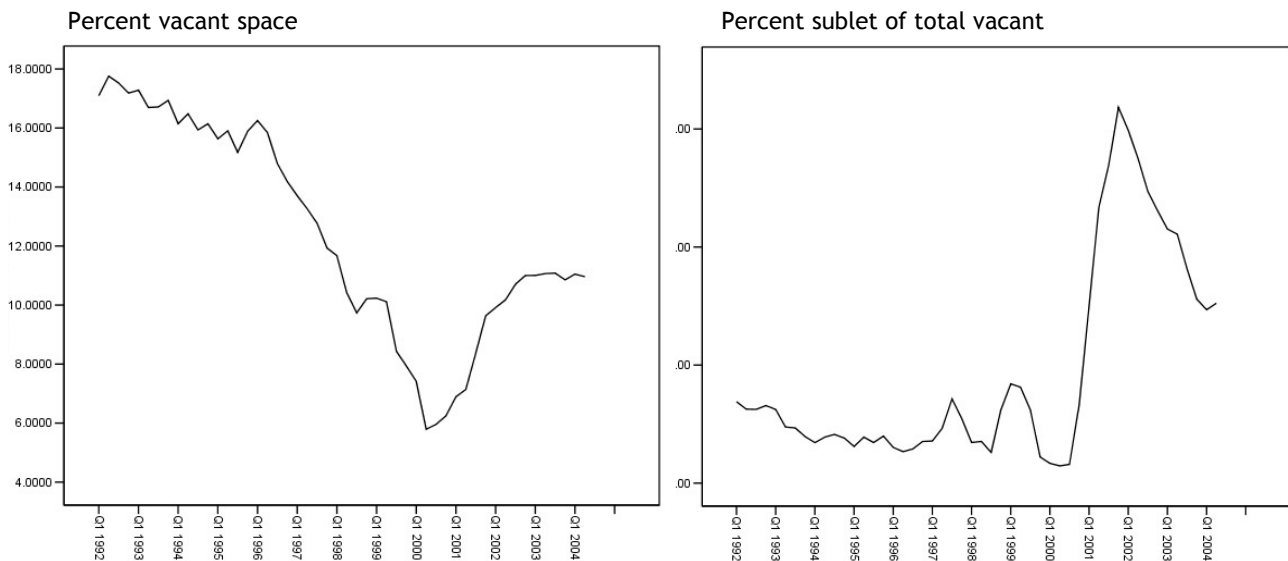


Figure 2: Vacant space as a percentage of overall office space inventory (left) and sublet space as a percentage of overall vacant space (right). Data: Grubb & Ellis

The relationship between direct vacant space and sublet space is of particular relevance for understanding the market mechanisms of commercial real estate. It is noteworthy that the share of sublet space in total vacant space more than tripled within one year (from the third quarter of 2000 to the third quarter of 2001). In general, the more sudden and unexpected a recession is, the higher the amount of sublet space put on the market will be. This phenomenon became evident in the Manhattan office market at the end of a prolonged growth period. When the market unexpectedly started to soften at the end of 2000, many tenants realized that some of the space they had leased would not be required in the near future, and they made a large proportion of the excess space available for sublease. The third quarter of 2001 marks a peak in the percentage of sublet space. The additional amount of sublet space, however, not only is an indicator of weakened demand but also reflects the expectations of tenants with excess space that they would sublet some of it to displaced World Trade Center tenants. Thus, tenants with unused space in their portfolio were more apt to offer sublet space on the market in the wake of the 9/11 attack than would have otherwise been the case. In the following quarters, the percentage of sublet space decreased as leases expired, direct vacancies increased, and tenants withdrew some of the available sublet space from the market.

Apart from the fact that displaced tenants were accommodated in a firm's existing space portfolio, the strongly negative absorption in the aftermath of 9/11 has also been caused by the fact that displaced companies rented less space than they had occupied in the damaged or destroyed buildings. Table 2 demonstrates this phenomenon for a subset of 6.4 million square feet for which both tenant and building information was available (Grubb & Ellis 2002). Backfill is not considered in this subset. Grouped by submarkets, the data show on average that companies rented only about 15 percent less space in the new buildings than they originally held in the affected buildings.

A further reason for reduced space usage by displaced tenants at their new locations is price elasticity of demand. The observed reduction in newly leased space by displaced tenants was particularly strong in high-priced buildings and submarkets, such as the Plaza District or Grand Central (Table 2). Relatively high rents in some submarkets had an additional dampening effect on the amount of space leased by displaced companies. In turn, the reduced space usage contributed to higher vacancy rates and declining asking

rents in the following quarters. The aggregated demand elasticity of the World Trade Center tenants in the destination submarkets is -1.12. The aggregate price elasticity of demand is calculated here as the quotient of the percentage change in rented space and the percentage change in average rental rates. The basis of the comparison are the average rents paid at the original WTC location versus rental rates at new locations weighted by the amount of space that the tenant held in the WTC. Typically, demand for space is considered rather inelastic in the short run. For example, Wheaton, Torto and Evans (1995) and Wheaton (1999) assume a general price elasticity of demand of -0,4 in the office market. Owing to the particular circumstances of the 9/11 attack, displaced tenants were forced to sign new leases in the various submarkets during a macroeconomic recession, when price sensitivity is particularly high. While it is difficult to separate the contribution to reduced space demand of recession-related employment layoffs from a 'true' price elasticity effect, the cross-sectional data presented in Table 2 suggest an inverse relationship between submarket prices and space reduction.

