CITIES AND WARFARE:

THE IMPACT OF TERRORISM ON URBAN FORM

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ABSTRACT

What impact will terrorism have on America's cities? Historically, large-scale violence has impacted cities in three ways. First, concentrations of people have an advantage in defending themselves from attackers, making cities more appealing in times of violence. Second, cities often make attractive targets for violence, which creates an incentive for people to disperse. Finally, since warfare and terrorism often specifically target means of transportation, violence can increase the effective cost of transportation, which will usually increase the demand for density. Evidence on war and cities in the 20th century suggests that the effect of wars on urban form can be large (for example, Berlin in World War II), but more commonly neither terrorism nor wars have significantly altered urban form. As such, across America the effect of terrorism on cities is likely to be small. The only exception to this is downtown New York which, absent large-scale subsidies, will probably not be fully rebuilt. Furthermore, such subsidies make little sense to us.

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I. Introduction

On September 11, 2001, two airplanes flew into both towers of the World Trade Center and the towers subsequently collapsed. Five surrounding buildings were also destroyed and downtown New York was forever changed. As of this writing, the death toll stands above 3,500. The real estate losses were also staggering: 13.45 million square feet of office space were destroyed (Bagli [1]). This loss represents 30 percent of the total class A real estate in the downtown area (Heschmeyer [14]) and 3.6 percent of total office space on the island of Manhattan (Enright [11]).

Since September 11, there has been a string of anthrax attacks through the U.S. postal service. Moreover, warnings and fear of subsequent attacks have been ubiquitous. At least for the foreseeable short-term future, expectations about the danger of terrorist attacks on American soil appear to be significantly increased.

What do these attacks mean for the future of New York and the American city? What do they mean for the future of New York? What do they mean for the future of urban spaces generally? In this essay, we provide a basic overview of the economic links between warfare and urban development, and suggest what links may matter in the current crisis. We then use a variety of data sources to get an idea of the impact of large-scale violence on urban development in the 20th century. Finally, we discuss the future of downtown New York.

While economists have generally stressed the role of cities as centers for commerce or industry, a longer view of the history of cities suggests that historically their primary purpose may have been protection. In one sense, the advantage that a group of settlers have in defense relative to a lone homesteader is the "original" agglomeration economy. Of course, warfare also destroys cities, and times of peril have sometimes strengthened and sometimes weakened the impulse to urbanize.

Broadly speaking, there are three main ways in which physical danger has affected urbanization. First (and most important historically), cities have often been safe harbors. The need to crowd together for safety is a primary reason the houses of European farmers are much closer together than the houses of American farmers. This safe harbor effect is unlikely to be important within the U.S. The war's danger may make living inside the U.S. more attractive than being abroad, but cities are not safe harbors against modern terrorism.

Second, there is the target effect—cities have historically been rich targets for looting bandits or terrorists seeking to maximize damage. The impact of an explosion is increasing in the density of the surrounding area, so higher density areas make for more attractive targets. If terrorism continues in the U.S., this may be an important force, but only for a limited number of cities. New York and Washington especially may become somewhat less attractive to Americans because of their appeal as targets. Locales of extreme density, such as the World Trade Center, are surely less likely to be built. However, in most cities, at medium density levels, the target effect is unlikely to be important.

The third impact of danger is on the costs of transportation. War has always made travel more precarious and all of the recent terror attacks on the U.S. have specifically used transportation technologies—passenger airlines and the postal service. Cities are the absence of space between people and firms; they come about to minimize transportation costs for goods, for people and for ideas. Therefore when transportation costs rise, the demand for urban proximity tends to rise as well.[1] This force will act to make living in a remote location and traveling extensively for business less attractive.

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1 There is an exception at early levels of development where, as Krugman [15] emphasizes rising transport costs may keep farmers close to their natural resources.

The target effect and the transportation cost effect therefore pull in opposite directions and lead to a theoretically ambiguous relationship between danger from terrorism and urbanization in the U.S. However, since the danger effect is likely to be relevant mainly in extremely high-density areas (and especially in New York and Washington), theory seems to predict that big, medium-density metropolitan areas will continue to grow.

In addition to these effects of danger on cities, there is a fourth—more direct—effect of terrorism: the actual destruction of buildings. This physical destruction may be the most important impact of warfare on individual cities. In the current crisis, the direct effect of terror has been the destruction of downtown Manhattan. Davis and Weinstein [8] have argued that the direct physical damage from World War II did not have a long-term impact on Japanese cities. They may well be right, but the 50 years after 1945 saw a massive urban growth in Japan. It is not surprising that the Japanese cities got rebuilt. The case of the downtown New York is more difficult. While there are clearly important economic functions to this area, it is less obvious the World Trade Center area either should or will be rebuilt. After all, WTC was itself built as an attempt to revitalize a declining area. If the WTC area is not rebuilt, then this change in the shape of New York City may end up being the most important effect of terror on cities.

After discussing the effects of terrorism in greater detail, we turn to the limited applicable data that is available. First, we examine the impact of terror on Israel and London. Within Israel, we compare the relatively safe havens of Tel Aviv and Haifa with the much less safe area surrounding Jerusalem. This type of comparison is, of course, difficult, but we find little evidence of a big impact of danger on the growth of Jerusalem. The impact of IRA terror on London also appears to have been fairly minimal. These examples suggest that the impact of terror on urban land use may end up being quite small.

