6-2014

Effects of the World Trade Center Attacks and Hurricane Sandy: Manhattan Commercial Real Estate Market

Michael Miceli
Union College - Schenectady, NY

EFFECTS OF WORLD TRADE CENTER ATTACKS AND HURRICANE SANDY: MANHATTAN COMMERCIAL REAL ESTATE MARKET

by

Michael J. Miceli

* * * * * * * * *

Submitted in partial fulfillment
of the requirements for
Honors in the Department of Economics

UNION COLLEGE
June, 2014

ABSTRACT

MICELI, MICHAEL J. Effects of the World Trade Center Attacks and Hurricane Sandy: Manhattan Commercial Real Estate Market. Department of Economics, June 2014.

ADVISOR: Younghwan Song

Two rare and uncontrollable events that recently took place in Manhattan were the attacks on the World Trade Center and Hurricane Sandy. Both of these catastrophic events affected the commercial real estate market in Manhattan in several ways. Using quarterly time-series data between 1996 and 2013 collected from Brookfield Office Properties, this paper utilizes regression analysis to investigate the effects of these events on vacancy rate, absorption rate and rent in Manhattan. The regression analyses control for location and building type such as Midtown, Downtown and Classes A,B,C, as well as economic factors such as unemployment rate and the S&P index. The regression results show that rent decreased in Downtown after 9/11 by 22% compared to Midtown. Rent showed a similar relationship with Sandy. Absorption rate also significantly decreased in Downtown by 4.98% after 9/11 compared to Midtown. Vacancy rate showed no significant effects from these two events.

TABLE OF CONTENTS

List of Tables iv

Chapter One: Introduction 1
- A. Rare and Uncontrollable Events 1
- B. Contribution and Organization of This Paper 2

Chapter Two: Literature Review 4
- A. Interview Accounts of 9/11 and Sandy 4
- B. Implications of 9/11 5
- C. Implications of Sandy 6
- D. Contribution of This Paper 7

Chapter Three: Data Description 8
- A. Overview of Variables and Data Sample 8

Chapter Four: Econometric Model 10
- A. Description of Existing Models 10
- B. Equations and Overview of Model 10
- C. Anticipated Results 11

Chapter Five: Empirical Results 13
- A. Review of Variables and Regressions 13
- B. Effects of 9/11 and Sandy on Vacancy Rate 14
- C. Effects of 9/11 and Sandy on Absorption Rate 14
- D. Effects of 9/11 and Sandy on Rent 15
- E. Overview of Results and Previous Literature 15

Chapter Six: Conclusion 17
- A. Conclusion of Results 17
- B. Limitations and Recommendations 17
- C. Policy Implications 18

References 19

Tables 20

LIST OF TABLES

Table 1: Descriptive Statistics for all Observations including Dummies 20

Table 2: OLS Regressions of Vacancy Rate in Manhattan During the Period of 1996 Q1 – 2013 Q2 21

Table 3: OLS Regressions of Absorption Rate in Manhattan During the Period of 1996 Q1 – 2013 Q2 22

Table 4: OLS Regressions of Log(Rent) in Manhattan During the Period of 1996 Q1 – 2013 Q2 23

CHAPTER ONE

INTRODUCTION

A. Rare and Uncontrollable Events

There is always uncertainty following a rare and uncontrollable event. Two specific rare and uncontrollable events that this paper discusses are the attacks on the World Trade Centers and Hurricane Sandy.

September 11th, 2001 was an infamous day that affected the lives of all Americans. The landscape of Manhattan as a whole and the Manhattan commercial real estate market was affected in many ways. The emotional toll that this took on New Yorkers cannot be quantified. From a real estate perspective, this was an attack on the largest, most prestigious complex in Manhattan. Numerous safety measures have taken place for commercial Manhattan landlords since the attack. The most significant change was the increase in insurance payments.

Hurricane Sandy was also an uncontrollable event that took a major toll on New Yorkers from October 22, 2012 – October 31, 2012. The damage done was devastating, but in a different way than September 11th. Mother Nature was the cause of this event, rather than a group of people attacking. There is less of an emotional and psychological factor after Hurricane Sandy than after September 11th. Many buildings, especially downtown, were flooded and lost power. One policy in progress is moving the generators and electrical units above the ground floor.