Table 2: Former WTC/WFC tenants by destination submarket (new leases only)

Submarket	Occupied space old (sq. ft.)	Occupied space new (sq. ft.)	Difference (%)	Average rent (\$)	Typical floorplate (sq. f.)
Plaza District	817,496	355,724	-56.49	39.87	22,294
Grand Central	619,470	481,733	-22.23	38.44	23,190
Hudson Square/Tribeca	60,000	80,000	33.33	33.00	65,828
Madison Square	1,142,482	923,911	-19.13	19.17	18,705
Midtown West	2,351,352	2,299,163	-2.22	19.75	19,578
Penn Station	578,800	472,000	-18.45	22.30	67,308
Wall Street	843,404	793,500	-5.92	25.38	10,881
Total	6,413,004	5,406,031	-15.70	32.22	25,981

Data: Grubb & Ellis (2002), CoStar (2001)

In summary, the most unanticipated effect in the aftermath of 9/11 has been the fact that the expected surge in additional space consumption attributable to the leasing activities of displaced tenants did not occur. Backfill of displaced tenants into existing leased space, employee layoffs, and reduced space usage per worker as evidenced by a

relatively elastic demand for surrogate space are the three most important reasons for this. As a consequence, predictions of increasing rents and extreme space shortages did not come true because they were based on the simplistic calculation that constant demand after a 10 percent reduction in supply would bring the vacancy rate to almost zero. On balance, however, absorption in the Manhattan market was overall negative because the wider economic recession and the indirect effects of 9/11 more than offset the positive absorption of space induced by displaced WTC tenants.

The impact on office employment and locational behavior

The employment dynamics of office-based service industries are a main determinant of the demand for office space and an integral part of contemporary metropolitan economies. This is particularly true for Manhattan, where FIRE (finance, insurance and real estate) and other office-using industries account for over 40 percent of the total employment. In Lower Manhattan, office jobs make up approximately 75 percent of all jobs. The importance of these jobs for the local economy, however, is even greater than the primary employment statistics suggest. When taking into account local multiplier linkages of the FIRE sector, one employee in the financial industry supports two further jobs in various types of economic activities, such as business services and restaurants (NYC Partnership and Chamber of Commerce 2001, 11).

To assess the dynamics of office employment in the context of 9/11 adequately, empirical datasets are analyzed at three levels. First, I examine the regional context of office employment dynamics for spatial shifts of agglomeration economies. The second step is analyzing Manhattan office industries at the zip code level to determine which submarkets were hit hardest by the attack. Third, I trace the relocation patterns of the displaced World Trade Center tenants. The observed relocation patterns of the displaced companies can provide valuable clues in our attempt to estimate the longer-term reverberations of the attack on the locational behavior of office companies. If the companies that were immediately affected by the attack chose to remain within the office districts of Manhattan, there is reason to assume that the long-term negative impact of the 9/11 attack was not as powerful as it would be when displaced companies choose to disperse to peripheral locations.

Other analysts have disagreed on the implications of the attack for the future of Manhattan and particularly Lower Manhattan. Some authors claim that 9/11 has had no significant lasting impact on the city (for example Harrigan and Martin 2002), but others envisage a downward spiral that will eventually lead the demise of Lower Manhattan and some of the older inner-city office clusters. Those who take the latter view claim that even before the catastrophic events of September 11, 2001, New York's financial district was an 'anachronism' whose economic viability could only be artificially maintained by massive government subsidies (Glaeser and Shapiro 2001). Arguing that the direct and indirect damage caused by the 9/11 attack created a need for even more subsidies to keep Lower Manhattan alive, they conclude that it might not be justified to attempt saving the area at all because the public funds needed for this endeavor might be spent more efficiently elsewhere. On the other hand, Lower Manhattan has experienced considerable economic growth in the years preceding the attack, thereby demonstrating that the area's structural problems are in principle curable. Before reliable conclusions on this highly controversial topic can be drawn, however, it is necessary to provide some background on the long-term locational behavior of service industries and office employment in various parts of the New York metropolitan area in which the effects of the 9/11 attack are embedded.