After examining the impact of modern terror on urban growth, we turn to the impact of warfare on the growth of Berlin, London and Paris during the First and Second World

Wars. The First World War appears to have increased the size of these cities, especially Berlin. The technology for bombing civilian targets in the First World War was weak enough so that only Paris was really in danger. As such, the dominant effect of war on city growth was the rise in war-related industries and government in these capitals. This effect tended to stimulate city growth. The Second World War was completely different. Only Paris—which saw little bombing —escaped unscathed. London and particularly Berlin lost substantial amounts of population during the war. The destruction of housing was massive and unsurprisingly the populations also fell. It is worth stressing that while World War II shows how violence can hurt cities through the target effect, the scale of violence was so great that it is hard to know whether it is remotely comparable to the dangers of today.

Across countries, the connection between danger and urbanization is somewhat ambiguous. Countries with high numbers of terrorist actions during the period 1968-1977 did exhibit higher levels of urbanization, but urbanization does not correlate with any other measure of internal or external violence. Moreover there is little cross-country evidence to support a strong connection between the threat of terrorism and the height of buildings.

Finally, we turn to New York itself. While Paul Krugman has interpreted the work of Davis and Weinstein [8] on Japanese cities to mean that New York is unlikely to be affected by the World Trade Center bombing, we are less optimistic. We think that the impact of the bombing on the structure of New York is likely to be significant, and indeed that it should be significant.

Our view is that while New York City itself is likely to be quite robust, the future of the downtown area is much less clear. This area once had a significant comparative advantage that came out of its proximity to the Port of New York. This advantage is no longer. Within Manhattan, the only remaining advantage of this area is its proximity to New Jersey and Staten Island. We think that the downtown is unlikely to be rebuilt in the

absence of large-scale government subsidies. We also think that such subsidies are unlikely to be an efficient use of funds.

II. Discussion of Warfare and Cities

In this section, we discuss the impact of warfare on cities in a broad historical context. We use the term warfare to refer to any external physical danger on a country, and it is meant to include IRA terrorism in Great Britain, and Palestinian terrorism in Israel. Throughout human history warfare has had a significant impact on the development of cities, but this development has been different across time and place. We therefore consider four principle ways in which warfare has historically interacted with urban land use.

Effect # 1: The Safe Harbor Effect

The first, and probably most important, interaction between warfare and urban development is that historically cities have provided protection against land-based attackers. Cities have the dual advantages of large numbers and walls and thus, holding the size of the attack constant, it is much better to be in a city than alone in the hinterland. Indeed, the role of cities in protecting their residents against outside attackers is one of the main reasons why many cities developed over time. As Mumford [19] writes "the power of massed numbers in itself gave the city a superiority over the thinly populated widely scattered villages, and served as an incentive to further growth." Pirenne [21] sees the origins of European cities in "fortified cities erected by the feudal princes to provide shelter for their men." Bloch [4] notes that "the disorders of the early Middle ages had in many cases induced men to draw nearer to each other."

The main theoretical reason for this effect is the tremendous value of scale in physical combat with a fixed opponent. One soldier attacking an army will generally accomplish little except getting himself killed. Military strategists have always argued that a primary

purpose of military strategy is to have a scale advantage over one's opponent. In the *The Art of War*, Sun Tzu writes "and if we are able thus to attack an inferior force with a superior one, our opponents will be in dire straits" (Clavell [7]). Clausewitz [26] writes that "superiority of numbers is the most important factor in the result of a combat." More recently, the Powell doctrine emphasizes the use of overwhelming force. In the urban context, this effect means that individual farmers are likely to be easy prey for marauders, but once these farmers group into a town, they may be able to defend themselves.

Urban scale economies in defense show up in particular with regard to city walls. While city walls don't seem important today they have played a critical role in the history of cities and in that of warfare. As late as 1871, the Franco-Prussian war came to a standstill as the Germans laid siege to Paris instead of breaking through the city walls. In pre-modern societies, walls were the great equalizers where small forces were able to withstand much more sizable onslaughts.[2] Walls also create a natural scale economy. If a city has a population of N, and each person occupies a fixed area of space (denoted A), then the size of the wall needed to circle a round city will equal $2\sqrt{\pi AN}$. The size of city walls scales with the square root of city population, so that the length of wall that must be built per person declines sharply with the size of the city.

Many traditional cities have existed because of the safety provided by size and city walls. Constantinople continued as a major city for centuries after the military strength of the Byzantine Empire had collapsed. The city's legendary wall structure kept its residents safe. Likewise Paris, London and Rome all began as fortified places that provided safety against attack.

We see the impact of the safe harbor effect on the population patterns of the American and European farmers. Bairoch [2] describes the different settlement patterns of traditional villages and 19th century American farmers. Traditional farmers group together in a small village and their land extends out from their homes like pie slices from

[2] Constantinople was perhaps the most important city that continued to exist in large part because of the protection created by its close to insurmountable walls.

the center of a pie. American farmers, particularly in land developed in the 19th century, generally put their homes in the center of their land. This development assuredly has many causes, but a primary reason for the traditional pattern is that these small groupings of homes provide a certain amount of protection. In the American west, property rights were much more secure than in medieval Europe, and putting one's home in the center of one's farmland was safer.[3]

While the safe harbor effect created by urban scale may have been extremely important historically, it is less likely to be important in the war against terror. Some agglomeration economies in safety still exist: it is easier to enforce a no fly zone over New York than over a similarly sized dispersed population.[4] But more generally, the essence of terrorist technologies is that they enable small groups to inflict harm on much larger populations. The weapons of terrorism thus severely limit the safe harbor advantage enjoyed by cities in times of traditional warfare.

