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Measuring the Effects of the September 11 Attack on New York City

- The total cost of the September 11 attack on the World Trade Center—comprising earnings losses, property damage, and the cleanup and restoration of the site—is estimated to be between $33 billion and $36 billion through June 2002.
- The earnings losses consist of $7.8 billion in deceased workers' prospective lifetime earnings and $3.6 billion to $6.4 billion in reduced wage and salary income in city industries affected by the attack.
- The cost of cleaning up the site, replacing the destroyed World Trade Center buildings, and repairing damaged buildings and infrastructure is expected to reach $21.6 billion.
- Although the loss of life and disruption of activity temporarily reduced New York City's productive capacity, the attack's effects on employment and consumer confidence had largely run their course by mid-2002.

The attack on the World Trade Center on September 11, 2001, traumatized New York City and the nation. Almost 3,000 lives were lost, and more than 30 million square feet of office space in Lower Manhattan was damaged or destroyed. The loss of workers, physical capital, and infrastructure reduced the productive potential of the city's economy and disrupted the lives of hundreds of thousands of people. Damage to the transportation and communications infrastructure depressed economic activity for a number of months, especially in Lower Manhattan.

This article evaluates the short-term economic consequences of the attack on Manhattan and the four other boroughs that make up New York City. We begin with the deepest loss—that of human lives. We then look at the effects of the attack on the inputs to the production process: labor and capital.

The attack led to an idling and underutilization of labor not only in the World Trade Center area, but also in other parts of the city. (Views of New York City and Lower Manhattan are provided in Appendix A.) Our analysis of labor focuses on aggregate city employment as well as on industry effects and factors that impact employee productivity, including health and confidence.[1] The analysis of capital covers the destruction of commercial space and infrastructure. We also discuss the effects of the attack on the markets for office space, home construction, and home sales. Finally, we examine how the attack affected the city's most economically vulnerable residents.

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This framework is an economic one, incorporating quality-of-life issues. To pursue our analysis, we have restricted ourselves to the labor and capital markets. In theory, it should be possible to evaluate output and income losses directly. In practice, however, such an evaluation is unworkable because official tabulations of gross New York City product do not exist and income figures are reported with a considerable lag.[2] Thus, output effects must be inferred from the behavior of the labor and capital markets. Whenever possible, we separate the effects of the attack from the effects of the business cycle (although we do not attempt to isolate the effects of the fall 2001 anthrax scares from the effects of the attack). Unless otherwise noted, the data presented here cover the period through June 2002, the end of the recovery process at the World Trade Center site.

We conclude that the attack disrupted New York City's economy in many ways. Although it is difficult to put a dollar value on lives lost, it is also inappropriate to omit loss of life from an estimate of the damage sustained. Our intention is to present as complete a picture of the attack's effects as possible. Accordingly, we estimate that the aggregate present value of lost lifetime earnings for these workers is about $7.8 billion. In addition, in the nine months following the attack, lost jobs and a reduction in the number of hours worked translated into an estimated shortfall in aggregate earnings of $3.6 billion to $6.4 billion. The cost of replacing the destroyed and damaged physical capital and infrastructure is estimated at $21.6 billion. Finally, the sum of these labor and capital losses yields an estimated total loss through June 2002 of between $33 billion and $36 billion.[3]

Loss of Life

The death of almost 3,000 people in the attack was a loss to New York City and to the nation. This number includes those who worked in the two World Trade Center towers, the firefighters and police personnel who responded to the attack, and the tourists and other visitors who were in the World Trade Center complex that morning. The method we use to value loss of life is based on the concept of "lifetime-earnings loss." This method estimates individual economic losses by adding up a worker's pretax annual income from the year of death to the year that he or she had expected to retire.[4] For those who died in the attack, the estimated earnings loss is calculated by multiplying the average expected level of annual earnings by the average number of years left to work before retirement.[5]

We estimate workers who died in the attack earned, on average, $127,000 a year. This estimate is based on the average income in 2000 for all workers in Manhattan and all workers in the finance and insurance sectors in Manhattan. The average annual income for workers in the finance and insurance sectors—where about half of the deceased workers had been employed—is estimated to be $197,275 in 2002. The average annual income of all workers in Manhattan, excluding the two sectors, is estimated at $57,000.[6] We use the average age of the workers killed in the attack, forty, and assume that they had twenty-two more years left to work until retirement. The average income of these workers is assumed to grow at the rate of inflation, which is assumed to equal the average discount rate. Under these assumptions, the current value of the aggregate earnings loss reaches about $7.8 billion, or an average of $2.8 million per worker.[7]

Although private insurance is expected to cover a portion of these losses, it is not likely that all of the workers had taken out private life-insurance policies. The earnings losses sustained by the workers' families will be partially covered by various charitable funds. In addition, the families of all World Trade Center attack victims will be eligible to receive compensation under the federal Victim Compensation Fund.[8] Although these various payments will partially offset losses to families and individuals, they do not reduce the overall cost of the attack because those payments represent costs to other parties, such as the government and insurance companies.

Employment Disruptions

In addition to the loss of lives, the attack on the World Trade Center had a dramatic disruptive effect on employment in New York City. The number of private-sector workers started to decline at the beginning of 2001 because of national and local business cycles. The level of employment bottomed out in March 2002 and edged up during the second quarter of the year (Chart 1). From the peak in employment in December 2000 to the trough in March 2002, the number of people working in New York City's private sector fell by 147,000, or 4.6 percent. (By comparison, the number of private-sector jobs lost during the 1989-92 recession was 344,000, or 11.4 percent.) In this section, we estimate the number of jobs lost because of the attack separately from those jobs lost because of the business cycle.

More than one-third of the net job losses in the recent downturn—specifically, 55,000 of the 147,000—occurred between January and September 2001. However, the sharpest

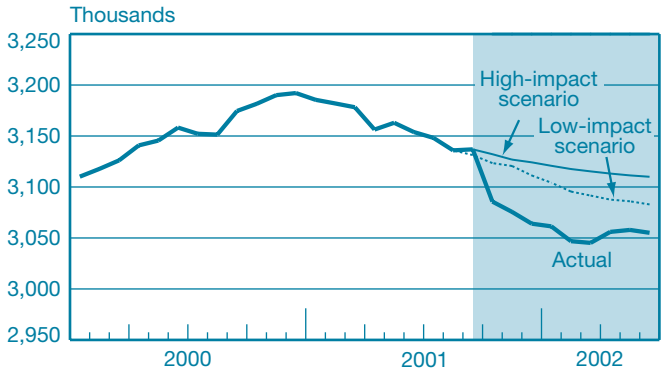
drop was in October 2001: a record 51,000 private-sector jobs were lost in that month alone. The remaining 41,000 job losses of the peak-to-trough decline occurred between October 2001 and March 2002. However, in the following months of April, May, and June, the number of private-sector jobs rose by a total of 10,000, or 0.4 percent.