Spatially disaggregated analysis of employment impacts

Estimates of the total number of jobs lost because of the catastrophic events of September 11 differ considerably depending on research methodology and time frame of the analysis. Jason Bram, James Orr and Carol Rapaport (2002) applied an autoregressive forecasting model and arrived at an estimate of initial job losses in the amount of 38,000 to 46,000 in October 2001. Although the exact number of lost jobs is difficult to assess, it is clear that office-using industries were hit particularly hard by the attack.

This section explores the dynamics of office employment after September 11 in various Manhattan submarkets. While almost all areas of Manhattan have been affected by the economic recession and subsequent declines in the number of office jobs, Lower Manhattan has sustained particularly great losses because of the double impact of the 9/11 attack and the macroeconomic recession. The attack of September 11 ended a period of sustained strong job growth in Lower Manhattan, turning the overall balance

from 2000 until 2003 negative. Besides the World Trade Center area, the sharpest relative decline in office employment occurred in the neighborhoods formerly dubbed 'Silicon Alley' - in particular Chelsea - as a consequence of the collapse of the dot-com boom. More surprisingly, the submarkets in the eastern section of the Midtown market -including the Plaza District, which is the highest priced area of Manhattan- saw their shares in Manhattan office employment diminish to varying degrees. In contrast, the western areas of Midtown exhibit relative growth in office employment; a large part of Manhattan's new office space was built in the Times Square and Columbus Circle areas. In the Downtown area, sharp losses in the World Trade Center area are juxtaposed with relative gains in the eastern financial district and north of the World Trade Center area in Tribeca. Although these areas have not been major recipients of displaced WTC tenants, it seems likely that temporary locational shifts of office companies away from the western area of Lower Manhattan to the east and north contributed to their relative increase. Nevertheless, almost all areas of Manhattan lost office jobs in absolute numbers. Since this happened to varying degrees, however, relative shares in overall office employment increased even if office employment in absolute numbers decreases.

The loss to Lower Manhattan's economy as outlined in the previous sections becomes even clearer when considering the displaced tenants of the World Trade Center attack. DRI-WEFA (2002, 36) estimates that approximately seventy thousand jobs were lost as a consequence of the attack, whereof thirty thousand are estimated to be displaced permanently. Taking into account that each of these jobs supports other jobs, for example in the financial sector through economic linkages to the business and hospitality services sector, a complete economic recovery of Lower Manhattan is bound to be a difficult long-term endeavor. The overall employment prospects may be more positive as these initial job loss assessments suggest, simply because new companies are attracted by the positive locational profile of Lower Manhattan. Additional business incentives and tax benefits are available through a number of government programs, which enhance Lower Manhattan's reputation as an attractive business location. Incoming new tenants attracted by lower rents and government incentives are bound to fill the vacancies created by those displaced tenants who are not returning to their original locations in Lower Manhattan. It remains unclear, however, how long it will take to achieve a new market balance in the Downtown area.

In the wake of the September 11 attack, some have argued that the collapse of the twin towers was definite proof that skyscrapers are 'an experimental building topology that has failed' (Peirce 2001) and have prophesied the eventual demise of dense Central Business Districts characterized by office high-rises. Contrary to these predictions, the relocation patterns of displaced World Trade Center firms and other developments after 9/11 demonstrated that agglomeration economies, the underlying invisible forces that created and sustain dense urban environments like Manhattan's, are surprisingly resilient. Outside of Lower Manhattan, companies displaced by the 9/11 attack relocated mainly in other high-density office submarkets in Manhattan. As outlined in the previous section, Midtown Manhattan captured the majority of displaced tenants who moved away from Lower Manhattan.

Relocation patterns of displaced WTC tenants

The data presented in the preceding section suggest that urbanization economies were relevant in the location decision of companies displaced by the 9/11 attack since the share of displaced tenants in a particular area corresponds roughly with the overall size of the respective target area. Comparing GINI values of the overall distribution of office firms and the displaced WTC tenants shows that they are more concentrated in Manhattan than office employment in general (GINI of 0.48 versus 0.33 for overall office employment). This finding runs contrary to the notion that WTC tenants spread out to low-profile locations after the 9/11 attack to escape possible future attack and adds further evidence to the relevance of urbanization economies in the dispersal process after September 11.

To further explore the relevance of localization economies, the destinations of the former World Trade Center tenants who left the Lower Manhattan area are broken down by both industry and submarket in Figure 3. The charts demonstrate that most companies chose to relocate to the largest existing cluster of their respective industry, thereby roughly mirroring the overall distribution of their industry sector across the submarkets. This is in part corroborated by the correlation coefficients (Spearman's rho) which compare the rank order of submarkets for an industry with the rank order of submarkets for just the displaced WTC tenants of the same industry. While the distribution is far from perfect it

lends sufficient support to the claim that localization economies have also played an important role in the relocation decisions of displaced WTC tenants. A further complication is that urbanization economies and localization economies cannot be separated sufficiently in this analysis since the core of Midtown is not only the largest overall office submarket within Manhattan but also hosts the largest share of many office-using industries, thus making it difficult to distinguish between the overall size effect and the industry-specific effect. In this respect, it is interesting to focus on some of the industries that are concentrated in smaller submarkets such as architects or communication services. The data on these industries reveal that the WTC companies displaced by the 9/11 attack were more likely to move to submarkets with an existing cluster of the respective industry as opposed to moving to the largest overall office cluster (Midtown Core). These findings give some preliminary clues about the relevance of both urbanization and localization economies in the wake of the September 11 attack.