Both events affected a similar area and market in Manhattan (Downtown), which allows for a unique opportunity to compare the effects. Both also created the cost of owning and operating a building to increase tremendously, which has major effects on the

market. Economist will be interested in this topic because it will bring more clarity to the uncertainty that follows catastrophic events. If there are trends in the market that follow uncontrollable events, economists can have a more clear view of the actions that they will have to take. This could give commercial landlords a blueprint as to what rents they should offer to tenants following the events. This can also help commercial landlords position themselves by having a good idea as to how the vacancy rate and absorption rate shift.

B. Contribution and Organization of This Paper

Previous literature on this subject focuses on either 9/11 or Hurricane Sandy, but not both. Abadie and Dermisi (2008) looks at the effects on the Chicago commercial real estate market after 9/11, but not Manhattan. It also only utilizes vacancy rate as a commercial real estate market indicator. I use vacancy rate as well as absorption rate and asking rent. Abadie and Dermisi (2008) concludes that companies moved outside of a "high risk" area after 9/11. Larkin (2013) discusses policy changes, including the increase in insurance costs after 9/11. After 9/11, there was a separate line on insurance statements for terrorism called "TRIA," as discussed in Bosso (2013). Marcuse (2002) states that there was an existing movement of "back office space" outside of the Central Business District to a more "decentralized" space. 9/11 just made the process move at a much quicker pace.

I utilize data from Brookfield Office Properties, a prestigious, worldwide commercial landlord. The time-series data was collected from 1996-2013 on a quarterly basis. The data is divided by market as well as class of building (A, B, or C). The

dependent variables are vacancy rate, absorption rate, and asking rent. These are the three main indicators of the commercial real estate market. Vacancy rate shows the amount of space available in a certain area. Absorption rate shows the pace at which office space is being leased. Asking rent shows the average price that property is being leased for, per square foot, in a certain area at a certain time. Independent variables include dummies based on time and market, as well as economic indicators such as unemployment and S&P 500 index.

In Chapter 2 this paper looks at existing literature regarding terrorist attacks and natural disasters in relation to real estate. Chapter 3 delves into data description, explaining sources of data and describing variables. This is followed by an in-depth look at the econometric model in Chapter 4. There are several equations, which are explained. The empirical results are then revealed and analyzed in Chapter 5. Finally, the results are tied together in my concluding chapter.

CHAPTER TWO

LITERATURE REVIEW

A. Interview Accounts of 9/11 and Sandy

Jeremiah Larkin is the President of Leasing at Brookfield Properties, and was in the same position in 2001. Brookfield Properties is the landlord of the World Financial Center, which is directly across the street from the World Trade Center. In Larkin (2013), we discussed the effects on the market in the financial district of Manhattan after both 9/11 and Hurricane Sandy. In order to understand the effects, one first needs to research possible causes. Larkin said that after 9/11 and Sandy, there were several policy changes that led to an increase in landlord operational costs, and in effect alters the deals that are done with tenants. One example was skyrocketing insurance costs after 9/11 to include a new "terrorism insurance." Another cause was the human nature of being at risk. Larkin stated that as the CEO of Lehman Brothers was watching the World Trade Center fall on television he called and said he would not be coming back to the World Financial Center. They subleased some space and sold their stake in the other space. This shows that people wanted to move from high risk areas.

Michael Bosso is the President of Operations at Brookfield Office Properties, and was a Vice President of Operations in 2001. He was on site after both 9/11 and Hurricane Sandy. In Bosso (2013), we discussed the differences between both events and what changes have taken place since. Bosso explained that 9/11 had a deep rooted psychological effect on New Yorkers, which is consistent with Larkin (2013). After 9/11 a policy change that Bosso highlighted was the installation of "bomb blast" windows from floors 12 and up. He also spoke about the effects of Hurricane Sandy. There was

massive flooding in downtown Manhattan, and many electrical units were ruined. The steps taken after both events were different, but they both were extremely adverse situations.

B. Implications of 9/11

Abadie and Dermisi (2008) confirm the idea in Larkin (2013) that people do not like to be in high risk areas. Abadie and Dermisi (2008) focuses on the effects on the commercial real estate market in the Chicago Central Business District post 9/11. The authors choose Chicago because no space was destroyed and there are many landmarked and tall buildings. They focus solely on vacancy rate and note that asking rent would not be a great indicator because it is only listed for available space and not all space. The authors focus on the effects on vacancy rate in a "shadow area" which is a 0.3 mile radius of 3 major, landmarked buildings. The authors find that vacancy rate increases as it gets closer to at risk buildings, meaning that people wanted to move away from tall buildings.

