Urban Adaptation to Low Probability Shocks: Contrasting Terrorism and Natural Disaster Risk

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Introduction

Suburbanization is a long-run trend in cities around the world. All households and firms face tradeoffs in terms of location choice. Until recently, urban centers were the cultural and social epicenters and the suburbs were boring places for households needing more space and willing to put up with a long commute to the center city. Suburban locations offer cheaper land prices and a newer, more efficient building stock. While in the past transportation costs to access the productive city center posed a significant cost of suburbanization, improvements in transportation such as highways and information technology diffusion have dramatically reduced this cost. Starting in the 1960s through the early 1990s, center city decline introduced a new “push factor” encouraging suburbanization. Major cities suffered from high taxes per dollar of government services, poor inner city public schools, pollution, urban poverty, racial discord and crime (Mieskowski and Mills 199x).

Center city terrorism risk represents another “push factor” encouraging suburbanization. The pursuit of individual self interest suggests that fear of terrorism will accelerate metropolitan area suburbanization. If individuals and firms increasingly suburbanize, in part due to salient terrorism risk, then a re-enforcing “chicken and egg” dynamic will play out as more households and jobs suburbanize. This paper examines whether this intuitive logic is likely to play out in America’s major cities and evaluates the economic consequences of such a trend. I will argue that center city terrorism risk will not lower metropolitan area productivity and due to recent improvements in center city quality of life the impact of center city terrorism risk accelerating suburbanization will be attenuated.

Cities are the growth engine of capitalism because they facilitate trade, specialization, learning and innovation. Those cities that can attract and retain the skilled are most likely to prosper. Today, there are hundreds of major cities for households and firms to choose from in the United States. Our modern and technologically savvy society has unprecedented access to information about each city’s opportunities and challenges.

The modern urban empirical literature has emphasized the agglomeration benefits of cities as workers and firms learn, specialize and trade (Glaeser et. al. 1992, Dumais, Ellison and Glaeser 2002, Rosenthal and Strange 2004). If terrorism erodes such agglomeration spillovers,
then adaptation to terrorism risk could impose large social costs. This view is argued in a recent paper by Abadie and Dermisi (2008) who document evidence of an increase in vacancy rates in downtown Chicago commercial office spaces in the aftermath of the September 11, 2001 attacks.

Fear of center city terrorism could certainly encourage both population dispersion and job sprawl. Paul Krugman and I anticipated this point immediately after the September 11th attacks. In the days following the September 11th attacks, I wrote a draft of an editorial that was never published titled “Will Wall Street Leave Wall Street?” This editorial built on my current work at the time on the causes and consequences of employment suburbanization (Glaeser and Kahn 2001, 2004). But, Dr. Krugman authored a far better piece in his New York Times column. An excerpt from the October 3, 2001 opinion piece, “Reckonings; An Injured City” 1 is worth reprinting here:

“Will the terror attack permanently damage New York's position as America's economic capital?

After all, America's pre-eminent city owes its position to historical accident. The natural advantages of New York -- its fine harbor, its location at the terminus of the only possible canal route to the Great Lakes -- were real enough during the city's rise. But those natural advantages have long since ceased to be important to the city's economy. What keeps New York a great city is circular causation; people and businesses locate there because of the opportunities created by the presence of other people and businesses.

And because the city's economy is sustained by circular causation, a sufficiently large blow to that economy could in theory do permanent damage. If enough businesses and people leave, for whatever reason, the local economy could fall below critical mass and enter a downward spiral in which businesses leave because other businesses are leaving.

The beneficiaries of such an exodus would probably not be other great cities; instead, businesses would move out into the endless sprawl. I was not the only person in suburban New Jersey who, somewhat to my shame, felt perfectly safe on Sept. 11: there are millions of people living and working nearby, but no obvious targets, because there's no there here.

The question is how large a blow would be needed to start such a spiral? How robust are cities, anyway? (Krugman 2001)

This paper elaborates on Krugman’s themes. Could cities such as New York City be “knocked out” by further terrorist threats? If Manhattan suffers from such a perception, will the greater New York City metropolitan area suffer or do geographical areas within the same

metropolitan area compete via a “zero-sum game” for such economic activity as hedge fund trading?

Fortunately for the Mayors and land owners in center cities, there are counter-veiling “consumer city” trends occurring at the same time that terrorism risk lurks. Center city crime is falling, pollution problems are improving and people are rediscovering the perks of center city living. These trends should allow center city decision makers to sleep soundly at night as they recognize that their new “golden goose” is fusion of cuisine and leisure activity rather than Goldman Sachs.