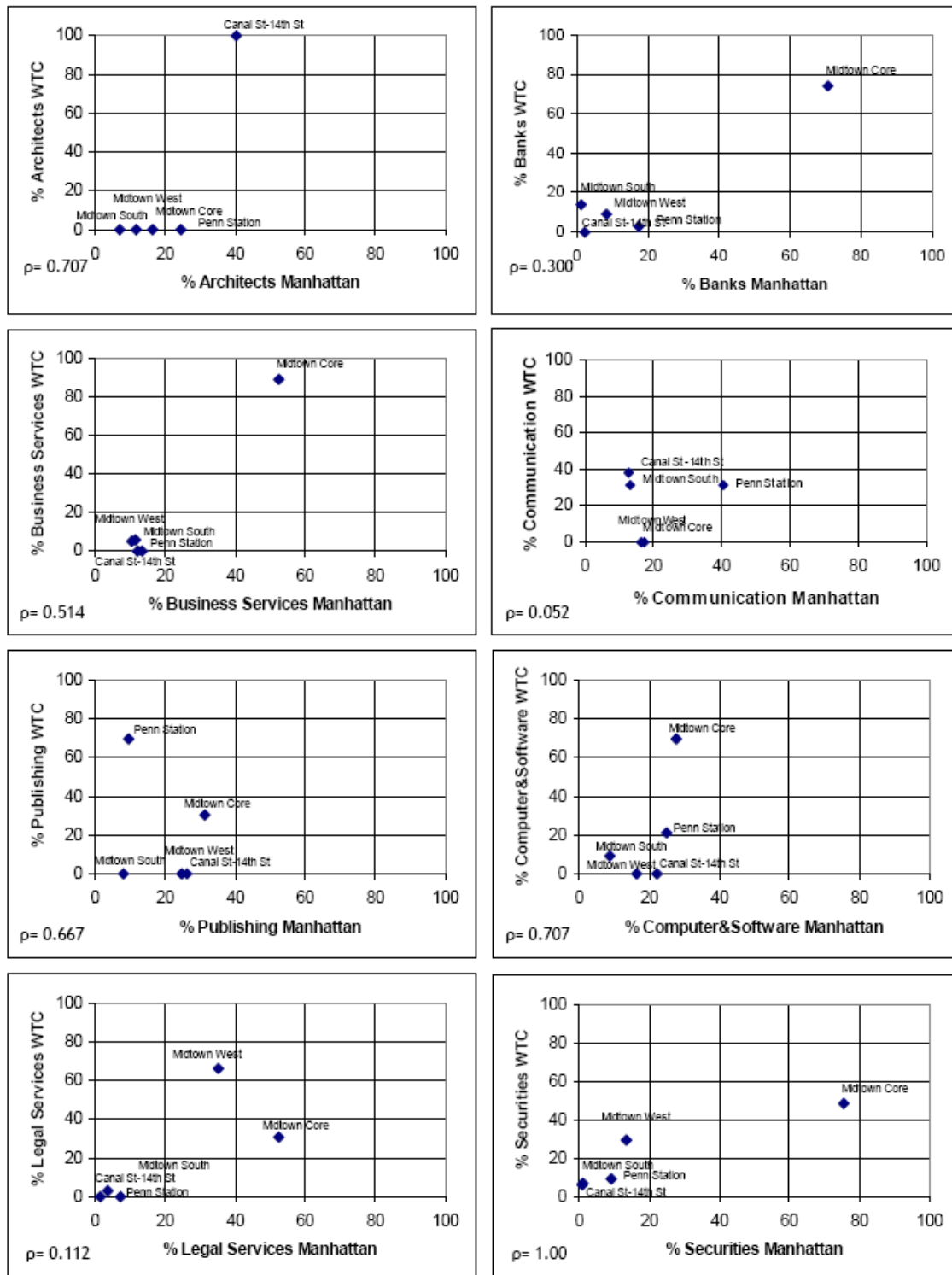


Figure 3: General distribution of selected industries in Manhattan submarkets and destinations of displaced World Trade Center tenants (Spearman's ρ indicated in lower left corner). Data: Kelly (2002), Grubb & Ellis (2002)

The impact on rents

As demonstrated by the data presented in the previous section, displaced tenants were not led merely by cost considerations in their relocation decisions. The aggregated dataset as well as anecdotal evidence suggest that companies did not simply migrate to areas where office space was readily available at the cheapest prices but gravitated towards existing agglomerations of the respective industry. The resiliency of agglomeration effects in the face of the 9/11 attack which had nurtured concerns of a catalyzed dispersion of office firms to remote locations, bodes well for the ability of New York City to retain the industries that form its economic base.