Marcuse (2002) researches both policy changes and the movement of jobs in New York post 9/11. Marcuse (2002) agrees that tenants will move from high risk areas, as discussed in Abadie and Dermisi (2008). The author states that businesses were looking to move "back offices" to a more "decentralized" area, but 9/11 made these changes happen at a much faster pace. He notes that headquarters may or may not remain in the financial district. Marcuse (2002) also discusses that new developments were being stopped in major cities and moved to a more "decentralized" area. Marcuse (2002) agrees with Larkin (2013) in the sense that policy changes took place after 9/11. Security changes were discussed the most, as landlords must do this to make tenants feel as safe as

possible. Policy changes also took place and are continuing to take place after Hurricane Sandy.

C. Implications of Sandy

The previous papers discuss effects of September 11th, but do not discuss the effects of natural disasters. Cochrane (2004) focuses on assessing flood damage after natural disasters. The author talks about double-counting, which means that one not only needs to account for the direct damages, but also account for value added. There is also the issue that resources will need to be placed into a certain area, such as direct damages and taken from another (ie. a renovation taking place). Cochrane discusses the effect on insurance, which is similar to that explained in Larkin (2013).

The effect of natural disasters on the economy is the main topic of Toya and Skidmore (2007). The authors state that a more developed economy with higher income and education are affected less by a natural disaster. The paper uses deaths in a natural disaster as an independent variable along with many other economic dependent variables. This shows that there is an effect on the economy after a natural disaster. Economic factors such as unemployment rate and S&P Index affect the commercial real estate market as well. However, they do not directly discuss the commercial real estate market.

Bengtsson, Botzet and Esch (1996) research the effect of greenhouse gas induced climate warming on future hurricanes. They find the Global Warming will actually reduce the amount of hurricanes and intensity of hurricanes. There will be even less hurricanes in the southern hemisphere. The authors utilize high resolution climate models to back up their results. This is contrary to the popular belief that with Global Warming,

come more hurricanes and more intense hurricanes. It is in fact the opposite, which bodes well for the future of Manhattan. However, that does not mean that there will not be another storm like Hurricane Sandy.

D. Contribution of This Paper

The data I used includes vacancy rates, absorption rates, and asking rents for markets in Manhattan divided by the building class (A, B or C) unlike in Abadie and Dermisi (2008). My paper focuses on two existing markets rather than proposed at-risk areas based on radii around tall buildings.

CHAPTER THREE

DATA DESCRIPTION

A. Overview of Variables and Data Sample

The data used in this paper is from Brookfield Office Properties, a prestigious commercial landlord worldwide, including Manhattan. There are three main indicators of the state of the commercial real estate market. The dependent variables include vacancy rate, absorption rate, and asking rent. Vacancy rate is the percentage of properties in a certain area that are available. This is calculated on a quarterly basis. Vacancy rate is one of the main indicators of how well the commercial real estate market is at a certain time. A high vacancy rate shows that the market is doing poorly and a low vacancy rate shows that a market is doing well. Absorption rate is the pace at which real estate units are leased in a specific area. This is calculated by dividing the available space by the space leased in that quarter. A high absorption rate shows that space is being leased at a fast pace, and the market is doing well. A low/negative absorption rate shows that there is little space being leased, and the market is doing poorly. Asking rent is a basis of how much a unit may be rented for in a specific market. Rent is charged by the square footage of a space. A rent may be $40.00 per square foot. Asking rent reflects the supply and demand of properties.

The independent variables include a dummy variable for the location and time of the data. The first dummy variable is the market of interest. There are two major markets in Manhattan: Midtown and Downtown. The World Trade Center was in the downtown market. The quarterly data was gathered from 1996 through 2013, which is time-series data. This gives a basis for before 9/11 and after Hurricane Sandy. The second dummy

variable is based on time of the data. The time periods will be post-9/11, and post-sandy. There are also dummy variables based on the type of building, Class A, B and C.