Effect # 2: The Target Effect

The previous section emphasized that cities can provide better protection against any given attack. However, attacks are endogenous with respect to the size of the target, and bigger cities will provide a more attractive target. This is the second major factor that has created an interaction between urban form and warfare. For Islamic terrorists, American daylight bombers during WWII, and Attila's Huns, large urban concentrations have made attractive targets. As Mumford [19] writes "no doubt the urban surplus tempted poorer folk, for each city must have seemed a sitting duck to swift-moving raiders from the highlands or steppes." Urban density means that it is possible to destroy (or steal) a large amount in little time. As such, holding defenses constant, attackers will be drawn to dense urban agglomerations.

[3] Other reasons for the U.S. differences include the generally larger sizes of American farm lots and the improved transportation available to American farmers. Better transportation made social interaction possible despite isolated locations.

The tendency of marauders to destroy large urban areas helps us to understand why, historically, urban life disappears during chaotic periods. For example, the urban world that grew under the Pax Romana disappeared from much of Europe during the subsequent middle ages. In no small part, this disappearance occurred because large cities were regularly being sacked. The most famous example, of course, is Rome itself, which was sacked regularly for centuries after Alaric first seized the city. A farmer in the campagna might hope to avoid the attention of the marauding hordes. A shopkeeper in Rome was pretty sure to have his goods and shop stolen or destroyed. Unsurprisingly, the Rome in 800 A.D. had less than 10 percent of its 400 A.D. population.

Rome is, of course, far from being the only example of a target city. Indeed, as Pounds [22] writes "the destruction of urban life was on a far greater scale along the empire's northern frontier and in the Balkan peninsula." Trier in Belgium was sacked three times.

In other times and in other places, wars have also decimated cities. The Thirty Years War led to a massive de-population of German cities. Wedgwood [27] writes that between 1620 and 1650, "the population of Marburg, eleven times occupied, dwindled by half." Augsburg also lost more than one-half of its population. The great cities of pre-Columbian America all but disappeared during the Spanish conquest. The urban world of the Byzantine Empire collapsed along with imperial authority.

When cities end up without the military strength to protect their riches, they are invariably targets, and destruction tends to follow. The objective of terrorists is destruction, not plunder, but cities are still ideal targets. The best evidence for this is that the September 11 attack targeted the single highest density area in the United States. It seems likely that this attraction of terrorism to density will continue and will create an added cost to urban agglomeration.

[4] Another example is that dispersed Jewish settlements in Israel's West Bank are much more vulnerable to attack than the larger populations in Tel Aviv and Jerusalem.

Effect # 3: The Transportation Effect

The final impact of warfare on cities is indirect and operates through the transport system. Warfare, including terror, often makes travel relatively unsafe or at least more costly. Transportation infrastructure is often destroyed in combat. Ongoing threats of destruction may make it dangerous to be on roads, planes or boats. The sinking of the Lusitania is among the most famous events of World War I. If homes behind city walls create a safe harbor, then travel creates exposure to danger. Sometimes, with sufficient protection, travel can be made reasonably safe even in times of danger. Even then, of course, these precautions themselves create an added cost of mobility.

There are three main reasons why wars tend to make travel unsafe. First, travelers are exposed to war-like conditions without urban defenses. The scale economies that make cities safe mean that solitary travelers are easy prey. The breakdown in transport after the middle ages is primarily a result of this effect. For example, Bloch [4] describes "How great was the surprise and relief at the court of Charles the Bald, when in the year 841 that prince witnessed the arrival at Troyes of the messengers bringing him the crown jewels from Aquitaine: how wonderful that such a small number of men, entrusted with such precious baggage, should traverse without accident those vast areas invested on all sides by robbers." This effect may be important for international travel today where countries outside of the U.S. may not be taking as many precautions to protect Americans. However, it is less important for domestic travel, since—as we argued above—scale economies in defense are less likely to be important in the war against terror.

The second reason why war reduces transport is that warfare destroys transport infrastructure, as it destroys everything else, and makes it less likely, in many cases, that authorities will be able to replace that infrastructure. Lawrence of Arabia busied himself destroying train tracks in his guerilla war against the Ottomans. Bloch [4] writes "the collapse of the Carolingian empire had destroyed the last power sufficiently intelligent to concern itself with public works, sufficiently strong to carry them out." The destruction

of the Path Station in the World Trade Center is a modern example. Even if the threat of terror were to end today, this loss has already increased the cost of transport into and out of the New York's downtown.

The final reason why war increases the cost of transportation is a variant on the target effect. Large vessels—airplanes, trains and ships— combine the size of small towns with much more vulnerability. As such, throughout history, thieves, soldiers and terrorists have particularly focused on these forms of transport as desirable targets. Historically, the only large transportation devices were ships, but since the dawn of large-scale shipping, pirates have preyed on these targets because of their combination of wealth and vulnerability. For example, the British crown used privateers to attack Spain through the weak chink in Phillip II's empire—the Manila galleons transporting gold from the New World to Spain. In the 20th century, submarines have regularly destroyed large ocean-going vessels. As innumerable movies about the Wild West have depicted, trains were also targets for robbers. Finally, in the modern era, planes have been a regular target of hijackers.