In addition to facing elevated terrorism risk --- coastal cities also face the risks posed by climate change. I compare and contrast how urbanites and their greater metropolitan areas will adapt in the face of two distinct, low probability but potentially very costly threats; namely terrorism and climate change. There are valuable lessons to be learned by comparing how we individually and collectively respond to a passive, semi-predictable opponent (Mother Nature in the case of climate change) versus our responses to an active and less predictable opponent engaging in “intelligent design” (terrorists).

**Terrorism Will Not Erode the Productivity Advantage of Metropolitan Areas**

Across all major U.S cities, there has been an ongoing decentralization of activity (Mieskwwi and Mills). After World War II, the population suburbanized and commuted to the center city work places. Over the last 40 years, there has been a sharp growth in suburban employment (Glaeser and Kahn 2001). Given that time is our scarcest asset; workers will have a high demand to live close to employment centers. As a result, the majority of U.S workers now live and work in suburban areas. These workers commute using private vehicles and move at higher speeds than those who use public transit to commute downtown (Glaeser and Kahn 2004). These suburbanites live a life that would be quite familiar to the New Jersey residents who Paul Krugman’s quote alluded to in the introduction. Such suburbanites face little terrorism risk even though they live in New York City’s metropolitan area.
Terrorism could accelerate this suburbanization trend. Urban centers face the greatest risk from terrorism because by definition they feature the highest population density and offer the most victims per terrorist action. Center cities receive more media coverage than suburban locations and this further amplifies the effect of a terrorist attack and the likelihood that an attack would take place there.

In anticipation of this risk, each centrally located firm such as Goldman Sachs on Wall Street must evaluate its choices for optimal location. While center city locations offer attractive social and entertainment options for commuting workers, rents tend to be higher for their employers. Each individual firm will choose its optimal location decision by comparing its own private benefits and costs of remaining in the center city. No individual firm has an incentive to internalize the spillover effects its location choice has on other companies. For example, if Goldman Sachs moves to the suburbs there will be other companies in New York City such as small companies seeking venture capital because of the lost proximity to this industry leader.

If a given major city now faces increased terrorism risk, could this erode the metropolitan area’s overall productivity? The logic chain underlying such a claim is built upon the belief that beneficial agglomeration externalities are maximized in the densest part of the metropolitan area and that such benefits are lost if economic activity decentralizes. However, there is nothing intrinsic about center city locations such as Chicago’s Loop or Wall Street that guarantees that a firm that locates to the center city will experience increased productivity. Instead, this observed fact that center city firms are more productive is due to a “selection effect” (the set of firms who can afford the expensive downtown rent are not a random sample) and a “treatment effect” (the Central Business District has traditionally solved a co-ordination problem). As the Nobel Laureate Schelling taught economists years ago, two strangers must meet each other somewhere in New York City will both individually gravitate to Grand Central Station because each knows that the other is seeking such a focal point. A similar effect happens in the case of the Central Business District (CBD). In this case, a type of self-fulfilling prophesy unfolds. The CBD is productive because it attracts best and brightest to locate there and this “snowball” effect comes into play. In order to become successful, emerging firms must relocate to regions of high activity and productivity, such as the CBD. This logic indicates that central locations matter but there is no explanation as to why downtown a *unique* epicenter of productivity.
As suburbanized employment permeates, new employment centers will emerge. If Goldman Sachs moves to the New Jersey suburbs, “pilot fish” firms will follow it and a new agglomeration will emerge. While the downtown land owners and the mayor who presides over this physical area will bemoan this trend, it is unlikely that the overall macro economy will suffer. Only a handful of industries benefit from very close physical proximity (i.e. walking distance) to other firms. A recent example is the empirical study of the advertising industry by Arzaghi and Henderson (2009). In general, the major agglomeration force across industries is the need for labor pooling. Workers want to live and work in cities that feature multiple employers because this leads to thick local labor markets and a lower risk of unemployment. Due to the high percentage of car ownership, suburban workers are able to commute to many different suburban locations to work. The new metropolitan area of San Jose in California is an example of a highly productive “sprawled” metropolitan area. In lower density cities such as San Jose, people can drive at higher speeds and cover more ground to increase their range of employment opportunities.