To gauge how much of the fall in the number of jobs can be attributed to the attack, we use a standard dynamic forecasting model to estimate what the path of New York's employment would have been in the absence of an attack (Appendix B). The difference between the actual path of employment and this estimated path can be interpreted as the marginal effect of the attack on employment in the city at monthly intervals. Using this technique and two alternative sets of assumptions (high-impact scenario and low-impact scenario), we estimate that in October 2001, the number of private-sector jobs in the city was about 38,000 to 46,000 lower than it would have been otherwise. In February, this range moved to as high as 49,000 to 71,000, then eased to between 28,000 and 55,000 by June 2002 (Chart 2).

Data on weekly initial claims for unemployment insurance seem to confirm the pattern seen in payroll employment: the attack's effects on employment were substantial in October and November of 2001, but had largely run their course by early 2002 (Chart 3). Prior to September 11, weekly claims in New York City had been fluctuating in the 7,000 to 9,000 range—or about 1,000 to 3,000 higher than a year earlier, reflecting a general weakening in the economy. The weekly volume of claims more than doubled in the second half of September, and was running 10,000 to 12,000 higher than a year earlier, but then retreated steadily for four months, returning to approximate pre-attack levels by late February 2002. Aside from a brief spike in late March and early April—largely attributable to filings for extended benefits—the number of jobless claims was relatively steady throughout the first half of 2002.

These employment disruptions varied across the city's boroughs and neighborhoods, and across industries (Box 1). The most pronounced impact was concentrated in the blocks surrounding the World Trade Center, where numerous businesses, offices, and retail shops were either destroyed or

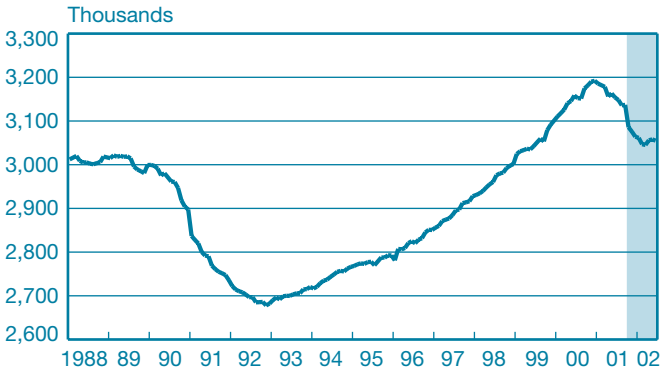
Chart 2
Path of New York City Private-Sector Employment



Sources: U.S. Department of Labor, Bureau of Labor Statistics; Federal Reserve Bank of New York.

Note: See Appendix B for methodology and a full explanation.

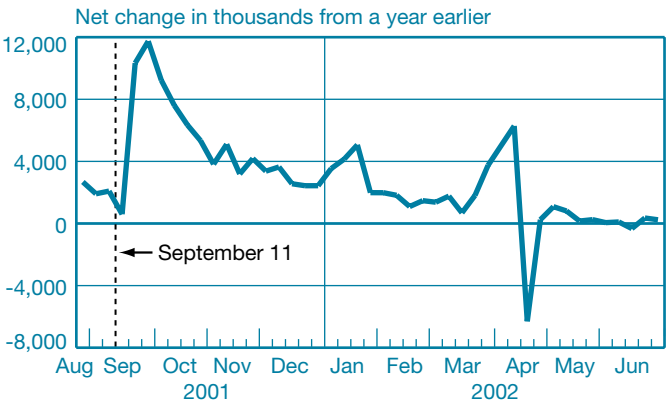
Chart 1
Private-Sector Employment in New York City



Source: New York State Department of Labor.

Note: The shading indicates the post-September 11 period.

Chart 3
New York City Initial Jobless Claims



Source: New York State Department of Labor.

Box 1

Employment Disruptions by Industry

The dynamic forecasting model suggests that most of the attack's net impact on employment levels occurred in October 2001. Here, we take a closer look at what appear to be the most directly affected industries: financial services, restaurants, hotels, and air transportation. Together, these industries accounted for 42,000 of October's 51,000 drop in private-sector employment. In subsequent months, although the estimated effect on *overall* employment was relatively modest, some industries registered further losses while others rebounded (see chart below). To get a better understanding of the attack's effects over time, it is helpful to examine these industries and their performance. Because swings in employment after September 11 are far larger than any preexisting trends within these industries, we assume that changes in employment after that date are mainly attributable to the attack.

The **financial services industry** appears to have been the most directly affected sector by far. In New York City, the number of jobs in the securities industry fell by 12,000, or 7 percent, in October 2001, and by an additional 6,000 from October 2001 to June 2002. In addition, the banking industry saw a net job loss of 8,000, or 8 percent, in October and lost another 1,000 jobs through June 2002. Net job losses in these key financial industries totaled 20,000 in October and another 7,000 through June 2002. Because some of the loss reflected a relocation of operations to nearby suburbs—mostly northern New Jersey—this figure overstates the net impact on the metropolitan area overall (see chart at right).

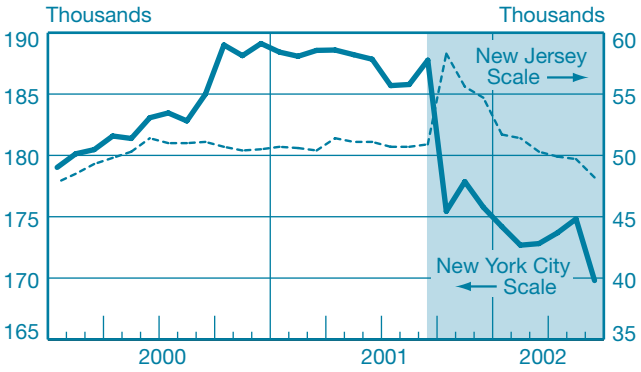
The **restaurant industry** also sustained steep job losses immediately following the attack. For the city overall, the number of jobs at bars and restaurants—which was imperceptibly affected at the national level—fell by an estimated 9,000 (6 percent) in October, but rebounded fully by December and held steady up to June 2002. However, these are net changes and do not capture the geographical distribution of employment in this industry. Thus, it is not clear if restaurant employment in the areas closest to the World Trade Center—the Financial District, Tribeca, and Chinatown—has fully rebounded to pre-attack levels.

The **hotel industry** lost an estimated 6,000 jobs, or 15 percent, citywide between September 2001 and March 2002. This reflected the drop-off in tourism, although 5,000 of those jobs were lost in October alone. In April 2002, the number of hotel jobs rose markedly by an estimated 4,000 and held steady in May at about 5 percent below pre-attack levels. Nationally, hotel industry employment has fallen by a more modest 4 percent since September 2001, but has yet to show any sign of bottoming out.

