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SYMPOSIUM:



ECONOMIC COSTS AND CONSEQUENCES OF A TERRORIST ATTACK 2005

OPTIMAL INSPECTION STRATEGIES FOR COAST GUARD OPERATIONS

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The level of threat posed by the introduction of weapons to carry on attacks in the U.S. has significantly grown over recent years. Sea borders remain vulnerable to such threats as it is very costly to inspect every ship that sails in American waterways. In this paper, I analyze the inspection strategies that the Coast Guard should pursue given the level of threat and costs of operations that could deter commercial or personal ship owners from collaborating with terrorists. I study how the optimal strategy changes with respect to the critical factors that affect the decision to collaborate with terrorists. Some insight is also provided on the impact of risk aversion on an optimal strategy.

THE ECONOMIC COST OF ILL-INTENTIONS: PERMANENT OR EPHEMERAL?

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Do shocks to regional economies result in permanent or temporary departures from trend? That issue has received attention from economists before the concern about domestic terrorism in the post 9/11 atmosphere. The central question of this paper is whether a terrorist attack with significant death and destruction, a shock to a region's economy, will have a long-term adverse effect upon measures of economic performance or rather only an ephemeral effect, however startling. The pre and post 9/11 path of the New York City economy is analyzed to throw light on that question. Then the aftermath of some other negative shocks, both natural and man-made, are examined. The object is to tentatively identify conditions that determine whether or not a negative shock will have permanent adverse effects upon a regional economy.

TERRORISM: CONSIDERING NEW POLICIES

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Deterrence has been a crucial element in fighting terrorism. But there are superior strategies to deterrence. We suggest three policies, which can well be integrated into the existing constitutions of democratic and rule-based countries. One is to make terrorist attacks less attractive. Another to raise the opportunity cost – rather than the material cost – to terrorists. The third is to deviate attention from terrorists, once a terrorist act has been committed. These alternative strategies effectively dissuade potential terrorists. Empirical evidence is reviewed to enlighten these policies.

TOURISTS AND TERRORISTS: MODELING THE STATE-BY-STATE IMPACTS OF TERRORIST ATTACKS ON MAJOR U.S. TOURIST ATTRACTIONS

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Some of the most costly international terrorist attacks in recent years have been on prominent tour destinations. Yet, the economic impacts of these disruptions have not been widely studied. We apply our new National Interstate Economic Model (NIEMO), to our knowledge the only up-to-date operational interstate intersectoral and interregional trade model of the U.S., to the problem of estimating the economic impacts of hypothetical terrorist attacks on some major tourist destinations in several States. The model itself accounts for the interactions among 47 major economic sectors over all fifty states, the District of Columbia, and the rest of the world.

TERRORISM INSURANCE: EVALUATING THE ROLES OF THE PUBLIC AND PRIVATE SECTORS

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The terrorist attacks on September 11, 2001 (9/11) against the United States raise the fundamental question as to what are the responsibilities of the public and private sectors in reducing the risks of terrorist attacks and in providing adequate financial protection to victims of catastrophes. Although numerous efforts have been undertaken during the last three years to prevent new terrorist attacks on U.S. soil, the economic impact of a mega attack has to be seriously considered. More specifically, who should pay for future losses so as to assure business and social continuity should the terrorists be successful? This paper examines the role that insurance has played in dealing with terrorism before and after

September 11th. It then evaluates alternative terrorist insurance programs for the future ranging from a free market solution to having the federal government play a prominent role.

A WORST-CASE ELECTRICITY SCENARIO: THE BENEFITS & COSTS OF PREVENTION

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worst case scenario for the electricity system would begin with a terrorist attack that caused a blackout in New York City and surrounding areas. The attack is likely to occur on a day of either record low or high temperatures. We explore likely attack modes and show that preventing the attack would be extremely difficult. We then explore subsequent actions that terrorists could take that could lead to panic, thousands of deaths, and the destruction of monumental buildings or infrastructure. Since preventing the attack is all but impossible, we explore preventive measures that could be taken to minimize the social cost of the blackout and subsequent actions. These require changes in infrastructure, many of which should be done without the threat of terrorist attack. We present rough estimates of the social benefits and costs of these preventive measures, concluding that either there would be a net social benefit or that the net cost would be small, without considering the threat of terrorism. Once there is a credible threat of terrorist attack against the electricity system, there are large social benefits from these preventive actions.

DEVELOPING COST-EFFECTIVE
STRATEGIES TO ADDRESS URBAN
TERRORISM: A RISK MANAGEMENT
APPROACH

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As the United States has regrouped in the years since the attacks of September 11, 2001, the question of how best to protect our cities from future acts of terrorism has been a topic of continuing discussion. However, despite a rational concern with terrorist vehicle-bomb attacks, a coherent, cost-effective strategy for protecting buildings and facilities while maintaining full and free access to them has yet to emerge. As a result, building owners and managers have been forced to implement ad hoc approaches targeted more at generic vulnerabilities than at actual threats—not necessary an effective, let alone cost effective, approach to urban terrorism. This paper explores basic risk management principles as a means of developing responses that balance actual threats, available resources, and a consensus level of risk tolerance.