Before estimating the impact of 9/11 on overall market rents and subsets of office buildings, we examine the spatial differentiation of Manhattan's submarkets over time. Being by far the largest office market in the United States, and arguably the second largest office market in the world (after Tokyo), Manhattan's wide range of specialized business and financial services as well as the array of building types and locations, generate effects in the submarkets that reflect the particular industry mix of tenants and the building characteristics. Figure 4 shows a boxplot of the rental rates of the fifteen Manhattan submarkets in relation to overall aggregate market rents over a period of about twelve years. The horizontal reference line represents the average Manhattan rent and the vertical reference lines delineate the areas of Midtown (left), Midtown South (center), and Downtown (right). The boxplot shows the quartiles of the distribution for each submarket. The length of the box represents the difference between the 25th and 75th percentiles of the rent distribution relative to the Manhattan aggregate. It may seem surprising at first sight that the median values of all but three submarkets are below the Manhattan average. This can be explained, however, by the fact that about half of Manhattan's office space is concentrated in just three Midtown submarkets with above average values.

The height distribution of the columns in the boxplot resembles a longitudinal cross-section of Manhattan's built environment. This pattern is in line with urban economic theory, which states that the physical density of the built environment is a function of the bid rents in the area. Apart from the differences in median rent, the submarkets also differ in the volatility of rents over time, as illustrated by the spread of the quartiles. In general, the established Midtown and Downtown office core locations

exhibit less variability in office rent over time than the more peripheral locations of Midtown-South. The greater volatility of rents in Gramercy Park, Chelsea, Soho or Tribeca can be attributed to the 'dotcom' boom of the late 1990s when more than one thousand technology-related start-up companies settled in these hitherto peripheral office locations. Soon after the precipitous fall of technology share prices and the subsequent demise of many start-up companies in the district in the year 2000, rents also began to decline to previous levels and few areas were able to retain a significant share of office companies.

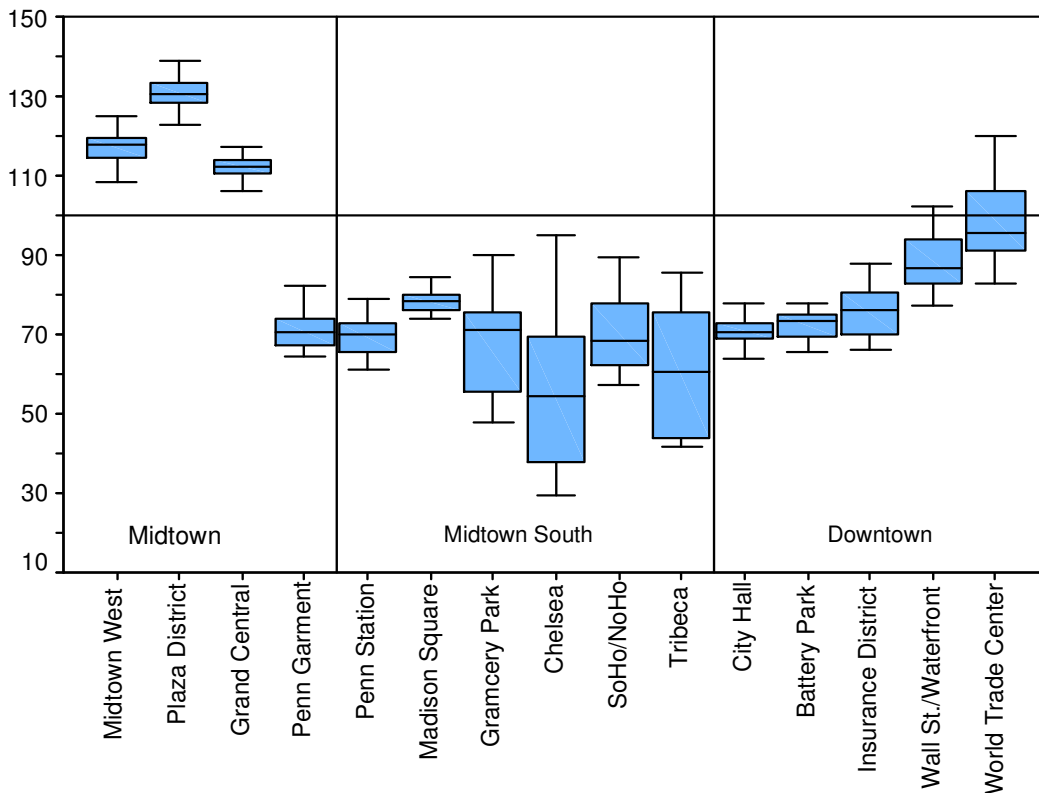


Figure 4: *Boxplot of submarket rents relative to the overall Manhattan office market from Q1-1992 through Q1-2004 (index, Manhattan=100). Data: Grubb & Ellis.*