The steep decline in the number of people traveling also led to job losses in areas away from the World Trade Center site—in particular, at John F. Kennedy International Airport and LaGuardia Airport, both in the borough of Queens. The number of jobs in the city's **air transportation industry** fell by about 11,000, or 20 percent. Almost all of this decline occurred in October and November 2001, and there has been no sign of a rebound. Nationally, the number of jobs in this industry fell by 10 percent, with losses spread over the fourth quarter of 2001.

Although other industries, such as business services, apparel manufacturing, printing, and publishing, were also presumably affected, largely because of their strong concentration in Lower Manhattan, there is no indication of any significant shift in employment trends following September 11. However, it should be noted that many business owners and workers who did not lose their jobs evidently suffered income losses because of the disruptions in the weeks and months immediately following the attack. This is of particular concern in the restaurant and apparel industries, where workers' pay depends on business volume.

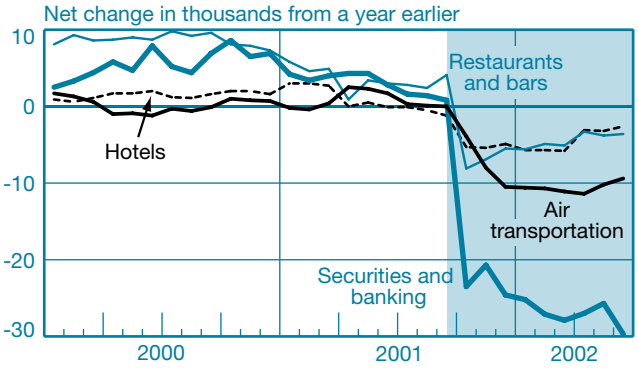
Financial Services Jobs in New York City and New Jersey
Seasonally Adjusted Level



Sources: New York State Department of Labor; New Jersey Department of Labor; Federal Reserve Bank of New York.

Note: The shading indicates the post-September 11 period.

Employment in Selected New York City Industries



Source: New York State Department of Labor.

Note: The shading indicates the post-September 11 period.

badly damaged. Substantial employment effects were also felt in the whole of Lower Manhattan (south of Canal Street [Appendix A]), where transportation access was curtailed and the volume of customer traffic fell precipitously. However, because of the drop-off in tourism—as well as possible multiplier effects from the loss of finance jobs—businesses throughout the city suffered because of the attack. For example, John F. Kennedy International Airport and LaGuardia Airport (both in the borough of Queens) saw, as did related businesses, a sharp decline in employment in the fourth quarter of 2001.

It is less clear whether the job losses were across all income levels. One might hypothesize that low-skilled, low-paid workers were more at risk of losing their jobs; labor economists generally maintain that the workers with the least job-specific skills are the first to be laid off in times of economic stress. Indeed, many of the workers in the hard-hit restaurant and retail sectors are relatively low-paid.[9] To test the hypothesis that the city's low-wage workforce faced a higher incidence of attack-related job loss than high-wage workers, we compare three industries where most employees are relatively well paid with three other industries where most employees are relatively poorly paid.[10] Both the high- and low-wage industries experienced a range of employment declines. Employees in the (low-wage) hotel and (high-wage) brokerage industries were especially affected. However, those in the (low-wage) general merchandise store and (high-wage) legal industries maintained previous employment trends. This example, although limited, does not support the hypothesis that the September 11 attack caused disproportionate job losses in low-wage industries.

We estimate that the attack led to a shortfall in wage and salary earnings of $3.6 billion to $6.4 billion as of June 2002. This estimate mainly reflects attack-related job losses but also includes the reduction in the number of hours worked.

The attack also led to a reduction in the number of hours worked. A recent study of the effects of the attack on workers in Chinatown indicates substantial short-term disruptions in the restaurant and garment industries.[11] Restaurants faced particularly severe declines in business volume in the weeks following the attack. These declines appear to have affected the number of hours worked as well as the number of jobs available. The garment industry also reported substantial declines in the number of hours worked (see Asian American Federation of New York [2002]).

On the basis of this analysis, we estimate that the attack led to a shortfall in wage and salary earnings of $3.6 billion to $6.4 billion as of June 2002. This estimate mainly reflects attack-related job losses, but also includes the reduction in the number of hours worked (Box 2).

Furthermore, worker productivity may have been lowered by changes in personal habits, health, and confidence. Vlahov et al. (2002) report the results from phone interviews with 988 adult Manhattan residents living south of 110th Street five to eight weeks after the attack. About 30 percent of the sample reported an increased use of cigarettes, alcohol, and/or marijuana. The same residents who increased their use of cigarettes and/or alcohol were also found to be more likely to have post-traumatic stress disorder (PTSD) and major depression. In a related study, Galea et al. (2002) report that about 7 percent of the phone sample reported psychological symptoms consistent with current PTSD and almost 10 percent reported symptoms consistent with depression. These percentages are about twice baseline values.

In addition, the New York City Department of Health and the Centers for Disease Control performed a door-to-door survey of 414 individuals living in the Battery Park City residential complex (next to the World Trade Center site) and two other downtown areas most directly affected by the attack (Centers for Disease Control and Prevention 2002). As of October 2001, almost 40 percent of the sample showed PTSD symptoms. Moreover, about 50 percent were still experiencing symptoms consistent with smoke inhalation from the still-burning fires.

Surveys of consumer confidence can also help shed light on the attack's psychological effect on behavior. The widely cited Conference Board survey is only available by census region (that is, New Jersey, New York, and Pennsylvania combined), but since 1997, Siena College in Loudonville, New York, has conducted a parallel monthly survey of New York State residents in which consumer confidence is reported separately for the New York City metropolitan area. According to the

[Consumer] confidence fell fairly sharply in September 2001, recovered somewhat in October, and then rebounded to above pre-attack levels in November.

Siena College (2002) report, the pattern of consumer confidence suggests a very short-lived effect from the attack. Confidence fell fairly sharply in September 2001, recovered somewhat in October, and then rebounded to above pre-attack levels in November. It remained well above its September trough through mid-2002. Interestingly, although this roughly parallels the national trend, U.S. consumer confidence did not begin to recover until December 2001, a month later than it did in the New York City area.

Overall, the effects of the attack were quite uneven across industries and workers. The finance, restaurant, hotel, and air transportation industries in the city were directly affected by the attack. Moreover, there is some evidence that the decline in business volume in Lower Manhattan (following a decline in demand) also led to a reduction in the number of hours worked, largely in the restaurant and garment industries. More generally, while many of the workers in the affected industries were relatively low-paid, we found no indication that employees in the city's lower paying industries were at significantly greater risk of losing their jobs because of the attack than were workers in higher paying industries. We did find some evidence, however, that the productivity of workers living in Manhattan may have been lowered in the immediate aftermath of the attack because of health problems. Nevertheless,

Box 2
Earnings Disruptions

To estimate the marginal effect of the attack on wage and salary earnings, we must first come up with a reasonable assumption regarding the average earnings per worker associated with the net job shortfall. Because the industry profile of attack-related job losses evidently differs from the city's overall industry mix, it would be inappropriate to assume that the average earnings associated with these job losses match the citywide average.