Two types of transportation have been particularly affected by the terrorist attacks on the U.S. The first is air transport. The combination of fear and greater time costs of travel (because of safety precautions) has caused an approximately 20 percent decrease in the amount of air travel (Simon [24]). It is unclear whether this slump will persist, but at least for now, there has been a sizable impact of terror on airborne transportation.

The second, more surprising, effect of terror on transportation costs has come through the postal service. The anthrax attacks have made the postal service more dangerous and has certainly increased anxiety about the mail. It is unclear what permanent effect this will have on the transfer of information through the post, but at least temporarily, the use of the post has been deterred.

As Krugman [15] shows, increases in transport costs can have two opposite effects on urban agglomeration. At low levels of development, higher transport costs are often

related to decreasing urbanization as proximity to natural resources becomes a dominant concern. (For example, the destruction of Roman roads led to a decline in cities as peasants stayed on their land to ensure that they had food.)

In modern societies, higher transport costs are typically associated with more urban concentration, because proximity is a substitute for travel. Improvements in transportation technologies have made suburbanization and sprawl a reality. Business partners can either locate near one another, or travel regularly to meet each other. If it is harder to maintain long-distance relationships because of the risks and delays of air travel, and because of problems with the post, then this may act to make urban concentration more attractive.

If close substitutes are available for air travel and the postal service, then this impact is likely to be muted. If teleconferencing can easily replace air travel, then the need for co-location drops. This seems even more relevant in the case of the post office where faxes and email have already become a primary alternative to the post. It is hard to imagine, today, that breakdowns in the postal service will serve as more than a minor inconvenience to most long-distance relationships.

In conclusion, the safe harbor effect has historically been quite important for cities, but is unlikely to be important today. Cities no longer have walls and if they did, these walls would make little difference to terrorists anyway. The target effect and the transportation cost effect will clearly have some impact. Developers have already expressed fears about building huge towers. Airline travel is down 20 percent since before September 11, but we don't know if this is having any sort of an agglomerating effect. Given the degree of uncertainty about the magnitude of these forces, we'll now turn towards the limited available empirical evidence on warfare and urban form.

Effect # 4: The Destruction of Buildings

The final impact of warfare is the most simple. In many cases, war will end up destroying the existing infrastructure of cities. We separate this effect from the target effect and consider, here, only past destruction not future risk. Thus, this effect includes only the impact of the destruction of the World Trade Center itself and not any future bombing.

The long-term impact of the destruction of buildings depends critically on whether the demand for physical space in the area is such that the buildings will be rebuilt. In an area where demand is great enough to pay the costs of new construction, the physical destruction will not matter. However, in other cases, when the demand is low, the destruction of physical infrastructure may matter a great deal. In some cases, agglomeration economies may mean that demand for the space was high before the bombing but low afterwards. If the price of space after the destruction is not high enough to cover the costs of new construction, then the direct impact of bombing will be permanent.

This simple framework makes it clear that the results of Davis and Weinstein [8] may not be that relevant for downtown New York. The era following World War II saw dramatic growth in the Japanese economy and massive increase in urban manufacturing. The high price of physical space in Japan is a major stylized fact of their economy. As such, it is not at all surprising that the destroyed areas got rebuilt. However, downtown New York may be somewhat different.

Downtown New York has done extremely well over the past 10 years, but this success should not hide the long-term weakness of the area. It has many natural disadvantages, such as being surrounding by water on three sides. Apart from the remarkable intellectual spillovers in the area, it hard to see why firms would want to locate there. Moreover, prior to the 1980s, the area was in steep decline for decades. The World Trade Center itself was a heavily subsidized project meant to prop up a declining region. As such, the prices in New York after the bombing may very well not justify reconstruction on a large scale.

III. Empirical Evidence of the Impact of Terror on Urban Form

In this section, we review the empirical evidence that is available on warfare and urban form. We first present evidence from cross-country data on danger and urbanization. In that section, our goal is to see whether violence increases or decreases the tendency towards concentration. We then turn towards extreme episodes of city-specific danger: Berlin, London and Paris during the two World Wars. In these episodes, the risks were so high that if there is a connection between urban growth and danger, it is likely to be quite evident. Finally, we turn to two specific terrorist situations. First, we look at urban land use in Israel—the country most constantly at risk from terror. Second, we look at whether the IRA bombings had an impact on the development of London.

Cross-National Evidence on Safety and Cities

While measurement of the true effect of terrorism on urbanization and urban form is difficult, we make a first pass at the cross-national evidence in Table 1. Here we examine the relationship between two important measures—the extent of urbanization and the number of tall buildings—and several measures of the risk of terrorism and other violence, both internal and external. The first column shows the results using the percent urban in 1978 as a dependent variable, where we control throughout for log (GDP per capita) and log (population). We find some evidence that the safe harbor effect dominates the target effect in the form of a statistically significantly positive coefficient on a dummy for whether the country experienced terrorism between 1968 and 1977. We find a similarly significant coefficient using the log of the number of terrorist actions in the country from 1968 to 1977 as the independent variable.