The other independent variables are based on the economy in Manhattan. The main economic indicator that affects the commercial real estate market is unemployment rate. If unemployment rate is high, companies will not need as much office space, but if unemployment rate is low, companies might need to expand their commercial footprint. The Manhattan unemployment rate was gathered from the Bureau of Labor Statistics. The second economic indicator that is especially important is the S&P 500 Index. This is the best indicator of how the stock market is doing, and the majority of companies in Manhattan over the past 10-20 years were financial institutions. The financial district was affected most by 9/11, so this will be a very useful variable. The S&P Index was collected from FRED Economic Data. Finally, the last independent variable is total inventory. Total inventory is measured in Square Feet (SF), and is the amount of commercial space in a certain area. In Manhattan, the total inventory changed after 9/11, and this variable will solve for that issue. Inventory was also from Brookfield.

CHAPTER FOUR

ECONOMETRIC MODEL

A. Description of Existing Models

The econometric equation used in Abadie and Dermisi (2008) is: vacancy $rate_{it}$ $=\alpha(shadow_i \times post\text{-}9/11_t)+ f_t+\eta_i+\varepsilon_{it}$, where vacancy $rate_{it}$ is the vacancy rate in building $_i$ and quarter $_t$, $shadow_i \times post\text{-}9/11_t$ is a dummy variable. The dummy variable has a value one if building $_i$ is located in the shadow area and the quarter of the observation, $_t$, is after 9/11. This paper uses a very similar model, but utilizes absorption rate and asking rent as dependent variables as well. Instead of using a "shadow area" I use market. This is used to see which market was affected most by 9/11 and Hurricane Sandy. My equations will be:

B. Equations and Overview of Model

$$vacancy\ rate_{it} = \beta_0 + \beta_1(market_i \times post\_9\_11_t\ or\ post\_sandy_t) + \beta_2 market_i + \beta_3(post\_9\_11_t\ or\ post\_sandy_t) + \beta_4 unemployment_t + \beta_5 s\&p\_index_t + \beta_6 inventory_t + \beta_7\ class_i + \varepsilon_{it} \quad (1)$$

$$absorption\ rate_{it} = \beta_0 + \beta_1(market_i \times post\_9\_11_t\ or\ post\_sandy_t) + \beta_2 market_i + \beta_3(post\_9\_11_t\ or\ post\_sandy_t) + \beta_4 unemployment_t + \beta_5 s\&p\_index_t + \beta_6 inventory_t + \beta_7\ class_i + \varepsilon_{it} \quad (2)$$

$$\log(asking\ rent_{it}) = \beta_0 + \beta_1(market_i \times post\_9\_11_t\ or\ post\_sandy_t) + \beta_2 market_i + \beta_3(post\_9\_11_t\ or\ post\_sandy_t) + \beta_4 unemployment_t + \beta_5 s\&p\_index_t + \beta_6 inventory_t + \beta_7\ class_i + \varepsilon_{it} \quad (3)$$

Dependent Variables:

vacancy rate$_{it}$ – percentage of office space that is available/vacant at a time $_t$ and in a market $_i$

absorption rate$_{it}$ – rate at which available commercial office space is leased in a time $_t$ and in a market $_i$

asking rent$_{it}$ – average rent that is being charged and asked for at a time $_t$ and in a market $_i$

Independent Variables:

$market_i$ – dummy variable that indicates market $_i$ in Manhattan
$post\_9\_11_t$ – dummy variable that is 1 for after 9/11 and 0 before
$unemployment_t$ – percentage of workforce that is unemployed at time $_t$
$s\&p\_index_t$ – stock market index based on the market capitalizations of 500 large companies at time $_t$
$inventory_t$ – amount of total office space in Manhattan at time $_t$, measured in Square Feet (SF)
$class_i$ – dummies for class of building (Class A, B, or C)

All three of the equations are similar, except for the dependent variables. Vacancy rate, absorption rate and asking rent are all affected by the economic well-being of a certain area. The most important economic factor is unemployment rate because if companies are downsizing, they need less office space, which greatly affects the commercial real estate market. Another economic factor is the S&P 500 Index, which gives an indication of how well financial institutions are doing. I would also like to include the rise in insurance costs during this time, but that information is not accessible. Abadie and Dermisi (2008) did not research Manhattan because there was inventory lost during the attacks on the World Trade Center, but using inventory as a variable will remove this issue.

C. Anticipated Results

The anticipated results are consistent with Abadie and Dermisi (2008). In equation 1, I anticipate the interaction term to be positive for downtown. If true, this will show that vacancy rate increases in high risk areas. The coefficient on unemployment rate should be positive, because as unemployment rate increases, so does vacancy rate because companies need less space. The coefficient on S&P Index should be negative,

because if the S&P index is high, it means that companies are doing well financially. Finally, the coefficient on inventory should be positive because as more office space comes on to the market, vacancy rate will increase.