Although our employment simulation is based on a macroeconomic model that ignores the industrial profile of job losses, we can make assumptions about the mix of jobs lost based on total job losses by industry in the first few months after the attack (that is, October through December 2001). As indicated in the table, the most persistent job losses were concentrated in the financial services, air transportation, and hotel industries. The table shows two alternative estimates of the average earnings per worker in 2002 associated with the job shortfall. The "high-impact" scenario assumes that all of the job losses were concentrated in the financial, air transportation, and hotel industries. The "low-impact" scenario assumes that 75 percent of the job losses occurred in these industries, another 10 percent occurred in restaurants, and the remaining 15 percent was evenly distributed across all other industries.

These figures, combined with the employment scenarios described earlier, imply that total wage and salary earnings would have been between $3.4 billion and $6.2 billion higher if not for the attack. In addition, disruptions to Chinatown's garment industry and Lower Manhattan's restaurant industry may have reduced income by an additional $200 million, bringing the total estimated loss to within a range of $3.6 billion to $6.4 billion.[a]

	Distribution of Job Shortfall (Percent)		Average Earnings in 2002 (Dollars)	
Industry	Low-Impact Scenario	High-Impact Scenario	Low-Impact Scenario	High-Impact Scenario
Finance	45	64	197,275	197,275
Air transportation	10	13	50,752	50,752
Hotels	20	23	38,986	38,986
Restaurants	10	0	20,244	—
All other industries	15	0	61,511	—
Weighted average	100	100	115,470	142,775

Source: Authors' calculations.

Note: The 2002 average earnings figures are based on the 2000 County Business Patterns data for Manhattan (except for air transportation, where earnings are for Queens) and are increased by 8 percent.

[a] In the first few months after the attack, workers in Chinatown's garment industry reportedly incurred a steep fall-off in hours and income that was not reflected in the employment statistics (see Asian American Federation of New York [2002]). Although income data by industry are not yet available, aggregate reported income was about $220 million per quarter for the garment industry and $540 million for the restaurant industry in 2000. Our estimated $200 million earnings shortfall assumes a 25 percent reduction in hours and earnings (of those still employed) in these two industries persisting for one quarter.

Siena College's tracking of consumer confidence in the metropolitan area strongly suggests a mitigation of these adverse psychological effects and a general improvement in attitudes in subsequent months.

Physical Capital Losses and Damage

The major components of New York City's public and private physical capital stock in Lower Manhattan that were destroyed or damaged in the World Trade Center attack were as follows: about 30 million square feet of commercial office space and more than 100 retail stores in the World Trade Center area, subway tunnels (Lines 1 and 9), the Port Authority Trans-Hudson (PATH) train station at the World Trade Center, the streets surrounding the attack site, and parts of the telecommunications and power infrastructure in Lower Manhattan, including a switching facility and substations. In all, the resulting loss to the city's productive capacity is similar to what can follow an earthquake or major natural disaster.[12]

Several economic and financial measures have been used to estimate the dollar value of the city's physical capital losses associated with the attack.[13] In this article, we cite publicly available repair and replacement cost estimates for the major buildings and infrastructure affected by the attack. These dollar values are nominal gross replacement and repair costs over a multiyear period and do not explicitly account for the depreciation of the assets or any potential offsets from government rebuilding programs or private-insurance proceeds.

We group the main components of the city's physical capital losses directly related to the attack into three categories: 1) the cost of the cleanup and restoration for rebuilding at the site, 2) the cost of replacing about 14 million square feet of office and retail space in the World Trade Center complex and its contents and repairing the damaged buildings in the areas adjacent to the World Trade Center,[14] and 3) the cost of repairing the damage to the New York City subway lines, the destroyed PATH terminal in the World Trade Center, destroyed or damaged Con Edison facilities and equipment, and damaged telecommunications lines and equipment in Lower Manhattan.[15]

At the end of June 2002, the cleanup and restoration of the World Trade Center site was deemed complete and the final costs are expected to be about $1.5 billion (see table). These costs cover debris removal, street repair, police and firefighters' overtime pay, and other forms of disaster assistance and relief. Most of these expenses are expected to be reimbursed by the Federal Emergency Management Agency (FEMA).[16]

The cost of replacing destroyed or damaged buildings in the World Trade Center complex and adjacent areas is estimated to be $11.2 billion. Of this, $6.7 billion will be for rebuilding the destroyed World Trade Center complex, although it is unlikely that the pre-attack design will be duplicated.[17] The remaining $4.5 billion is the estimated cost of repairing the damaged buildings. The cost of replacing the contents of the destroyed buildings, including the technology and fixtures, has been estimated to be $5.2 billion.[18]

A tracking of former occupants in the World Trade Center complex shows that tenants from about 65 percent of the destroyed space have leased new space within New York City, with the majority relocating to midtown offices. Tenants from about 17 percent of the destroyed space have moved to New Jersey. It is expected that about two-thirds of the damaged property in the World Trade Center area will be reoccupied. It is also expected that tenants from about 11 percent of the damaged space will relocate to offices in New Jersey.[19]

The losses to the public infrastructure in Lower Manhattan are concentrated in three key areas—the collapsed subway tunnel and other damage to the 1 and 9 subway lines, the destroyed World Trade Center PATH station, and the damage to and destruction of parts of the telecommunications and power infrastructure. The Metropolitan Transportation Authority (MTA) has estimated the cost of repairing the subway lines to be $850 million and the Port Authority has estimated that restoring basic PATH service will cost $550 million.[20] FEMA funds can be used to meet these costs, although private insurance taken out by both the MTA and the Port Authority is expected to cover a portion of them.

The estimated cost of repairing the communications and power infrastructure is $2.3 billion, much of which is expected to be covered by private insurance and FEMA funds. Improvements to the infrastructure in Lower Manhattan will likely be undertaken, and the final bill, including these improvements, may well be significantly larger. The estimated total replacement and repair cost for these parts of the city's infrastructure is $3.7 billion. Although private insurance and funds allocated through FEMA will substantially offset much of the cost of these rebuilding efforts to New York City residents and businesses, the productive potential of the city was significantly reduced by the attack and will remain below its pre-attack level until the rebuilding is largely completed.

Aggregating the cost estimates for each of these components shows the total physical losses sustained in the attack to be about $21.6 billion.[21] To put this amount in perspective, it is equivalent to about 9 percent of the total earnings in New York City in 2000, or an average of $2,650 per

city resident. As we have observed, private insurance is expected to cover a significant amount of these losses, and FEMA funds appear to be sufficient to cover a substantial share of the uninsured public infrastructure costs. Of course, this coverage mitigates the cost to New York City residents but not to the nation as a whole.

