Urban Commerce and Security Study

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Abstract

There is often a perceived conflict between freedom of economic activity and the need for increased security. Are the goals of enhanced economic activity and increased security necessarily in conflict? That is the question underlying a new study, the Urban Commerce and Security Study (UCASS), sponsored by the Department of Homeland Security University Programs and involving a unique partnership of three DHS university centers of excellence. This paper describes the UCASS study, the project's interactions with stakeholders in Lower Manhattan as an initial case in point, and the economic modeling and computer simulation modeling that is anticipated. Also described is the goal of developing a decision support tool that planners and decision makers can use to make choices about security initiatives by assessing relevant costs and benefits of various combinations of security measures and policies.

Keywords: security economics, risk assessment, economic modeling, simulation modeling, precision information environment

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Introduction

There is often a perceived conflict between freedom of economic activity and the need for increased security. Nowhere is this more apparent than in Lower Manhattan, in particular at the site of the new World Trade Center. It is an area where there are conflicting goals: It is a hub of economic activity and a vibrant center of the City, but there is a history of terrorist attacks that make an emphasis on security vitally important. Are the goals of enhanced economic activity and increased security necessarily in conflict? That is the question underlying a new study, the Urban Commerce and Security Study (UCASS), sponsored by the Department of Homeland Security University Programs and involving a unique partnership of three DHS university centers of excellence. In this paper, we describe the UCASS study.

Discussion

The Problem Addressed by the UCASS Study

Two seemingly opposing forces dictate activities around the new World Trade Center site and, more generally, Lower Manhattan: The need to deploy security measures to deter, prevent, or reduce impact of future terrorist attacks; and the desire to enhance commerce and economic activity. A related problem arises in much more general settings involving security. For instance, a crime outside a hotel in Manhattan leads the police to close off a several-square-block area around the hotel, severely impacting not only traffic but also business at shops and restaurants in the area. A gas smell on the 20th floor of a downtown building leads the fire department to order an evacuation of the entire building, and the rerouting of traffic in the neighborhood. The work to be done at hundreds of offices in the building, as well as commerce in various establishments in the area, is severely affected. A high-rise apartment building installs turnstile-type access

control, requiring residents to remember to carry access cards even when they leave for a short walk. Some people in the building find this annoying and decide to move while others feel safer and may even be willing to pay extra rent as a result. In these and many other such instances, the extent of the security initiative can make a large difference in the economic impact it has. However, rarely do (or even can) the authorities take into account the potential economic impact of their actions, whether to prevent an incident or respond to it. The UCASS project aims to assess the economic impact of security initiatives. We seek to develop a general approach to understanding the interplay between security and commerce, one that would be widely applicable to situations arising in diverse urban settings around the country. We seek a methodology that will also enable us to identify cases where increased security actually enhances commerce, as that will provide us with tools for understanding how to minimize the negative impacts of security initiatives on economic activity.

The UCASS Research Methodology

The UCASS project is a unique effort by three DHS university centers of excellence to bring diverse talents and areas of expertise to bear on the fundamentally multi-disciplinary challenges arising from the commerce-security interplay. The Center for Risk and Economic Analysis of Terrorism Events (CREATE), based at the University of Southern California, specializes in analyzing risk and modeling economic impact. The Command, Control, and Interoperability Center for Advanced Data Analysis (CCICADA), based at Rutgers University, has expertise in managing large and complex problems involving massive amounts of data of all kinds, under varying conditions of certainty and accuracy, from multiple, distributed sources, and varying in quality. The National Transportation Security Center of Excellence (NTSCOE), and in particular its partner the Mineta Transportation Institute based at San Jose State

University, has considerable experience in understanding the world-wide structure and form of terrorist events. Together, these three partners are spearheading the UCASS project.

We have chosen to concentrate on security and commerce in Lower Manhattan, as a concrete application area with which to develop our methodology. Later, we hope to apply the methodology to other urban areas, e.g., parts of Los Angeles and Chicago. Numerous stakeholders have (often contending) security and economic goals for Lower Manhattan. Stakeholders include the New York City Police Department, the Port Authority of New York and New Jersey (which owns the World Trade Center site), various local and state government agencies, the Mayor's Office, real estate firms, financial sector firms, residents who live in the area, and workers who commute into the area to work in its many offices and shops. A key part of the UCASS study is to engage these numerous stakeholders in a dialogue, to elicit their views about the interplay between commerce and security. Out of this dialogue, we hope to establish close working relationships with key stakeholders. The DHS university centers are academic entities and UCASS is very much an academic study. We are in the process of arranging to place some of our graduate and postdoctoral students with such key stakeholders as police departments and real estate firms. Out of this will come not only academic research, but also a much better way of understanding the practical problems of security and hence a much better basis for developing our tools.