Among the submarkets in the established office cores of Midtown and Downtown, the World Trade Center area (which today comprises about seventeen million square feet of office space in the World Financial Center and a number of other office buildings in the vicinity of the World Trade Center site) shows the greatest volatility. An analysis of the rent time series reveals that this volatility is attributable to a particularly steep decline in rents in the first half of the 1990s, possibly exacerbated by the first

terrorist attack on the WTC building complex, a subsequent sharp increase in rents in the second half of the 1990s; and a dramatic decline in the wake of 9/11, with a partial recovery in the more recent quarters.

Afraid of heights? Tall buildings before and after 9/11

The 9/11 attack had a unequal impact on various spatial submarkets, as the preceding section demonstrates. A further assumption to be investigated is that tenants would shun prominent skyscrapers in response to the 9/11 attack. The susceptibility of famous buildings and very tall buildings to terrorist attack in the future might lead tenants in search of office space to move to low-height and 'low-profile' buildings instead of the most prestigious and conspicuous buildings, which were favored locations before 9/11. Norman Miller and his colleagues (2003), along with Torto Wheaton Research (2002), postulate, however, that these so-called trophy buildings are still coveted by both tenants and investors and that there is no flight from tall buildings due to psychological reasons and fear of new attack. By analyzing a set of seven high-profile trophy buildings, Torto Wheaton Research shows that these buildings exhibited below-average vacancy rates one year after the attack. Miller et al. (2003) envision, however, that adverse affects will harm the marketability of a few truly famous office buildings such as the Empire State Building.

To test this assumption, it is important to distinguish between 'trophy' buildings and 'tall' buildings (despite a large overlap of both categories). There are several buildings in Manhattan that are considered 'trophy' or 'top-tier' but not all of these buildings are in the group of the thirty or even fifty tallest buildings in Manhattan. Conversely, not all of the thirty tallest office buildings in Manhattan are considered trophy. As far as a discounting of market values for fear of future terrorist attack is concerned, it is simply the height of an office building that evokes concerns about being the target of another terrorist attack rather than the rating of a building by brokerage professionals or any measures of value and rental income. Figure 5 compares the vacancy rates of two sets of buildings (forty or more stories and fifty or more stories) extracted from the CoStar (2001) building database. The samples are weighted by rentable building area. The vacancy rate which is a leading indicator and thus more appropriate to reveal trends than rental rates, shows that the tallest buildings (fifty or more stories) in particular recorded a sharp hike in vacancies after 9/11.

Despite the fact that vacancy rates declined and approached the values of the average market in the following quarters, they still remain above market average and significantly above rates for buildings forty or more stories high. The difference becomes even more pronounced when fifty-story-or-higher buildings are eliminated from the forty-story-plus subset of buildings. The category of buildings between forty and forty-nine stories high shows significantly lower vacancies for these buildings. In general, it is evident that the expected flight of tenants from tall office buildings did not occur in the first three years following the attack. The data point to a potential problem for the tallest office buildings (fifty stories or higher), at least in the first three years following the attack. This might be attributed to a psychological effect among office tenants perceiving some of the tallest structures in the city as potential targets of terrorist attack and seeking to avoid them, but the impact of this effect on overall vacancy in the affected buildings appears to be small and is likely to dissipate barring another incidence involving tall office buildings.