These results, though statistically significant, are fairly weak. They could easily reflect reverse causality where urbanism engenders terrorism and not the reverse. Moreover, there is no significant effect on a wide range of non-terrorism-related measures of

internal instability, including the frequency of civil war. We also see no significant relationship between urbanization and two measures of the extent of participation in external wars. Nevertheless the data do seem to suggest that the safe harbor effect may be important in countries prone to terrorism.

Turning to the second column, we find no evidence for any effect of terrorism or other internal violence on the number of skyscrapers built. In general the coefficients do seem to be negative as we would expect but none is statistically significant. However, since the number of skyscrapers may be a highly non-market outcome—depending on urban planning regulations and politicians' desires for aggrandizement—it is difficult to interpret these results.

Three European Cities in Two World Wars

In this section, we review the population patterns of Berlin, Paris and London during the two World Wars. Figure 1 shows population trends in these cities over the 20th century. The impact of the World Wars on these three major cities gives us an idea of just how varying the effect of violence on urban growth can be. We looked at these wars because they were extremely large-scale conflicts, and if there is a general relationship between urban land use and violence, we should be able to see it in these three city histories. Of course, both of these wars also moved large numbers of citizens to the front, so this would serve to temporarily de-populate cities as well.

World War I was fought on both French and German soil. To the extent that Berlin was at risk, the risk came from the east. However, after the victory of Tannenberg it seems unlikely that living in Berlin was seen as creating danger. Indeed, the growth of Berlin in the 1910s is quite striking. While Berlin had been growing substantially throughout all of Wilhelmine Germany, the 1910-1920 period is particularly dramatic. The population of the capital rose substantially from 2.1 million to 3.8 million.[5] This growth reflected the

[5] These numbers do not take into account a border change during this period and therefore probably overestimate the increase in population.

increase in both government administration and military industries in the capital city. There may also have been some increase in the population because of refugees from East Prussia who fled before the Russian advances in 1914.

The population effects on London and Paris seem to have been quite small. London was never at any risk during the conflict. Generally, we might have expected the population levels to rise slightly in response to the expansion of government during this time period, but the city grew by only 232,000 people between 1910 and 1920. This is less than London's growth in the 20s and less than its growth between 1900 and 1910. If anything, it seemed like WWI deterred the growth of London slightly, perhaps because of the draft.

Of the three cities, Paris was most at risk during this time period. On August 30, 1914, the German army was only 30 miles from Versailles. Throughout the war, the chance of a German breakout from the trenches was always there. However, the population of Paris was almost exactly the same in 1910 and 1920. Growth in the 1920s and between 1900 and 1910 was small also. Paris's population was extremely constant between 1900 and 1960, so it is hard to argue that the war directly had a large impact.

World War II had a much larger impact than World War I on civilian life in London and Berlin. While Paris, of course, was conquered, the speedy French surrender saved the city from most of the ravages of warfare. This perhaps explains why, of the three cities, Paris is the only city that grew (albeit only slightly) during the 1940s.

While Paris was relatively unaffected by the War, both Berlin and London were ravaged by constant bombing. London was attacked during the blitz and through the end of the war, V-2 rockets were fired at the city. Berlin was subject to even more massive exposure to bombs. Between August 1940, when the British began to bomb, and April 20, 1945, the city was blasted with more than 76,000 tons of explosives and bombs.

The impact on the population of Berlin was devastating. In 1940, the population of Berlin hit 4.33 million residents. In 1946, Berlin had 3.18 million residents. While

Berlin's population soared during the First World War, it plummeted during the Second World War. Massive Allied bombing had the effect of eliminating the population of Berlin, partially through their deaths (an estimated 52,000 were killed), but also to a large extent through emigration. It is also worthwhile emphasizing the close (almost one-to-one) connection between the number of people and the number of buildings in a city (see Glaeser and Gyourko [13] for more discussion). The allied bombing raids destroyed a huge amount of the building stock in Berlin, so it would have been shocking if the population of Berlin had not fallen.

The impact of German air raids on the population of London was also large. The population of London dropped by about 400,000 during this time period. But in both absolute and relative terms, this is much less than the impact of the war on Berlin's population. The terror of the blitz certainly negatively affected London's growth (which had still been substantial before the war), but the city shrank by less than 5 percent during the time period.

The lesson of the World War is that the target aspect of cities can mean that some cities decline during periods of warfare and risk. The target effect does matter (especially when the city is not just at risk, but also physically destroyed). However, we think that the wars emphasize the resilience of cities more than their vulnerability. It took 76,000 tons of explosives to cause a major reduction in the population of Berlin. The population of London fell by only 5 percent during the entire Second World War. Terrorist attacks may shrink New York and Washington slightly, but given how much smaller these attacks are than the blitz, it seems unlikely that the impact will be all that large.

Jerusalem and Tel Aviv: Terrorism and Israel's Cities

We now turn to Israel, a modern center of terrorist activity. Historically, Jerusalem has been less safe than Tel Aviv. If there is an impact of terror on urban growth, it should show up as disproportionately limiting the growth of Jerusalem relative to Tel Aviv.

However, as Table 2 shows, we find little evidence that Jerusalem's growth has been sluggish compared to Tel Aviv's. Indeed, Jerusalem's share of the total population of Israel actually increased over Israel's first fifty years of statehood, perhaps because of Jerusalem's increased political role. Jerusalem's average annual population growth over this period was 4.2 percent, as compared to Tel Aviv's more sluggish 2.6 percent. It would seem that Jerusalem's advantages—physical beauty, a strong tourist economy, and historical significance—outweigh the relative dangers of terrorism in that city.