In equation 2, I anticipate the interaction term to be negative. The rate at which office space is leased will slow down following both events because of uncertainty. The coefficient on unemployment rate should be negative because as unemployment rate increases, absorption will decrease because companies will slow their search for new office space with fewer employees. The coefficient on S&P Index is anticipated to be positive because as the stock market is booming, companies will be looking for larger, more luxurious office space. Finally, the coefficient on inventory will be negative because with more space comes more challenge in leasing space.

In equation 3, I anticipate the interaction term to be negative. Prices of rent should decrease to entice tenants to move to an "at-risk" area. The coefficient on unemployment rate should be negative because as there are less jobs, companies will be less willing to pay a high price for office space. The coefficient on S&P Index should be positive because when the stock market is doing well, companies will want more luxurious office space and will be willing to put forth the money. Finally, the coefficient on inventory should be positive because with a newer, updated supply of office space, comes a premium price.

CHAPTER FIVE

EMPIRICAL RESULTS

A. Review of Variables and Regressions

Table 1 reports the descriptive statistics for the sample. Vacancy rate has a mean of 9.54% and absorption has a mean of 0.07%. Vacancy rate was very high in Class A buildings following 9/11, reaching 17% downtown (not reported in the table). Absorption also has a minimum that is a negative, which means that more office space came on the market than was leased. The maximum rent from the sample is $92.59 per square foot, which was in 2008, right before the recession hit. Average rent in Manhattan from this sample was $38.73 per square foot, which encompasses Class A, B, and C buildings. Inventory in Class A buildings downtown also took a major toll following 9/11, dropping by over 10 Million Square Feet (MSF) to 38 MSF (not reported in the table), which shows that 9/11 affected a large amount of office space. Unemployment rate in Manhattan had a maximum of 8.9%, coinciding with the start of the recession.

For all regression tables, columns 1-3 use the time variable of September 11th, and columns 4-6 use the time variable of Hurricane Sandy. Columns 1 and 4 are OLS regressions excluding the interaction term to get a base view of the dependent variable's separate relationships with downtown and the time period after 9/11/Sandy. In columns 2 and 5, the interaction term is included to see if the dependent variable was affected by being downtown after 9/11/Sandy. Finally, columns 3 and 6 include year dummies for 1997-2013 and quarter dummies for quarters 2-4. The number of observations for all regressions was 396. The S&P Index variable was divided by 1,000, and the inventory variable was divided by 100,000,000 before placed in the regression.

B. Effects of 9/11 and Sandy on Vacancy Rate

Table 2 shows the regression results using vacancy rate as the dependent variable. In column 1, we see that vacancy rate is higher downtown than midtown by 2.2%. When including the interaction term in columns 2 and 3, we see that the coefficient is positive and insignificant. Looking at the results for the Sandy regressions in columns 4-6, we see that vacancy rate is higher downtown than midtown, and the interaction term is still insignificant, but now negative. The class dummies give us interesting results in column 6. As expected, the Class A vacancy rate is lower than Class C, but Class B vacancy rates are higher than Class C. This may be due to the fact that if a person is looking to lease office space they would either want to save the most money and go with a Class C building, or impress their clients and choose to pay a little extra for a Class A space, leaving Class B space with more vacancy. But, this is just my conjecture. We see unemployment rate and vacancy rate are positively correlated. When unemployment rate increases, there are fewer people employed in office space, so companies decide to lease less space. Inventory and vacancy rate are also positively correlated showing that if more space comes on to the market, there will be more vacant space.

C. Effects of 9/11 and Sandy on Absorption Rate

Table 3 reports the regression results using absorption as the dependent variable. Looking at column 1, we see the relationship between absorption and downtown is insignificant. We also see that the relationship between absorption and 9/11 is insignificant. In column 3, the interaction term becomes negative and significant at the

10% level. Absorption decreased by 4.98% downtown after 9/11 compared to midtown. The results of the Sandy regressions are mostly insignificant. As opposed to vacancy, absorption is higher in Class B than Class C, which was expected.