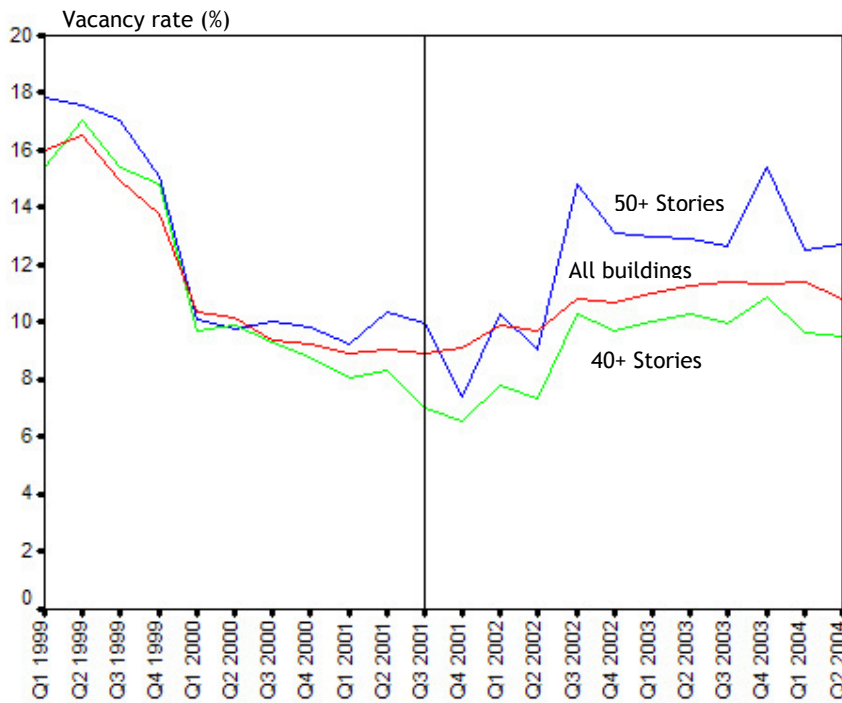


Figure 5: Vacancy rates in office buildings of various heights. Data: CoStar

A list of the destinations of displaced tenants published by Grubb & Ellis (2002) reveals that most tenants in the database moved to buildings with more than twenty, but fewer than forty stories. A smaller percentage moved to buildings with forty to forty-nine stories, and a few large tenants decided to move to buildings with fifty or more

stories. Overall, only a small share of the displaced tenants contained in the subsample moved to non-skyscraper buildings (i.e. buildings with fewer than twenty stories). These findings underline the conclusion that there is no clear evidence of an aversion effect for either tenants in general or the group that was immediately affected by the attack.

The impact on building values and sales transactions

Beyond the destruction of human lives, the September 11 attack also resulted in a massive destruction of capital values. The market value of the destroyed World Trade Center was assessed at \$4 billion and the replacement cost estimated at \$6 billion (not including excavation, infrastructure repair, environmental costs, internal finish, telecommunication and other technological equipment). The total cost for restoring the damaged space in the World Trade Center is estimated at \$2.2 billion (New York City Partnership and Chamber of Commerce 2001, 74).

One of the most remarkable and unexpected phenomena in the wake of 9/11 was the significant increase in sales prices per square foot, despite widespread speculations that falling rents, rising vacancies, and a growing aversion to working in high-rise office buildings would drive prices down dramatically. Simultaneously, average capitalization rates of Central Business District (CBD) office buildings (closed rates) continuously declined from about 9 percent in the third quarter of 2001 to 7.57 percent in the third quarter of 2004. Figure 6 shows the increase in sales prices after September 11, despite worsening market fundamentals and the overall economic recession. One particularly notable case is the sale of the General Motors Building in Manhattan in September 2003 for \$1.4 billion (\$764 per square foot), the highest price ever paid for an office building.

The rise in property values has been attributed to historically low interest rates and the fact that real estate is still considered a "safe haven" in times of economic and political uncertainty (Reis 2003). Large capital flows into office real estate and the sizable portion of international and domestic investors looking to purchase class A office buildings in prime locations put additional upward pressure on prices in the high-quality segment of inner city office markets. It appears that the downward pressure on capitalization rates exerted by the extremely low level of interest rates was stronger than the upward pressure induced by weak market fundamentals (Torto Wheaton Research 2002). Although the complex interaction of interest rates, sales

prices, and capitalization rates in the wake of 9/11 cannot be adequately considered in this paper, the apparent disconnect between market fundamentals and sales prices in the aftermath of the 9/11 attacks deserve further investigation in order to arrive at a more comprehensive understanding of these effects.

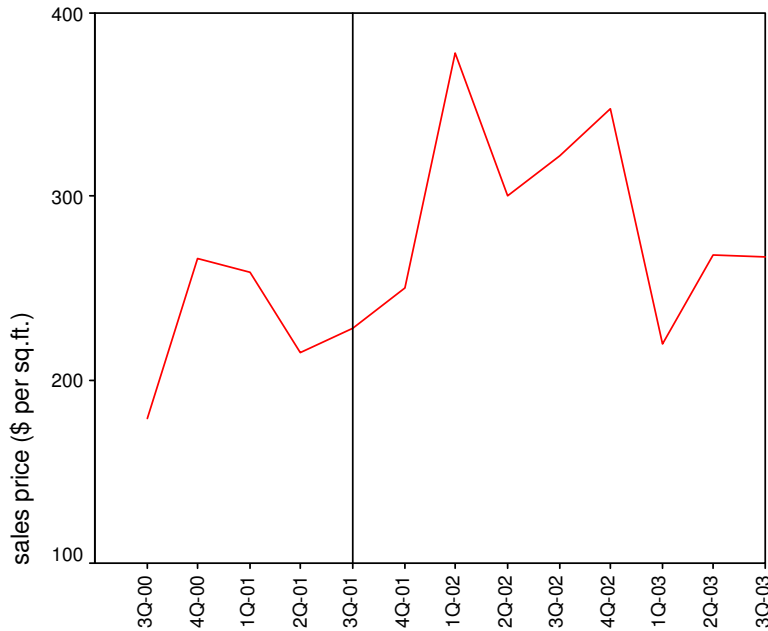


Figure 6: Average sales price per square foot for office properties in Manhattan (n=183).