Moreover, there seems to be little evidence that terrorism has impacted the urban landscape in Israel. While Jerusalem has no buildings more than 500 feet tall and Tel Aviv has two (with more in the works), it seems that Jerusalem's lag has more to do with concerns for the city's aesthetic than for concerns over safety. As Furstenberg and Susser [12] report, though Jerusalem's planning ordinances do not specify a maximum height, attempts to build high-rises and skyscrapers are typically met with strong opposition from those dedicated to preserving the city's character. Despite this ongoing struggle there are already quite a number of tall buildings in the city and more in the planning stage. Safety concerns appear to be swamped by the conflict between commercial and aesthetic values in decisions about Jerusalem's skyline.

Of course, it is possible that until September 11 tall buildings were not perceived as being especially attractive to terrorists. Future construction projects may therefore be affected by safety concerns even if those concerns have not been terribly important in the past. Since we cannot measure the true change in perceived risk to tall buildings associated with the September 11 attacks, this must remain an unresolved issue.

London and the IRA

The history of IRA activity in London offers another window on the effects of terrorism on major cities.[6] Table 3 shows the evolution of the population of Inner London since World War II. We focus on this part of Greater London as the component most affected

[6] Here we draw on Smith [25] for historical evidence.

by terrorism. In the initial part of its post-World War II history, the IRA confined its violence primarily to Northern Ireland itself, attempting to wage a border war with Great Britain. The complete failure of this approach led to a split between the so-called Official IRA (OIRA) and Provisional IRA (PIRA). In 1970, the latter organization began an unprecedented campaign of violence, directed primarily at British soldiers stationed in Ireland. By this time the population of Inner London was already declining. Then in 1973 the PIRA began to move its efforts into England itself, deploying several car bombs outside Old Bailey and bombing a London hotel.

The population decline seems not to have sped up noticeably following the beginning in 1975 of a series of personal attacks on the rich and powerful and bombings of high-end London hotels and restaurants. One might be inclined to conclude that aggregate population trends were unaffected because the non-rich felt relatively insulated from this violence. However the population of Inner London grew steadily over the 1980s and 1990s despite several major and far less finely targeted attacks: the bombing of Victoria Station in 1991, the bombing of London Bridge Station in 1992, and the bombings at the Baltic Exchange and at Bishopsgate in 1993, to name a few.

One caveat to this discussion is that while permanent residential population does not seem to react to terrorism, temporary population—i.e. tourism—appears to be much more responsive. For example, Enders, Sandler and Parise [10] find that Western Europe suffered considerable losses in revenues from tourism due to terrorism during the period from 1974 to 1988. Their work suggests that even when terrorism does not make a city an unpleasant place to live, it can make it a considerably less comfortable place to vacation.

IV. The Future of New York's Downtown[7]

[7] Mitchell Moss greatly influenced our thinking in this section.

The impact of terrorism on cities throughout America may generally be quite small. However, the impact on New York City has already been dramatic. The skyline of the city has been altered considerably and thirteen million square feet of class A office space has been destroyed. In the short-run, some of the dislocated firms have found other quarters in Manhattan and some have moved to New Jersey or Connecticut. Will the longer run impact of this change be smaller than the short run change because downtown will be rebuilt and firms will return? Alternatively, will the long run impact be bigger than the short run change because other firms will follow in the exodus from downtown Manhattan?

The first key element to understanding this change is the business geography of Manhattan. The island separates into two separate geographic areas: midtown (roughly between 34th street and 59th street, east of 8th avenue), and downtown (south of Canal Street). These two areas contain 41 percent of the employment in the island of Manhattan and 26 percent of the employment in the five boroughs.[8] The attack directly impacted the downtown area. The midtown area also suffered, but no real estate was directly destroyed.

The two areas are certainly connected, but in many ways they are extremely distant. The travel time between midtown and downtown by subway is—on average—22 minutes, roughly the average commute time in the U.S. In principle, taxis can get between the two areas more readily, but traffic often means that the travel times are similar. There are certainly positive spillovers between the two areas, but the destruction in downtown employment is more likely to increase demand for midtown space (because of downtown employers substituting into midtown) than to decrease the demand for this space (as might happen because of spillovers).

Moreover, since World War II, the relative dominance of midtown relative to downtown has been continually rising. Today, midtown has over 3 times as many employees as downtown. In 1950 it seems likely that downtown had more workers. Midtown is the

[8] Source: Authors' estimates from Zip Code Business Patterns [29].

dominant area and its trajectory has been increasingly positive. It has strong advantages in its proximity to residential areas in the upper east and west sides. Midtown is also much more accessible to Manhattan's consumption advantages (e.g. museums, restaurants, and nightlife). Indeed, the downtown area's continued strength comes primarily from its access to New Jersey (via the path trains) and Staten Island (via the ferry) and from its historically rooted institutions (such as the New York Stock Exchange), which could certainly move to midtown.

Indeed, the World Trade Center was itself a government response to the perceived decline of the downtown area. It was subsidized by Nelson Rockefeller and built as a means of continuing support for the city. Many of its renters were government institutions (such as the Metropolitan Transit Authority) that had originally been pressured into locating at WTC to keep demand up. In the 1980-2000 period, the general problems of downtown New York were hidden by the vibrant financial sector in which it specialized. Nevertheless, downtown has continued to lose ground relative to midtown even in that area of specialization and even without the WTC bombing was likely to continue to lose further.