Ultimately, our project aims to develop a decision support tool that planners and decision makers can use to make choices about security initiatives. That tool will be based on a risk and economic analysis that includes the relevant costs and benefits of various combinations of security measures and policies and can be used to compare security measures or packages ("portfolios") of security measures as to risk and economic consequences.

At this early stage of the project, we are gathering information on possible threats, developing threat scenarios, and gathering information about alternative security strategies and policies, capital and operating costs of different security initiatives, and the relative efficacy of countermeasures deployed against a variety of threats. We are developing a set of working scenarios and security initiatives that we will use to develop and test our methods. The scenarios and initiatives we start with will be developed in consultation with stakeholders and modified as the project progresses. Among the security initiatives we are considering are video surveillance, screening programs, security perimeters-checkpoints, patrols, access control, street closures, etc.

We expect to develop micro-models of economic activity in Lower Manhattan, gathering data about rents, real estate transactions, vacancies, movement of firms out of Manhattan, etc. Our goal is to understand both the direct and the indirect effects of different security initiatives, e.g., effect on property values, congestion, delays, etc. We will survey both businesses and residents to seek to understand their views about security initiatives, and to determine when, and if, more security actually enhances the appeal of living or working in Lower Manhattan and when, and if, it detracts. The economic data gathered will feed into a computable general equilibrium model of the Lower Manhattan area, which includes key economic linkages between business in the area and the broader economy.

A risk model will be developed to provide probabilities of scenarios of different types and then we will seek to integrate the risk and economic models to get estimates of risk and economic consequences that can enable us to find portfolios of security initiatives that are “efficient” on a variety of criteria.

Ultimately, all of our data gathering and modeling will feed into a decision support tool we call a “Precision Information Environment” (PIE). A PIE is a future work environment for

emergency management that “will provide tailored access to information and decision support capabilities that adapt to the varying users and phases of emergency management. A PIE will provide analysis and simulation capabilities through novel interactions that transform planning, communication and decision making by first responders, policy makers, and the public” (http://precisioninformation.org/). Our PIE will be based on simulation tools that are being developed in two parallel efforts. First, we are exploring the use of the ARENA simulation software (Altiok & Melamed, 2007) with which our CCICADA team has extensive experience. Our initial studies start with a simple scenario and a small area around the World Trade Center site. We will develop tools for simulating the movement of individual entities (office workers, residents, shoppers, tourists, private cars, taxis, buses, etc.) through the area and their interaction with various facilities (shops, restaurants, office buildings, etc.). The simulation will allow us to model many different security initiatives, take into account assumptions about risk and behavior (that later would be based upon input from users of the software), and to output the effect on economic behavior (such as number of people shopping, number not returning to their offices after an evacuation, etc.) While powerful, the ARENA software is not open-source and not usable over the web. Thus, we have identified an open-source software tool called OMNet++ (http://www.omnetpp.org/) that we will be developing into our PIE, with one of the goals being to make it into a web-enabled decision support tool. Lessons learned from earlier experiments with ARENA will be used to feed into our OMNet++ tool.

As the project shifts into later phases, we plan to add more sophisticated components. For example, we plan to put more emphasis on incorporating “quality of life” measurements into our economic analysis. We plan to look at risk-modeling from a game-theoretic point of view, with a defender picking a security policy and an attacker picking an attack mode, as with the

Stackelberg games used in the successful implementations of work done at CREATE at LAX Airport and elsewhere (Paruchuri, et al., 2008; Pita, et al., 2008; Kiekintveld, et al., 2009; Tsai, et al., 2009; Jain, et al., 2010). Later, we aim to use our Lower Manhattan study to develop a theory and tools and models that are applicable to much broader contexts.

End Users/Customers/Who Would Benefit from UCASS

As noted earlier, there are many stakeholders who have an interest (and in some cases who should have an interest) in the economic impacts (positive or negative) of security interventions. Some of those are agencies such as local or regional or statewide police agencies, local and state government agencies (health departments, homeland security agencies, departments of transportation, OEMs), or regional agencies (such as the Port Authority of New York and New Jersey or the Los Angeles Board of Harbor Commissioners). However, other stakeholders come from the private sector. These include private security firms, chief security officers of major companies, management of real estate and other businesses affected by security initiatives, and private sector partnerships (such as the New York City Economic Development Corporation or the 911 Memorial). The goal is to develop a tool that is widely usable and applicable. Our tool is aimed at the planners and decision makers who have some time to shape the whole environment toward more safety while minimizing effect on or even enhancing commercial activity. It is not aimed at being a tool that is usable in real-time by first responders.