D. Effects of 9/11 and Sandy on Rent

In Table 4, the regression results using log(rent)as the dependent variable are listed. This set of regressions had the most significant results. In column 1, we see that rent is higher in downtown by 18% and higher after 9/11 by 30%. The coefficient on the interaction term in column 2 is negative and significant at the 1% level. This means that rent decreased downtown after 9/11 by 26% compared to Midtown. This shows us that 9/11 had a major impact on the level of rents downtown after 9/11. When looking at the Sandy regressions we see that similarly, rent downtown is higher by 21%. When including the interaction term, we see that rent decreased downtown after Hurricane Sandy compared to Midtown. The S&P Index has a positive coefficient, which explains that when economy is booming and financial firms do well, they can afford to pay more for rent. Also, inventory is positive and significant, explaining that most of the new developments are priced higher than the existing buildings on the market. As expected, both Class A and Class B space have higher rent than Class C.

E. Overview of Results and Previous Literature

Overall, the results were consistent with expectations. Rent and Absorption showed results of being impacted by 9/11 and Sandy. Rent decreased downtown after 9/11 by 22% compared to Midtown. This is a large swing in rental rates, explaining that

these two major events had a quantitative impact on the Commercial Real Estate Market. Also, several fundamental relationships such as vacancy rate and unemployment rate, vacancy rate and inventory, and rent and S & P Index helped solidify the results.

Abadie and Dermisi (2008) found that vacancy rate increased in at-risk Chicago areas following September 11th. After 9/11, I found that vacancy rate had a positive coefficient, but was insignificant in Manhattan. Abadie and Dermisi (2008) also did not use absorption rate or rent and claimed that rent was not a good indicator. Absorption gave us mostly insignificant results, but did show that absorption decreased Downtown after 9/11 compared to Midtown. Rent gave the most significant results and was a great indicator, showing that rent decreased Downtown after both 9/11 and Sandy compared to Midtown.

CHAPTER SIX

CONCLUSION

A. Conclusion of Results

The results of the regressions show us a relationship between the catastrophic events of September 11th and Hurricane Sandy with the Manhattan Commercial Real Estate Market. Using vacancy rate, absorption and rent as dependent variables we saw that there were significant results. Rent gave us the most significant relationship. Rent decreased downtown after 9/11 by 22% compared to Midtown. This shows us that 9/11 had a major impact on rent. Rent also decreased Downtown after Hurricane Sandy compared to Midtown. Absorption also decreased after Downtown by 4.98% after 9/11 compared to Midtown. Vacancy rate did not show significant results following these events.

B. Limitations and Recommendations

This research was mainly limited by the time frame of the sample. In order to see solid evidence of an events effect on an area, there should be six to seven years worth of data after the event. After Hurricane Sandy, there are only three quarters worth of data. In a few years, there may be more significant results in the case of Hurricane Sandy. Also, the data could have been more specific in terms of location. There are 15-20 submarkets in Manhattan that could have made the results more descriptive and interesting. Future research on the topic should use the submarket data if it is available. Also, if possible a focus should also be spent on other major cities after September 11th, to see the nationwide impact it had on the commercial real estate market.

C. Policy Implications

There have been thousands of policy changes after September 11th and Hurricane Sandy. These policy changes are ongoing in the case of Sandy. These policies include bomb-blast windows from floors twelve and up, terrorism insurance, and strategic placement of generators in the case of a flood. The results from this research do not have any major policy implications, but it may give insight to commercial landlords. They can look at the results of rent, and in the case of another catastrophic event, alter their rental rates based on the two previous events.

References:

Abadie , Alberto and Dermisi, Sofia. “Is terrorism eroding agglomeration economies in Central Business Districts? Lessons from the office real estate market in downtown Chicago” *Journal of Urban Economics*, Volume 64, Issue 2, September 2008, Pages 451‑463

Bengtsson, Lennart, Botzet, Michael and Esch, Monika. “Will greenhouse gas-induced warming over the next 50 years lead to higher frequency and greater intensity of hurricanes?” *Tellus*, Volume 48, Issue 1, 1996, Pages 57-73

Bosso, Michael. Interviewed by Author. Phone Interview. Schenectady, NY and New York, NY, October 25, 2013.

Cochrane, Hal. "Economic loss: myth and measurement", Disaster Prevention and Management, Volume 13 Issue 4, 2004, Pages 290 - 296

Larkin, Jeremiah. Interviewed by Author. Phone Interview. Schenectady, NY and New York, NY, October 2, 2013.