Downtown's loss of key office buildings and their tenants will certainly continue to hurt the area. The destruction of the Path station at WTC is likely to be just as harmful to the. In the absence of major government subsidies to the area, it seems reasonable to believe that downtown New York will continue its slide.

Will this slide pull midtown along? This seems unlikely. The spillovers between the two areas are probably not that strong to begin with. Many of the businesses will move to midtown. Many others will move to nearby suburban office parks that are likely to be close enough to provide agglomeration economies that are probably not that less than those provided by downtown. Indeed, this trend has already materialized. As Heschmeyer [14] notes, citing a report by Julien J. Studley, Inc.:

> The majority of large displaced tenants signed leases in locations outside of Downtown Manhattan. For transactions larger than 50,000 square feet, 65% signed in Midtown, 17% in New Jersey, 5% in Westchester County, NY, and Connecticut and 9% in Brooklyn and Queens in New York, the Studley report noted.

The strongest effect on the midtown economy is likely to come from increased taxes. If national or state subsidies don't completely make up for the increased costs and decreased revenues faced by the city government, then it is likely that midtown businesses will have to pay more in taxes. This could, of course, hurt the entire area. However, New York appears to have a great deal of room left in the budget, mostly in the area of social services. New York is unique among America's large cities in that it maintains extremely large local expenditures of health, housing and transfer payments. If New York funds its budget shortfall by cutting these expenditures, then the impact on the local economy is likely to be much less.[9]

In light of this, we remain hopeful in our assessment of New York's future, but much more gloomy in our thinking about the downtown area. This view begs the question: should the federal government step in and rescue downtown? Should large federal and state assistance be allocated towards rebuilding lower Manhattan, or should assistance be given to affected firms with the understanding that these firms are free to rebuild anywhere they want?

The case for subsidies hinges on the view that there are remarkable intellectual spillovers associated with the downtown area. Indeed, the continuing vitality of the area pre-9/11 gives credence to this view. However, midtown also has dramatic intellectual spillovers. If the activity moves from the dense downtown to the almost equally dense midtown, it seems unlikely that there will be a loss in New York's fertile financial industry. To the extent that employment moves to medium density areas in New Jersey, there is more of a concern. Nonetheless, the fact that most displaced firms have moved to midtown and the

[9] Of course, there will be a loss in social welfare spending as a result. It is our view that local safety nets are almost always a mistake, however, and it is our hope that state and national governments will replace at least some of any decline in local welfare spending.

absence of strong evidence for a loss of spillovers due to firms leaving Manhattan make the case for massive subsidies questionable at best.

We think that it is foolish to engage in a large federally subsidized rebuilding program downtown. It is surely more efficient to let businesses relocate either to midtown, where there is still plenty of room to build, or to office parks in suburban New Jersey. Downtown is far from the population centers of New York and is built around a port that no longer exists. If firms want to rebuild there, then so be it. The private market shouldn't be blocked, but the future of New York City doesn't depend on building in downtown, and there is no economic reason to explicitly subsidize that activity.

There is a final point worth stressing on rebuilding downtown and space-based transfers in the wake of 9/11. We think that there is a good case for government provided assistance to *people* who were hurt by the attack. Individuals who lost jobs or family members have every right to look to the government for at least some temporary assistance. However, there is no comparable case for place-based assistance. Place-based subsidies will just end up distorting spatial decisions and will not end up helping the people who were most hurt by the national tragedy. Just as it makes sense to help poor people, not poor places, it makes sense for the government to provide insurance to people rather than to locales.

V. Conclusion

Historically, the link between cities and mass violence is strong and complex. Cities originated from the need for protection. Urban walls created safe harbors. Violence made travel difficult and increases the advantages of proximity. Alternatively, wars have also destroyed cities and made them unsafe. In some cases, such as Berlin in WWI, cities have grown tremendously with warfare. In other cases, such as Berlin in WWII, cities have declined tremendously with warfare. As such, the expected impact of terror on America's urban landscape is unclear.

Moreover, while the size of the 9/11 tragedy is appalling, it is still small relative to the bombing that impacted London and Berlin during the Second World War. Over the past 30 years, terrorism seems to have had at most a small impact on Jerusalem and London. Across countries, there seems to be a positive link between terrorism and urbanization, but this link is small, statistically weak, and causally dubious. As such, we tend to think that the overall impact of terror on America's cities will be small.

The only exception is downtown New York. Before September 11, New York's financial district already seemed like an anachronism. During much of the past 50 years, it was propped up by government subsidies, most spectacularly in the building of the World Trade Center itself. In the wake of the massive destruction of 9/11, it seems likely that the area will not recover, because its natural disadvantages are pretty strong. Only massive government subsidies seem likely to save the area, and the case for these subsidies seems to us quite weak.