Challenges to Attaining the Solution and Results

The project faces a variety of major challenges. We have done an extensive survey of prior work on the interplay between economic activity and security; see Joyal (2010), from which many of the ideas in this section are derived. This paper reports that there has been a significant amount of literature devoted to the economic impacts of terrorist attack (e.g., the

work of CREATE on the economic impact of the September 11 attacks on New York City, on surrounding areas, and on the nation as a whole, as described in Blomberg and Rose, 2009), but considerably less on the economic impacts of security policies and practices. The term "security economics" is coming to stand for the activities that affect, prevent, or mitigate insecurity in the economy or the use of economic tools to analyze the dynamics of security (Schneider, Brück, and Meierrieks, 2010). Some methods in use are cost-benefit analysis and "impact analysis" (Cordes, Yezer, Young, Foreman, and Kirschner, 2006), and we will take advantage of such methods in this project. However, even in the more well-studied area of criminal justice and crime prevention, cost-benefit analysis and impact analysis are very rarely used (Cohen, 2005). Moreover, the challenge is to take such methods and adapt them to new complexities arising from situations with the amount of uncertainty involved in the scenarios of interest in this project. Also, many of these methods are based on data that falls on interval or ratio scales where it is meaningful to talk about averaging and comparing percentages (Roberts, 1994, 1999, 2009), whereas in many of the applications we have in mind, the best we can expect from users is to provide data on ordinal scales, e.g., "green, yellow, orange, red."

Much of the literature on economics and security has concentrated on events that have a reasonable frequency of happening and also where the recurrence of events (in the past or the future) allows for the testing of models and tools. An example is shoplifting, where the decision to invest in initiatives to deter or respond to shoplifting can readily be compared to the cost of not doing so. Insurance provides another similar example. There is also a significant literature on information security and the economic costs and benefits of investment in IT security (see e.g., Bohme and Nowey, 2008). One of the challenges in the IT security area is the need to develop

good metrics for the value of security and this challenge definitely faces us in this project as well.

The problems we are studying involve scenarios where there is minimal data to determine probabilities or other relevant parameters needed in our model building and risk assessments. Thus, risk assessments obtained in our study will have significant uncertainty and this will require extensive sensitivity analysis in order to develop any confidence in the conclusions. Similarly, any simulation models we build will, at least initially, be based upon rough estimates of relevant parameters, e.g., changes in the probability that a person in Lower Manhattan will enter a given store if there is a metal detector or other access control device installed. Thus, our initial stage of simulation modeling will be designed primarily to test out the methodology with parameters we believe are reasonably relevant/accurate. Once we understand the subtleties involved in the model building and the ways to produce output about economic costs that can be presented in a useful way, we can concentrate on more accurate inputs or leave it to users to refine those inputs for their own uses. However, we are mindful of the risk that some people might take the initial conclusions from our models as providing ironclad predictions about the relative economic cost of initiating a given security intervention or portfolio of interventions – thus giving the predictions much more credibility than we intend.

Assessing the costs of security interventions is particularly complex if we want to take into account indirect and, in some cases unexpected, effects. For instance, Hoffman, Chalk, Liston, and Brennan (2000) note the many indirect economic effects of closing off Pennsylvania Avenue in front of the White House, including effects on local businesses due to disrupted traffic patterns; reduced parking meter and parking ticket revenue; increased costs of rerouting buses;

increased employee commuting time; and even relocation of businesses resulting in decreased property tax revenues and property values. The list of such indirect impacts is long and complex.

Some of the data we need in this project will depend on (relatively subjective) input from individuals or businesses. While there is a long literature of surveys to obtain such information, there are complexities in the types of issues we are interested in. The work of Dermisi (2007) on the impact of terrorism fears on downtown Chicago's office market is relevant here. She found that tenants' fears of terrorism have most negatively affected "trophy buildings." We will be interested in "iconic" facilities – the new World Trade Center is a case in point – and the analysis of impacts of fears and of new interventions on such iconic facilities raises new and complicated challenges because the nature of such facilities is different from less iconic ones.

What literature there is on economics and security has focused primarily on the *costs* of security. To our knowledge, there is virtually no work that has been done on assessing the *benefits* of security investments from an economic point of view. There are several reasons for this: Difficulty of making economic benefits precise, differing time periods over which to assess the benefits, and the complexity of analyzing indirectly beneficial effects of security investments. Thus, a major challenge for the UCASS project is to develop methodologies for assessing the economic benefits of new security initiatives.

Conclusion

The UCASS study aims at developing a widely-applicable methodology, one that will help multiple stakeholders bring broader perspectives into their planning and decision making. By providing planners and decision makers with newly developed tools and methodologies to analyze the potential economic impact of security interventions, the project will enable them to take a much broader set of goals into account. The project will lead to insights into when added

security acts as a barrier to economic activity and when it enhances such activity. By taking a general modeling approach, the project leaders hope to produce a decision support tool that is usable in a wide variety of types of applications.

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