Data: Real Capital Analytics

Conclusions and further work

More than seven years after the destruction of the World Trade Center on September 11, 2001, there is scant evidence that the attack will have a long-lasting impact on the Manhattan office market.

The Manhattan office market as a whole does not show any signs of lasting economic damage. Of the companies that decided not to return to Lower Manhattan after 9/11, the majority relocated to Midtown Manhattan. An industry analysis demonstrated that both urbanization and localization economies were at play in the relocation process and that companies preferred to settle in preexisting large industry clusters in Manhattan. Taken together, the core markets of Midtown and Downtown Manhattan captured about 80 percent of the stream of displaced tenants after 9/11, while areas outside of these two core clusters captured only 20 percent, which bodes well for Manhattan's ability to remain a prime office location even in the face of a severe crisis.

To be sure, a more decentralized development of office space and a more dynamic increase in office workers in the wider CMSA region outside of Manhattan - a process that has been evolving for at least two decades - is likely to continue over the next years. Although security concerns are likely to accelerate this development at least temporarily as firms seek to create backup facilities and distribute key functions across various locations to protect their operations, preliminary analysis of the period after 9/11 shows that agglomeration economies and firm efficiency criteria are restraining and mitigating such dispersion tendencies in Manhattan. Moreover, Manhattan has clearly been able to retain a competitive productivity advantage in the office-using industries. In fact, Manhattan's productivity differential in the office-using industries over both the national and the regional average has continued to increase even since 9/11.

Lower Manhattan has demonstrated considerable progress in overcoming this crisis both physically and economically. A total of 31.1 million square feet of office space were affected in Lower Manhattan, of which 14.8 were destroyed and 19.6 million damaged and eventually restored. The affected space makes up less than 10 percent of the total inventory of New York City but accounts for roughly 60 percent of

Downtown's Class A space. The sudden loss of more than 100,000 jobs and of a large portion of its office inventory sent Lower Manhattan, which had been struggling for much of the last three decades, into a severe economic crisis.

However, the majority of businesses directly affected by the attack have opted to remain in the Downtown area or have returned there after the damaged buildings were restored. The rebuilding process is well under way, and the first office tower to be rebuilt on the World Trade Center site, Building 7, with 52 stories and 1.7 million square feet of office space, was delivered to the market in 2007. Rental rates and building vacancies seem to have stabilized after the Lower Manhattan market weakened dramatically in the quarters following 9/11.

Despite the progress made to date, the Lower Manhattan office market faces some serious challenges for the next few years. Office employment in the area is considerably lower than it was before the 9/11 attack, and it remains to be seen whether the losses can be fully recovered before the completion of the rebuilding process around 2015. Considering that the area has traditionally been more volatile due to the dominance of finance and technology industries, a full recovery is possible once these key sectors demonstrate sustained job growth again. In the long run, however, it is critical that for Lower Manhattan diversify its economy and attract a broader cross-section of office-using industries to the area.

Among the most notable phenomena found in this paper is the downward correction in occupied space across Manhattan when displaced tenants had the choice of leasing new space after 9/11. On the aggregate, companies rented about 15 percent less space than they had occupied in the World Trade Center. Space reduction was particularly pronounced in high-priced buildings and submarkets, such as Park Avenue or Grand Central. Moreover, the set of so-called "trophy" buildings proved to be less affected by the recession than the general market, a finding that runs counter to initial assumptions about the future of office high-rises. Only the tallest buildings in the city (fifty or more stories) exhibited slightly higher vacancies after 9/11, arguably because of an aversion to the very tallest and most famous structures in the city as potential targets of further terrorist attack.

In addition to a drastic reduction in leased space, accommodation of displaced tenants within the existing office space portfolio of large companies contributed further to lower occupancy rates than had been expected after the destruction of 10 percent of the inventory. This phenomenon, also known as backfill, caused overall absorption to be negative in the quarters following 9/11, since the positive demand created by displaced tenants was more than offset by losses incurred in the accelerated recession. Positive absorption of approximately 7 million square feet of office space in various submarkets of Manhattan can be attributed to tenants who were displaced by the 9/11 attack. This figure is much lower than expected given the square footage of the destroyed buildings. Approximately half of the anticipated demand dissipated through backfill into existing space, reduced staff, subleasing, and more economical space usage per office worker.

Acknowledgement

This study was enabled by a grant from the Russell Sage Foundation. The author is grateful to Howard Chernick, Andrew Haughwout, Ned Hill, Joseph Pereira, James Parrott, Hugh F. Kelly, Sanders Korenman and Cordelia Reimers for comments and suggestions on earlier versions of this paper. The author also wishes to thank CoStar, Grubb & Ellis and Real Capital Analytics for providing the data needed to perform this analysis. All errors remain my own.

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