These estimated replacement costs of the physical losses are based on the assumption that the reconstruction of the World

Impact of the World Trade Center Attack on New York City as of June 2002

Impact	Estimated Magnitude	Notes
Labor market		
Loss of human life	Estimated 2,780 workers, $7.8 billion lifetime-earnings loss	Losses estimated as present discounted value of lifetime earnings; federal Victim Compensation Fund set up to help offset earnings losses and psychological impacts on families
Net job losses	38,000-46,000 in October 2001, rising to 49,000-71,000 by February 2002, diminishing to 28,000-55,000 by June 2002	Most of the employment losses related to the attack were in finance, airlines, hotels, and restaurants
Net earnings losses	$3.6 billion to $6.4 billion between September 2001 and June 2002	Based on estimates of net job losses and reduced hours
Attack-related productivity effects	Some increase in post-traumatic stress disorder and alcohol and drug use three months after attack	Difficult to quantify attack's impact on workers' mental and physical disabilities
Total labor loss	$11.4 billion-$14.2 billion	
Physical capital		
Cleanup and site restoration	$1.5 billion	Completed June 2002; expenses covered by the Federal Emergency Management Agency (FEMA)
Destroyed buildings in World Trade Center complex	Approximately 14 million square feet, $6.7 billion to rebuild	Book value of towers at $3.5 billion; complex privately insured
Damaged buildings in World Trade Center area	Approximately 15 million square feet, $4.5 billion	Inclusion of damage to Class B and C space raises estimate to 21 million square feet
Contents of buildings in World Trade Center complex	$5.2 billion	Significant offset from private insurance
Public infrastructure		
Subway	$850 million	Estimated repair cost; significant offset from private insurance and/or FEMA for repair to all three components of infrastructure
PATH	$550 million	
Utilities	$2.3 billion	
Total capital loss	$21.6 billion	
Total (labor, capital) loss	$33 billion-$36 billion	

Notes: The rounding of the total (labor and capital) loss figure acknowledges imprecision in the estimates. On the one hand, estimates of the labor loss may be understated, primarily for two reasons: the June 2002 cutoff for estimating earnings impacts and the possible earnings reductions due to a drop in the number of hours worked (in industries other than apparel and restaurants). In addition, attack-related declines in worker productivity (due, for example, to stress) may have affected employed workers and are not captured in our estimated earnings losses associated with declines in employment and hours. On the other hand, estimates of the labor loss may be overstated, because of the double counting of the earnings losses of some of the deceased workers and the assumption that the deceased workers would have worked in New York City until retirement. Furthermore, although this earnings-loss tally corresponds to New York City proper, these figures will overstate the net impact on the broader metropolitan area and the nation because many of the job "losses" reflect job relocations from the city to the suburbs—largely northern New Jersey. Because these are aggregate loss estimates, the issue of distributional impacts is not addressed.

Trade Center area will essentially duplicate what existed before the attack. However, as of June 2002, a final reconstruction plan has not yet been reached and the subject remains under discussion.

The Lower Manhattan Development Corporation (LMDC), a public corporation with both city- and state-appointed members, is helping to coordinate the redevelopment of the site. The corporation has been soliciting from various advisory boards ideas for the redesign of the site, including putting a memorial to the attack victims on the site, setting aside part of the World Trade Center area for residential units, and reconfiguring the transportation linkages between PATH and the New York City subway lines. The ultimate cost of replacing the lost capital stock depends on the final decisions regarding redevelopment of the site.

Impact on the Office Market

One of the most dramatic and surprising outcomes of the attack was on Manhattan's (and the metropolitan area's) office market. Demand for office space had been weakening and vacancy rates rising prior to the attack. After the attack, with an estimated 3 percent of Manhattan's office space destroyed and another 3 percent rendered temporarily unusable, it was widely expected that a severe shortage of space would push down vacancy rates and cause a sharp spike in rents. However, quite the opposite occurred: vacancy rates rose further and rents declined (Chart 4). This happened because of a number of factors: demand weakened more than was anticipated, firms had a good deal of extra space (in both Manhattan and adjacent areas) that they were able to sublet to displaced firms, and some Manhattan hotels were retrofitted to serve as temporary office space.

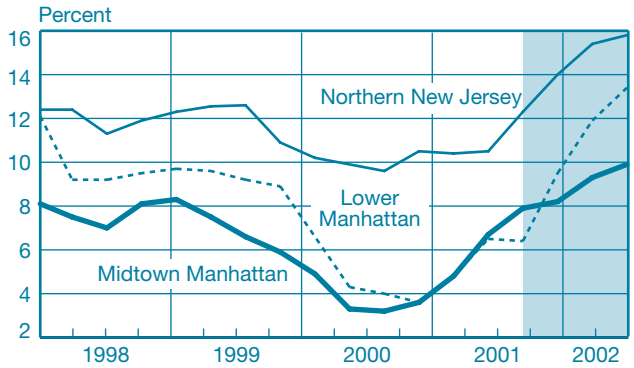
One of the most dramatic and surprising outcomes of the attack was on Manhattan's (and the metropolitan area's) office market. . . . Vacancy rates rose further and rents declined.

Impact on the Most Vulnerable

The preceding two sections focused on labor and capital losses. In this section, we look at the effects of the attack on the most economically vulnerable New York City residents.

Chart 5 shows the monthly aggregate number of public assistance caseloads and the Federal Reserve Bank of New York's index of coincident economic indicators since January 1999.[22] The bulk of public assistance is made through

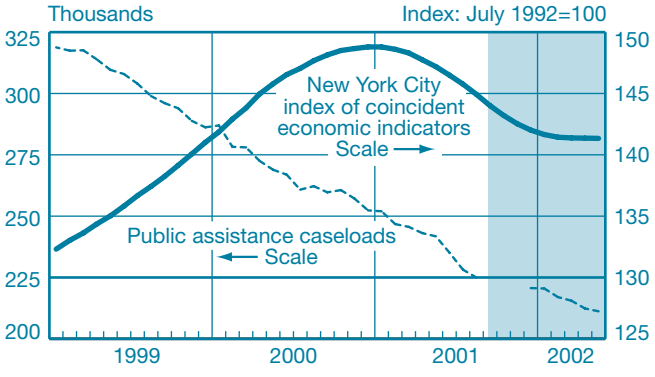
Chart 4
Office Vacancy Rates



Source: Cushman and Wakefield.

Note: The shading indicates the post-September 11 period.

Chart 5
Public Assistance Caseloads in New York City



Sources: Federal Reserve Bank of New York; New York City Human Resources Administration.

Note: The shading indicates the post-September 11 period.