For terrorism to considerably diminish industrial productivity, one would need to make a credible case that suburban employment centers are not productive places. The suburban corporate campuses of both Google and Microsoft represent counter-examples. The hedge fund traders clustered in Greenwich, Connecticut offer another example of productive, highly skilled people working and thriving far from a dense urban center. In all fairness to the “costs of terrorism” view, emerging firms and startups will have to work hard to mingle and “be in the loop” in a suburban employment setting. Unlike a publically accessible city street, Google can control its security and create a buffer around its own buildings. In a society of suburbanized employment, if emerging firms found that they could not “break in”, then new institutions such as hotel networking meetings and “social hours” would evolve to help connect companies to exploit gains to trade.

The Rise of Consumer Center City Will Offset the Terrorist Threat

While employment suburbanization suggests that terrorism will weaken the center city, the rise of center cities as “consumer cities” represents an offsetting trend. Today, large center
cities are regaining their “groove” thanks to declining center city crime and less pollution. Since the early 1990s, crime has fallen sharply (Reyes 2007). Regardless if the cause is legalized abortion, efficient policing or the decline in leaded gasoline, the effect is the same, a large reduction in the murder rate. In 1990, there were 2245 murders in New York City while in 2008 there were roughly 500 murders. ² Recently there has been a sharp growth in reverse commuting such that people live downtown and commute to suburban jobs.

These facts support the claim that the future of dense urban cities will become the epicenter of consumer living (Glaeser, Kolko and Saiz 2001). The greening of the Center City especially in port cities such as New York City and Boston have led to the rise of the “consumer city” and this has strengthened the its core. The attractive and unique cultural and historical amenities existing downtown cannot be reproduced in the suburbs. Incidentally, the wealthy can afford the higher cost of living and price premium of such a desirable environment. Wealthy people living downtown in major cities such as San Francisco, London, New York City express a purchasing power which creates an endogenous gentrification (Guerrieri, Hartley and Hurst 2010, Waldfogel 2008) such that the demand for fancy commercial stores and restaurants fuels desirable conditions for those businesses to prosper.

In my own research, I have emphasized the “greening” of center cities (Kahn 1999, 2006). The decline of center city manufacturing has offered an environmental silver lining. Cities such as New York City and London have lost hundreds of thousands of manufacturing jobs. An unintended benefit of the transition from manufacturing to a services and tourism economy is sharp improvements in air, noise and water pollution. Recognizing these gains, cities such as Boston have invested in major “greening” projects such as the Big Dig to develop green spaces with easy access to the waterways.

The rise of the consumer center city such as New York City, suggests that center city terrorism risk can be offset by local quality of life improvements. Mayors are well aware that

² Gould and Stecklov (2009) argue that fighting terrorism offers spillover benefits of reducing crime. Their results are consistent with a stronger deterrence effect produced by an increased police presence after a terror attack. A higher level of policing is likely to catch more people trespassing, and at the same time, reduce the number of property crimes.
tourism is a “golden goose” for cities. Center city quality of life improvements during a time of elevated terrorism risk discourages sprawl.

Cross Metropolitan Area Competition in an Age of Terrorism

Common sense and hedonic pricing research pinpoints the “best cities in America”. These tend to be coastal cities in attractive, temperate climates featuring sophisticated cultural opportunities. Albouy’s (2009) top nine amenity cities include: San Francisco, Santa Barbara, Monterey, Honolulu, San Diego, New York City, Los Angeles, San Luis Obispo and Boston. Seattle ranks 12th, Portland ranks 19th and Houston ranks 74th. Hedonic researchers identify such cities using revealed preference logic. If a city features relatively high home prices and offers relatively low wages and suffers low out-migration then it must have high quality of life.

Changes in city specific terrorism risk could shake up this ordering of “America’s Best Cities to live and work”. Terrorism risk is another spatially tied attribute that is capitalized into cross-city and within city real estate pricing gradient. Workers and firms not only choose where to locate within a metropolitan area but also which metropolitan area to locate in. There are over 300 in the United States. In an open system of cities, workers and firms will conduct a two stage location; choose a metropolitan area and then choose a location with the metropolitan area. Those cities and neighborhoods deemed to be risky will experience a reduction in real estate pricing. The owners of such assets will bear the incidence of this “new news”. While real estate values would decline in cities deemed to be increasingly at risk, there are other cities that could actually experience a windfall. For example, Boston and New York City are rough substitutes. If New York City is perceived to be at elevated risk from terrorism, this could displace economic activity both to its suburbs and to downtown Boston. In this case, rents could rise in downtown Boston because of demand displaced from the New York City market. Given that downtown areas are built up and thus there is an “inelastic supply” of durable real estate, any “new news” that lowers demand to locate there will translate into falling real estate prices.
Time Trends in Urban Concern about Terrorism as Revealed by Google Searches

The goal of terrorism is to disrupt the status quo and throw a society into a state of chaos. “Terrorism is a form of ‘psychological warfare,’” in which individuals or groups (whether by intimidation, torture, and/or mass attacks) seek to “invoke pervasive fear in a civilian population by personalizing the threat so that everyone feels vulnerable,” (Maguen et. al. 2008).