Marcuse, Peter, “Urban form and globalization after September 11th: the view from New York” *International Journal of Urban and Regional Research*, Volume 26, 2002, Pages 596– 606

Toya, Hideki and Skidmore, Mark. “Economic Development and the Impacts of Natural Disasters” *Economics Letters*, Volume 94, Issue 1, January 2007, Pages 20‑25

Table 1: Descriptive Statistics for all Observations including Dummies

	Mean	Std. Dev.	Maximum	Minimum
Vacancy Rate (%)	9.54	3.48	25.62	1.73
Absorption Rate (%)	0.07	1.24	5.60	-6.28
Rent ($ per Square Foot)	38.73	14.99	92.59	6.22
Unemployment Rate (%)	6.47	1.43	8.90	3.80
S&P Index	1,177.52	215.69	1,609.49	658.85
Inventory (Square Feet)	56,231,203	56,004,937	183,000,000	9,923,197
September 11	0.71	0.45	1	0
Sandy	0.05	0.21	1	0
Downtown	0.48	0.50	1	0
Midtown	0.52	0.50	1	0
Class A	0.35	0.48	1	0
Class B	0.35	0.48	1	0
Class C	0.31	0.46	1	0
Observations			396	

Note: Rent is calculated in constant dollars from 1996.

Table 2: OLS Regressions of Vacancy Rate in Manhattan During the Period of 1996 Q1 – 2013 Q2

	9/11 OLS	9/11 OLS with Interaction	9/11 OLS with Interaction, and Year/Quarter Dummies	Sandy OLS	Sandy OLS with Interaction	Sandy OLS with Interaction, and Year/Quarter Dummies
	(1)	(2)	(3)	(4)	(5)	(6)
Downtown*Sept 11 or Sandy		0.21 (0.58)	0.02 (0.51)		-0.64 (1.24)	-0.66 (1.10)
Downtown	2.20*** (0.34)	2.05*** (0.54)	2.29*** (0.48)	2.25*** (0.34)	2.28*** (0.35)	2.33*** (0.31)
Sept 11/Sandy	0.54* (0.30)	0.44 (0.39)	1.30 (1.35)	1.56** (0.72)	1.89** (0.95)	1.03 (1.24)
Unemployment	0.35*** (0.11)	0.34*** (0.11)	0.64* (0.38)	0.28** (0.12)	0.28** (0.12)	0.87*** (0.32)
S&P Index	-8.20*** (0.73)	-8.20*** (0.73)	-1.54 (1.73)	-8.77*** (0.81)	-8.77*** (0.81)	-1.51 (1.73)
Inventory	1.29*** (0.46)	1.29*** (0.46)	1.40*** (0.41)	1.33*** (0.46)	1.33*** (0.46)	1.39*** (0.41)
Class A	-1.36** (0.57)	-1.35** (0.57)	-1.54*** (0.50)	-1.45** (0.57)	-1.45** (0.57)	-1.54*** (0.50)
Class B	1.23*** (0.35)	1.24*** (0.35)	1.13*** (0.31)	1.17*** (0.34)	1.17*** (0.34)	1.13*** (0.30)
Constant	14.85*** (1.37)	14.91*** (1.38)	10.03*** (3.53)	16.25*** (1.55)	16.24*** (1.55)	8.27*** (3.15)
R-Squared	0.46	0.46	0.61	0.46	0.46	0.61
Observations			396			

Note: The standard errors are presented in parenthesis. For columns 1-3, the September 11th is used in row 1 and 3 and columns 4-6 use Sandy in rows 1 and 3. In columns 3 and 6 dummies for years 1997-2013 are used along with 3 quarter dummies (2-4). The S&P Index variable is divided by 1,000, and the Inventory variable is divided by 100,000,000.

*Statistically significant at the 0.10 level.

**Statistically significant at the 0.05 level.

***Statistically significant at the 0.01 level.

Table 3: OLS Regressions of Absorption Rate in Manhattan During the Period of 1996 Q1 – 2013 Q2