Temporary Assistance to Needy Families, a federal and New York State block grant program. The remainder of public assistance includes the New York State programs Safety Net Assistance and Safety Net Non-Cash. The caseloads for these programs are evaluated together.[23]

Understanding the causes of a downward trend in welfare caseloads is notoriously difficult (Blank 2001). The decline in the number of caseloads observed in the city between January 1999 and August 2001 could have stemmed from economic expansion, the welfare reform incentives to reduce the number of caseloads, or both. Between January and August 2000, when the city economy was expanding, the number of public assistance caseloads fell 8.7 percent. Between January and August 2001, when the city's economy was contracting but the incentives for families to get off assistance were especially strong, the number of caseloads fell 10.7 percent. In short, the attack came at a time when the number of caseloads in New York City was falling rapidly, despite the slowing economy.[24] The post-September 11 data show that the downward trend in caseloads is stronger than the attack's effects.

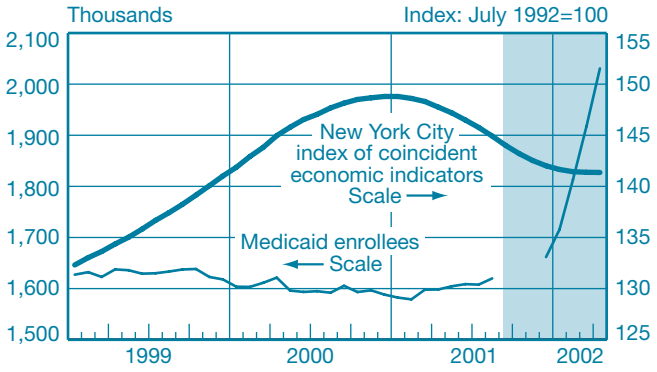
Chart 6 performs a similar exercise regarding the number of Medicaid caseloads. Medicaid—a federal government, New York State, and New York City matching entitlement program—provides medical assistance to certain low-income individuals and families with dependent children. Unlike public assistance, Medicaid enrollment displays some coincident sensitivity to the cycle. Between January and August 2000, when the city economy was expanding, enrollment fell by 12,000 to reach 1,592,000. Between January and August 2001, when the city economy was contracting, enrollment rose by 38,000. By December 2001, enrollment was up by 42,000, and by January 2002, it had reached 1,716,000.

The sharp increase in Medicaid enrollment after September 11 could stem from several factors. Those who were eligible for Medicaid but had not enrolled may have experienced worsening health from the attack and enrolled for the first time after September 11. In addition, those with incomes just above the Medicaid cutoff levels could have suffered attack-related income losses and become eligible.

However, the United Hospital Fund (2002) concludes that the increased enrollment is almost certainly the result of changes in the eligibility requirements for new enrollees. The attack disabled the Medicaid computer system and eligibility records, so New York City could not use the standard procedures to enroll patients. In response, the New York City Human Resources Administration and the New York State Department of Health developed a temporary assistance program, Disaster Relief Medicaid (DRM). DRM simplified the standard complex application process. Potential enrollees were asked only to fill out a one-page application stating that their income fell within certain guidelines. These individuals were then presumed to be eligible for DRM and received same- or next-day coverage.

Chart 6

Medicaid Enrollees in New York City



Sources: Federal Reserve Bank of New York; New York City Human Resources Administration.

Note: The shading indicates the post-September 11 period.

Summary of Losses

The loss of human life and the damage and destruction of commercial property and infrastructure that resulted from the September 11 attack significantly reduced the productive potential of the New York City economy. Moreover, the attack disrupted economic activity not only in the industries in the area of the World Trade Center, but also in a number of other industries throughout the city, further reducing employment.

In this article, we have assessed the impact of the attack on the city's economy by quantifying the effects on the inputs to the production process—labor and capital. We first considered the loss of human life. Although no single measure can capture the full impact of a premature death, the computation of the discounted value of a worker's expected future earnings is a conventionally used measure of an individual's economic loss. The attack claimed almost 3,000 lives and, using this discounted earnings measure, we estimate that it caused $7.8 billion in aggregate lost lifetime earnings for these workers and their families. This was as much a loss to the nation as to the city.

In addition, the attack caused significant declines in private-sector employment. Much of the job loss appears to have been concentrated in the finance, air transportation, hotel, and restaurant industries. Other adverse effects of the attack on the New York City labor market were also noted. In several industries, most notably restaurants and apparel, the hours worked by employees were significantly reduced. On the basis of these figures, the attack is estimated to have reduced city wage and salary income by a total of $3.6 billion to $6.4 billion. In addition, surveys found some increase in the incidence of PTSD and alcohol and drug use about three months after the attack, which likely resulted in time off from work and reduced productivity.

On the capital side, the attack caused an estimated $21.6 billion in physical capital and infrastructure losses. Adding this $21.6 billion in capital losses to the $11.4 billion to $14.2 billion in lost earnings yields a total loss of $33 billion to $36 billion. These losses include the costs of cleaning up the site, the replacement of the destroyed World Trade Center complex and its contents, the repair of the damaged buildings in the area, and the repair to the damaged public infrastructure. Although private insurance and FEMA funds are expected to cover a major portion of these costs, the loss of this capital is still a cost to the city's economy in terms of lost productive potential.

Recovery from the Attack

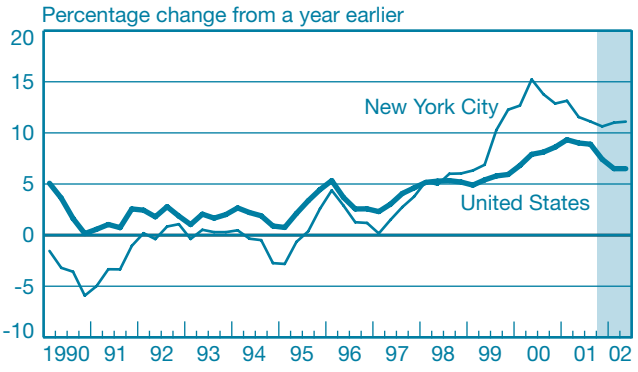
As we have observed, employment in the most clearly affected industries has been showing signs of a rebound since March 2002, despite little improvement at the national level and persistent weakness in the financial markets, which play a key role in driving the local economy. In terms of its distributional impact, the attack does not appear to have taken a strikingly disproportionate toll on low-skilled workers. Jobs in low-wage industries appear to have been adversely affected to the same degree as those in high-wage industries, and city welfare rolls show few signs of sudden growth in the months after the attack.