The residents of major cities such as New York City should express the greatest terrorism concerns. Such concern can feed on itself through social interactions. When the media covers a story, this raises the likelihood that people are talking about the issue and the event can take on a life of its own. It is easy to imagine there being multiple equilibria, whereby a population can become highly concerned about terrorism and interaction with like minded friends and colleagues reinforcing this world view. Consider a simple bandwagon model (see Becker 1991) in which your interest in a subject increases if your friends are also interested in the subject. For example, one’s concern about terrorism may decline if his or her peer group’s interest declines. From an empirical perspective, terrorist shocks represent an exogenous shock that ultimately reduces concern through both individual and peer-group effects.

Figure One provides some facts about the national television coverage of terrorism. Using the Vanderbilt Television Archives, I graph the aggregate count of network news stories which the search engine counted that mentioned “terrorism” reported that year. As shown in the graph, the terrorist attacks of 2001 and in 2005 lead to sharp increases in coverage but after 2001 there is a clear pattern of declining media attention.

A second way to look at public interest in terrorism is to use Google Trends. Google Insights is a publically available online tool for tracking aggregate Google search activity over time for specific geographic areas such as states. Recent research shows that Google search terms are a powerful tool to predict public health epidemics and economic activity. Here I track weekly Google searches from January 2004 until the present for the entire United States and for New York City to study trends in search activity for “murder” and “terrorism”. To provide a sense of the role of fads, I contrast these searches with interest in the popular music sensation;

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3 Google Insights is available at http://www.google.com/insights/search/##.
“Lady Gaga”. The data available on Google Insights is not the actual number of keyword searches, but rather a scaled variable that enables relative comparisons of trends through time within a keyword and also between keywords. Figure Two graphs the data for the entire United States. Figure Three presents the search activity trends for the New York City metropolitan area. These results suggest that concern about terrorism is on a downward trend in this country. Does this mean that people are letting their guard down? Or does this declining Google Search activity indicate an increasing trust in Homeland Security’s ability to protect the public?

Contrasting Urban Adaptation to Terror and Natural Disaster Risk

Coastal superstar cities such as London and New York City face low probability but potentially dangerous risk from both terrorism and climate change. A first point focuses on how they differ. By definition, there is “intelligent design” behind terrorist attacks while Mother Nature does not throw her punches with the intent of causing harm. In the case of natural disasters, there is more likely to be a clear temporal and spatial pattern concerning where the risks are most likely to take place (flood zones) and the time of year (hurricane season). This predictability enhances adaptation possibilities. The reoccurring seasonal cycles of disasters (i.e “hurricane season”) help to keep it fresh in the mind and makes it easier to adapt to because we don’t forget about the risk.

Anticipating that natural disasters will pose repeat challenges for specific geographical areas helps to induce innovation that will help us adapt to climate risks. UCLA’s Thom Mayne is designing floating homes that will face less flood damage in the event of another disaster. While examples of similar innovations, such as structures that can withstand flooding or earthquakes are easy to think of, it is more challenging to generate optimistic examples of how capitalist innovation can protect us from urban terrorism risk. Improved airport scanners are an obvious transportation example but could such “remote sensing” be used at public transit stations and group sporting events?

While climate modeling is both an art and a science, climate scientists have made progress in forecasting climatic conditions that provide an “early warning system” against anticipated disasters. Such information triggers short term migration responses as people move to higher ground and this lowers the damage caused by a shock. In contrast with terrorism,
Homeland Security has introduced its color coded system. It remains an open question whether such information changes individual behavior and in aggregate protects us from the impact of a terrorist attack.