	9/11 OLS	9/11 OLS with Interaction	9/11 OLS with Interaction, and Year/Quarter Dummies	Sandy OLS	Sandy OLS with Interaction	Sandy OLS with Interaction, and Year/Quarter Dummies
	(1)	(2)	(3)	(4)	(5)	(6)
Downtown*Sept 11 or Sandy		-4.05	-4.98*		-3.67	-4.12
		(2.78)	(2.57)		(6.00)	(5.54)
Downtown	0.38	3.27	4.35*	0.02	0.18	0.98
	(1.65)	(2.58)	(2.39)	(1.65)	(1.67)	(1.55)
Sept 11/Sandy	-3.35**	-1.57	-9.28	-4.17	-2.34	0.87
	(1.42)	(1.87)	(6.77)	(3.46)	(4.58)	(6.28)
Unemployment	-0.57	-0.56	3.07	-0.52	-0.52	1.21
	(0.52)	(0.52)	(1.90)	(0.56)	(0.56)	(1.63)
S&P Index	1.49	1.46	-0.57	1.95	1.94	-1.11
	(3.48)	(3.47)	(8.65)	(3.90)	(3.90)	(8.72)
Inventory	0.36	0.30	0.66	0.07	0.05	0.72
	(2.20)	(2.20)	(2.03)	(2.21)	(2.21)	(2.05)
Class A	-0.64	-0.80	-1.63	-0.03	-0.02	-1.41
	(2.72)	(2.72)	(2.51)	(2.72)	(2.72)	(2.53)
Class B	0.52	0.32	-0.24	0.90	0.89	0.01
	(1.65)	(1.66)	(1.53)	(1.65)	(1.65)	(1.54)
Constant	4.67	3.60	-19.54	1.58	1.53	-3.62
	(6.56)	(6.59)	(17.71)	(7.44)	(7.45)	(15.90)
R-Squared	0.02	0.03	0.22	0.01	0.01	0.20
Observations	396					

Note: The standard errors are presented in parenthesis. For columns 1-3, the September 11th is used in row 1 and 3 and columns 4-6 use Sandy in rows 1 and 3. In columns 3 and 6 dummies for years 1997-2013 are used along with 3 quarter dummies (2-4). The S&P Index variable is divided by 1,000, and the Inventory variable is divided by 100,000,000.

*Statistically significant at the 0.10 level.

**Statistically significant at the 0.05 level.

***Statistically significant at the 0.01 level.

Table 4: OLS Regressions of Log(Rent) in Manhattan During the Period of 1996 Q1 – 2013 Q2

	9/11 OLS	9/11 OLS with Interaction	9/11 OLS with Interaction, and Year/Quarter Dummies	Sandy OLS	Sandy OLS with Interaction	Sandy OLS with Interaction, and Year/Quarter Dummies
	(1)	(2)	(3)	(4)	(5)	(6)
Downtown*Sept 11 or Sandy		-0.26*** (0.06)	-0.22*** (0.04)		-0.28* (0.14)	-0.25*** (0.10)
Downtown	0.18*** (0.04)	0.36*** (0.05)	0.31*** (0.04)	0.21*** (0.04)	0.22*** (0.04)	0.17*** (0.03)
Sept 11/Sandy	0.30*** (0.03)	0.42*** (0.04)	0.08 (0.12)	-0.07 (0.08)	0.07 (0.11)	0.11 (0.11)
Unemployment	0.01 (0.01)	0.01 (0.01)	-0.03 (0.03)	0.04*** (0.01)	0.04*** (0.01)	-0.04 (0.03)
S&P Index	0.58*** (0.08)	0.58*** (0.07)	0.03 (0.15)	0.79*** (0.09)	0.79*** (0.09)	0.03 (0.15)
Inventory	0.43*** (0.05)	0.43*** (0.05)	0.41*** (0.03)	0.46*** (0.05)	0.46*** (0.05)	0.41*** (0.04)
Class A	0.32*** (0.06)	0.31*** (0.06)	0.34*** (0.04)	0.26*** (0.07)	0.26*** (0.07)	0.36*** (0.04)
Class B	0.33*** (0.04)	0.31*** (0.04)	0.33*** (0.03)	0.29*** (0.04)	0.29*** (0.04)	0.34*** (0.03)
Constant	2.03*** (0.14)	1.97*** (0.14)	2.54*** (0.30)	1.86*** (0.18)	1.86*** (0.18)	2.64*** (0.28)
R-Squared	0.66	0.68	0.83	0.58	0.58	0.82
Observations	396					

Note: The standard errors are presented in parenthesis. For columns 1-3, the September 11th is used in row 1 and 3 and columns 4-6 use Sandy in rows 1 and 3. In columns 3 and 6 dummies for years 1997-2013 are used along with 3 quarter dummies (2-4). The S&P Index variable is divided by 1,000, and the Inventory variable is divided by 100,000,000.

*Statistically significant at the 0.10 level.

**Statistically significant at the 0.05 level.

***Statistically significant at the 0.01 level.