Moreover, while surveys have found some psychological harm to residents in the immediate area of the attack, consumer confidence in the metropolitan area had rebounded strongly as of mid-2002, suggesting that any widespread pessimism associated with the terrorist attack was short-lived in the New York City area, as it was nationwide. Another reflection of improved confidence can be seen in local housing markets. The market for Manhattan cooperative apartments and condominiums picked up noticeably in the second quarter of 2002, with the average selling prices rising an estimated 3 percent to 4 percent from a year earlier and the number of unit sales rising nearly 50 percent.[25] Similarly, selling prices of single-family homes in New York City's outer boroughs and nearby suburbs were an estimated 10 percent to 15 percent higher in the second quarter from a year earlier (Chart 7).[26]

Additional evidence of a recovery can be found by looking at the cleanup and restoration of the site, which was essentially completed months ahead of schedule and at a cost that appears to be substantially less than the amount of federal money allocated to the city for that effort. Furthermore, a number of programs have been established to support the relief and rebuilding efforts in Lower Manhattan. The Lower Manhattan Development Corporation, for example, was established in December 2001 to help coordinate the efforts to redesign and rebuild the World Trade Center area. In January 2002, a federal compensation program for the families of all victims of the attack, the first of its kind, was set up, and has since started making payments. Finally, the federal government has authorized grants, tax relief, subsidies, and other forms of assistance since the attack to aid in the rebuilding and redevelopment of Lower Manhattan.

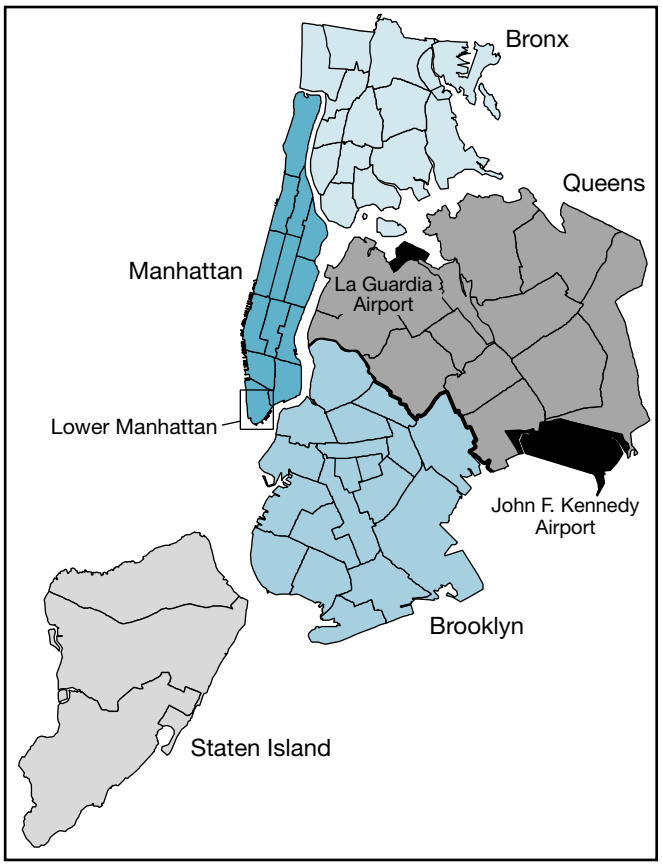
In conclusion, although New York City has clearly suffered a severe blow from the attack, the major disruptions appear to have been short-lived and conditions are in place to begin a recovery. At this point, the greatest challenge to the city comes from the economic fundamentals that have historically affected the local economy: the national business cycle and, in particular, developments in the financial markets.

Chart 7
Single-Family House Price Appreciation



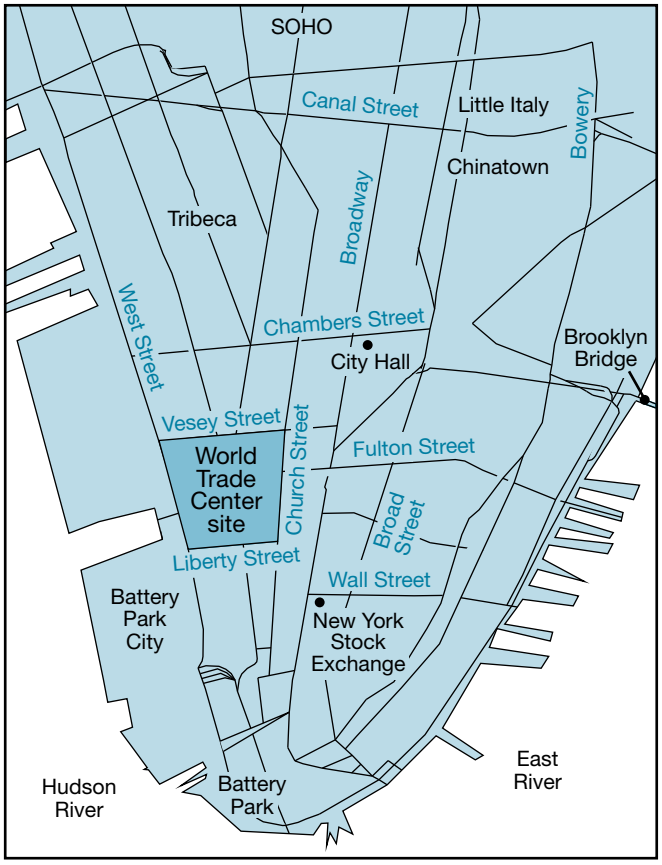
Source: Office of Federal Housing Enterprise Oversight.
Note: The shading indicates the post-September 11 period.

New York City Boroughs



Source: Federal Reserve Bank of New York.

Lower Manhattan



Source: Federal Reserve Bank of New York.

Appendix B: Methodology

Estimating the Effect of September 11 on the Path of Employment

To estimate the net impact of the terrorist attack on the subsequent path of employment, one must formulate a set of assumptions regarding the counterfactual—the path of employment had there been no attack. We do this by using an autoregressive forecasting model that estimates the relationship between employment growth in New York City and the rest of the nation. We then use this model to simulate the path of New York City employment after September 11 had there been no attack. However, there are various ways to specify this simulation, depending on a number of assumptions. To assess the robustness of the simulation (that is, to see how sensitive the outcome is to varying the assumptions), we run a number of simulations varying each of the following sets of specifications:

- *Number of lags used in the regression: three to eight.* The number of lags used in the estimation reflects the persistence of movements in employment. With relatively few lags, employment tends to snap back to its long-term trend relatively quickly, following any deviation. With more lags, employment reverts to trend more gradually. We run simulations using each of the above lag structures.

- *Post-September 11 U.S. data: actual, simulated.* Since it is generally preferable to use *actual* data whenever possible, we run one set of simulations using actual data for the United States (excluding New York City) after the attack. This implicitly assumes that employment outside New York City would not have behaved much differently if there had been no attack (that is, that the attack had a relatively small net effect on jobs outside New York City).

  If one assumes that the attack did have a significant impact on U.S. employment outside New York City, then using *actual* data after the attack would bias the results. Thus, we also perform a separate set of simulations in which U.S. data after September 11 are *predicted* based on pre-attack changes in employment for the private sector overall and for personnel-supply services. These estimates are then used in the original regression to predict New York City employment.