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Table 1: The effects of danger on urbanization and urban form, 1968-1977

	Dependent variable:[a]	
	Percent population urban, 1978[c]	Log(1+buildings 500+ feet tall built after 1977)[f]
At least one terrorist action 1968-1977 (dummy)[b]	6.7622*	-0.0617
	(3.3011)	(0.2466)
Casualties from terrorism 1968-1977 per million population in 1973[b]	0.0047	0.0009
	(0.0245)	(0.0018)
Log(1+number of terrorist actions 1968-1977)[b]	2.3375*	-0.0710
	(1.0659)	(0.0796)
Military personnel, % of total labor force 1985[c]	1.0784	0.0301
	(0.6350)	(0.0480)
Average number of government crises per year, 1968-1977[d]	1.3425	-0.1218
	(1.1053)	(0.0864)
Average number of purges per year, 1968-1977[d]	2.3752	-0.4245
	(4.9165)	(0.3833)
Average number of coups per year, 1968-1977[d]	12.5111	-0.4295
	(8.1916)	(0.6490)
Average number of riots per year, 1968-1977[d]	0.4635	-0.0058
	(1.0868)	(0.0853)
Fraction of years in civil war, 1968-1977[d]	0.3496	-0.2349
	(3.8286)	(0.2830)
At least one external war, 1960-1985 (dummy)[e]	3.0516	-0.0443
	(3.1364)	(0.2156)
Fraction of years involved in an external war, 1960-1985 (dummy)[e]	2.5362	0.3128
	(10.0014)	(0.6803)

* - Significant at the 5% level.
a - Regressions include controls for log(GDP per capita) and log(population) in 1973, the median year of the sample period.
b - Source: Mickolus [17].
c - Source: World Bank [28]
d - Source: Easterly and Levine [9].
e - Source: Barro and Lee [3]
f - Source: Marshall Gerometta's "Hot 500" database. (Available on request from marshall@worldstallest.com).

Table 2: Jerusalem and Tel Aviv, 1948-1998

	Jerusalem			Tel Aviv		
	c. 1948	c. 1998	Average annual growth	c. 1948	c. 1998	Average annual growth
Population (thousands)	87.1	717.0	0.042	305.7	1138.7	0.026
Density (population per sq. km)	159.5	1099.7	0.037	1834.0	6659.3	0.026
Percent of total population of Israel	10.2	11.9		35.7	18.8	

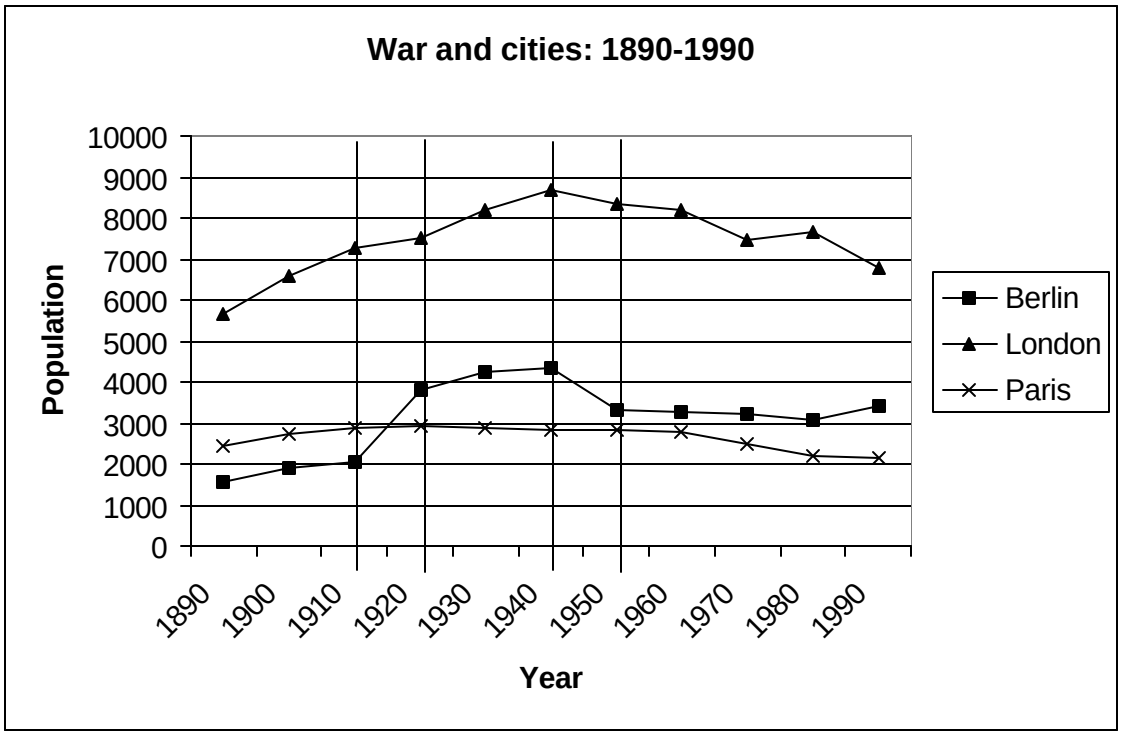
Average annual growth refers to (log(value in 1998) – log(value in 1948))/50
Sources:
Central Bureau of Statistics [5]
Central Bureau of Statistics [6]

Table 3: Population of Inner London, 1951-1999

Year	Population (thou)
1951	3,679
1961	3,481
1971	3,060
1981	2,550
1991	2,627
1999	2,817

Source: Office for National Statistics [23].

Figure 1



Source: Mitchell [18]. Note that these figures are based on contemporaneous borders and therefore may not be properly adjusted for changes in city definitions.