In the case of terrorist attacks, the attacks are much less likely to be concentrated in specific locations (the coast) or at specific times (hurricane season). This logic suggests that we may have over-responded to the September 11th attacks by being overly vigilant in airline safety. The cost of time lost on security lines can add up to a huge cost of terrorism. The strategic terrorist who recognizes the beefed up security at airports will attempt to identify other targets. This pessimistic logic suggests that past history is much less useful for predicting terrorist attacks on cities than in predicting natural disaster patterns. It is true that the highest population density parts of cities are highly correlated over time and remain a tempting target for terrorists but the mode of attack is less predictable.

Household income plays a role in protecting people from natural disaster risk. Richer people consume higher quality products and live in better, safer neighborhoods. The net effect of this population sorting is that the poor face greater risk from natural disasters. In contrast, this logic is less likely to apply in the case of terrorist attacks because they are concentrated in workplace communities. In a world where people work downtown and the majority live in the suburbs, it’s more likely to affect above average income people in terrorist attack. Conversely, in Israel terrorist attacks on public transit are more likely to yield lower income victims because richer people travel by private car.

Are government and individual efforts to protect the populace complements or substitutes? The social benefits of the Department of Homeland Security measured in terms of protecting the population from terrorist risk hinge on the ability and willingness of the public to take self-protective actions. In both instances, there is an issue of “crowding out” that arises. If one has faith in the success of Homeland Security, each household is less likely to suburbanize and this actually increases the possible victim count from a given terrorist attack. After all, if the population is uniformly distributed across a given area, then an attack will cause less damage than if an intelligently designed attack focuses on a densely populated area.
The same point arises in the case of defending cities such as New Orleans from a future Hurricane Katrina. As the federal government builds better sea walls around New Orleans, then a trusting public is more likely to remain in New Orleans. If the public did not trust the government, then fewer people would live in areas at risk. In this sense, public investment in risk reduction lures more people to live in at risk places. Economists call this the “crowd out” effect that public investment diminishes private household investment. Starting with Viscusi’s (xxx) work on lulling effects induced by safety regulation, economists have recognized this point. The empirical relevance of this point in the case of Homeland Security and adaptation to climate change would appear to be an important research topic.

Conclusion: Risk in Cities

Major coastal cities such as New York City and London face threats from terrorism and climate change. There are other cities such as Detroit and Manchester, England which are unlikely to face significant threats from either terrorism or climate change. Cities such as London and New York City are disproportionately at risk because they are coastal, dense, media centers with considerable downtown employment and a dense public transit infrastructure.

While Manhattan is likely to continue to be a prime terrorist target, the good news for Manhattan land owners is that center city living has made a major comeback. Urban crime has been falling since the early 1990s. The major downtowns are “greener”, “cleaner” and more peaceful than they have been historically. These prosperous diverse cities attract tourists which help to fuel a gentrification snowball featuring high-end stores and restaurants and the celebration of culture.

This paper has argued that the rise of “consumer center cities” will protect them against the dispersion threat of terrorism. While fear of terrorism may lead some economic activity to migrate away from center cities, the overall metropolitan areas will not suffer a productivity loss because of this suburbanization trend. Close proximity facilitates trade and learning but these interactions can take place in the suburbs.
The unintended social consequences of self protective strategies for minimizing terror risk will remain an active research topic. While I do not believe that a metropolitan area’s productivity will be lowered by suburbanization, I am concerned about a different “local learning” phenomena. The social capital literature (Putnam 2008, Costa and Kahn 2003) has emphasized the distinction between “bridging” and “bonding” social capital. The former relates to making friends with people who are less familiar while it is human nature to interact with people of similar backgrounds. Major cities contain increasingly diverse pockets of immigrant groups. If fear of terrorism causes the population to stratify by socio-economic group then “bridging social capital” is harder to achieve. Building up trust in such cases will be harder and this will affect our ability to engage in collective action.

A final thought about the geography of terror risk merits mentioning. Throughout this paper, I have assumed that the center city is the epicenter of the terrorist attack. An alternative scenario is that a highly populated metropolitan area is downwind from the attack site. Given the geography of nuclear plants in the Northeast United States and the densely populated areas nearby, millions of victims could be exposed to radiation from an attack on a nearby nuclear reactor. In choosing where to invest more of its resources, does Homeland Security invest more in protecting at risk sites for which there are a greater number of victims downwind?
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Putnam


Figure One

National Television News Stories in which Terrorism is Mentioned

Terrorism

- Terrorism
Figure Two

Weekly Scaled Google Searches in the United States from January 2004 until the Present

Figure Three

Weekly Scaled Google Searches in New York City from January 2004 until the Present