- *Last actual data point used: August, September.* Although the bulk of the effects of September 11 on employment showed up in the October 2001 data, it is possible that the September 2001 numbers were also slightly affected by the attack. Thus, we conduct one set of simulations using actual September data and another using actual data only through August.

As it turns out, the various combinations of assumptions yield results that do not vary dramatically. The weakest simulated employment path (low-impact scenario) is generated by using eight lags, with actual data for the United States, and using August as the last actual data point (for New York City). The strongest simulated employment path (high-impact scenario) is generated by using three lags, with predicted data for the United States over the simulation period, and using September as the last actual data point.

Equations:

e_t = private-sector employment in New York City,

E_t = private-sector employment in the United States (excluding New York City), and

P_t = U.S. personnel-supply employment.

Low-impact scenario (simulation begins after August 2001):

$$\hat{e}_t = \alpha + \sum_{i=1}^{8} \beta_i \hat{e}_{t-i} + \sum_{i=1}^{8} \gamma_i E_{t-i}.$$

High-impact scenario (simulation begins after September 2001):

$$\hat{e}_t = \alpha + \sum_{i=1}^{3} \beta_i \hat{e}_{t-i} + \sum_{i=1}^{3} \gamma_i \hat{E}_{t-i}$$

$$\hat{E}_t = \kappa + \sum_{i=1}^{3} \phi_i \hat{E}_{t-i} + \sum_{i=1}^{3} \eta_i \hat{P}_{t-i}.$$

Endnotes

1. Some of these factors affect residents who are unemployed.

2. Estimates of gross city product are reported by the New York City Office of the Comptroller. See <http://comptroller.nyc.gov>.

3. It should be noted that different concepts of losses are included in this sum, namely, replacement costs of capital, lifetime-earnings losses of the deceased workers, and the nine-month earnings losses of those idled because of the attack. Although there is evidently some double counting of losses in the latter two categories, we assume it is minimal and we make no adjustment for it.

4. The difficulties and pitfalls in putting a dollar value on human life are discussed in Dorman (1996). In addition to using a discounted earnings loss method, estimates of the economic value of a human life have also been based on observed wage premiums for job-related death risks faced by workers. A recent analysis using this methodology estimated the economic value of the life of an "average" worker to be between $1.5 million and $2.5 million in 1998 (Mrozek and Taylor 2002).

5. See the New York City Office of the Mayor for lists of the deceased (<http://home.nyc.gov>). The average age of those who died in the attack was 39.9 years.

6. These figures are based on data from the U.S. Department of Commerce and 2000 County Business Patterns. We obtain estimates for 2002 by incrementing those 2000 figures by 8 percent.

7. This method is similar to that used in the report by the New York City Office of the Comptroller (2001).

8. The federal Victim Compensation Fund was established by the federal government to compensate families of victims of the World Trade Center attack. A major component of the amount of compensation awarded to a family is the estimated lifetime-earnings losses of the victim adjusted for taxes, benefits, unemployment risk, and the victim's share of consumption. An additional sum is included in the compensation award for noneconomic losses. In calculating a victim's gross earnings losses, the fund assumes annual earnings increases of 3 percent from a combination of inflation and productivity growth, an annual increase related to experience (which rises at a decreasing rate), and a discount factor of 4.8 percent. Using these parameters, the fund estimates that a forty-year-old victim earning $127,000 would have lost $2.7 million. The ultimate compensation award is reduced by the amounts received from other sources of compensation, such as Social Security death benefits and life-insurance benefits.

9. Using a different methodology, the Fiscal Policy Institute (2002) concludes that the attack took a heavy toll on low-wage workers.

10. We used recent Bureau of Labor Statistics and Current Population Survey data to help identify two-digit industries where the average wages were toward the top or bottom of all New York City area industries. Within these groups, we selected three industries that represented a nontrivial fraction of city employment and displayed low wage variation across employees. We determined that hotels, food stores, and general merchandise stores are important low-wage industries in New York City, and engineering services, brokerage, and legal services are important high-wage industries. Although eating and drinking establishments is an important low-wage industry, wages varied across employees much more than they did in the selected industries.

11. Asian American Federation of New York (2002).

12. The most recent estimates of total insurance losses—including property, business interruption, aviation, and medical care—range from $38 billion to $50 billion associated with the attacks, including the World Trade Center, the Pentagon in Washington, D.C., and Pennsylvania, making it the costliest U.S. disaster in the past two decades. Prior to the attacks, the largest insurance losses (in 2001 dollars) were the $19 billion damage caused by Hurricane Andrew in 1992 and the $14 billion damage caused by the Northridge, California, earthquake in 1994 (Schaad 2002).

13. Two widely cited reports were produced by the New York City Partnership and Chamber of Commerce (2001) and the New York City Office of the Comptroller (2001).

14. About 14 million square feet of space in the World Trade Center complex—World Trade Center Buildings 1, 2, 4, 5, 6, and 7—was destroyed. Estimates of the damaged commercial space in the World Trade Center area range from a low of about 14 million square feet, largely Class A space, to a high of 21 million square feet, which includes damaged Class B and C space. Estimates of the repair and replacement of the damaged commercial space are available for the Class A space only.

15. The estimates presented here are largely based on those reported by the New York City Partnership and Chamber of Commerce (2001), the New York City Office of the Comptroller (2001, 2002), and the Independent Budget Office (2002), updated with information that has become available since those studies were released.

16. See New York City Independent Budget Office (2002).

17. See New York City Office of the Comptroller (2001).

18. See New York City Office of the Comptroller (2002).

19. Estimates are based on a survey of large tenants (that is, occupying more than 10,000 square feet). See TenantWise (2002).

20. See New York City Independent Budget Office (2002).

21. The Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce has estimated the property loss arising from the terrorist attacks on the World Trade Center and the Pentagon, treating the loss as a sharp increase in the depreciation of the fixed capital stock owned by private business and government. The value of the destroyed World Trade Center complex was based on its depreciated book value as opposed to replacement cost. The BEA estimates the total value of the assets destroyed in the attacks on the World Trade Center and the Pentagon at $15.5 billion. See U.S. Department of Commerce (2001).

22. Reliable welfare data for September, October, and November 2001 are not available.

23. The 1996 welfare reforms gave recipients incentives to move from the Temporary Assistance to Needy Families program to the Safety Net Assistance program. Examining the programs individually would confound the effects induced by these incentives with true changes in the rolls.

24. However, welfare caseloads may reflect a weakened economy with up to a two-year lag (Chernick and Reschovsky 2002).

25. These figures are based on data from appraisal firm Miller Samuel and calculations by the Federal Reserve Bank of New York.

26. These figures are based on data from the New York State Association of Realtors and the Office of Federal Housing Enterprise Oversight.

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