DEVELOPMENT OF RISK METRICS
FOR CATASTROPHIC EVENTS IN FOOD
SUPPLY

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Two features of a catastrophic event such as a bioterrorist event in the food industry warrant close analytical scrutiny. One is the potential extreme harm and the massive human, economic and social disruptions of such an event, and the second is the typically small likelihood of such an event taking place. Traditionally the Value at Risk (VaR) approach developed in finance theory has been used a standard to address the issue in the risk-management industry. but , the VaR approach frequently assumes a normal distribution, relegating the chance of extreme events to the *tail* of a normal distribution. Relegating the chance of extreme events such as stock market crashes, earthquakes, and even terrorist events occur more frequently than would be predicted by the tail of a normal distribution. The observation has led to the development of a branch of statistical analyses, known as the extreme value theory (ETV) that develops “*fat tail*” distributions. While the application of Extreme Value Theory to the fields of finance and insurance is rapidly growing, there is now an increasing recognition of the importance to the other fields, predicting such events as the likelihood of environmental disasters such as Exxon Valdez, space shuttle disasters, and so on. In this paper we consider the application of Extreme Value Theory to the estimation of the probabilities of catastrophic events in the food sector, based on existing data, complicate the analysis and we propose several methods to address these issues. Finally, aggregation to form optimal grouping for the purpose of extreme value analysis is of key importance which will be analyzed.

SIMULATING THE STATE BY STATE
ECONOMIC IMPACT OF A TERRORIST
ATTACK ON THREE MAJOR U.S.
SEAPORTS

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We apply the National Interstate Economic Model (NIEMO, developed by our group and to our knowledge the only operational interstate input- out put model of the U.S.) to the problem of estimating the impacts of seaport shut-downs following hypothetical terrorist attacks. The model accounts for the interactions of 47 major economic sectors over all fifty states, the District of Columbia and the Rest of the World. The ports studied are Los Angeles-Long Beach, New York-Newark and Houston, although the model can be applied to the problem of estimating losses associated with terrorist attacks at any major facility in the U.S.

RETHINKING AIRPORT SECURITY

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Congress made two fundamental mistakes in enacting the Aviation & Transportation Security Act in the immediate aftermath of the Sept. 11, 2001 attacks. The fact that this legislation has led to 90% or more of Transportation Security Administration (TSA) effort being devoted to aviation (at the expense of the remainder of transportation) is merely an unfortunate side effect. The first fundamental flaw was the assumption that as far as passenger airlines are concerned, all passengers (and their bags) must be screened as if each was equally likely to be a threat. This decision has led to a far more costly screening system than necessary and (since resources are limited) to underinvestment in many other areas of aviation and transportation security. The second fundamental flaw was to create TSA with a built-in conflict of interest: it is both a security service provider and a federal security regulator and policymaker. This paper critiques these two serious flaws and suggests what Congress should do to remedy the situation: shift to a risk-based policy in aviation and remove TSA's service-delivery role.

REGIONAL ECONOMIC IMPACTS OF
TERRORIST ATTACKS ON UTILITY
LIFELINE CUSTOMERS: A
COMPUTABLE DISEQUILIBRIUM

ANALYSIS

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Much of the research on the regional economic impacts of terrorism has been focused on utility lifelines and their industrial customers. However, households consume about 40% of these services. Although many of the impacts of lifeline disruptions do not show up in standard economic accounts, they do affect the well-being of everyone in a region directly through loss of services, in addition to the more typically measured decrease in factor returns (salaries, dividends, rents). This paper will advance the analysis of household impacts of terrorist attacks in two ways. First, the household component of a computable disequilibrium model will be refined to incorporate household production functions that include “time” as an input, and that reflect possible resilient responses such as input substitution and input conservation. Second, measures such as compensating variation and equivalent variation will be refined and applied to evaluate the impacts of utility service disruptions (both in terms of quantity and quality) on the well-being of households.

BALANCING FREEDOM AND SECURITY
AFTER 9/11: THE CHALLENGE
FACED BY THE NATIONAL PARK
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The 9/11 attacks forced the Department of the Interior and the National Park Service to confront a new reality: a number of cherished American landmarks were potentially in the cross-hairs of international terrorists. From the Statue of Liberty to the National Mall to the St. Louis Arch and beyond -- representing many of the nation’s most powerful symbols of freedom and liberty -- there was an immediate need to tighten security. Because these national icon sites were designed to attract millions of visitors in an open, welcoming environment, finding an appropriate balance between freedom and security has been an enormous challenge. The challenge is exacerbated by fiscal realities. The discretionary, non-defense federal budget is extraordinarily tight, and increases in security generally require trade-offs in other programs. Consequently, before investing in new security measures, the Department and the Park Service have engaged in a detailed risk assessment process, involving a series of critical questions, including the following: How real is the risk of a terrorist attack on a national icon? What kinds of attacks are most likely, and which security precautions would be most effective in deterring or mitigating the threat? If we invest in enhanced security measures, is there a quantifiable level of risk reduction to be achieved?

We will explore these questions and describe our institutional responses, in a series of real-world examples, where the task of managing risks and striving for an appropriate balance remains a work in progress.

TWO-SIDED ELECTRICITY MARKETS: SELF-HEALING SYSTEMS

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High voltage electricity systems may become more reliable under market-based dispatch than they were under cost-based, regulated assignments, if customers are faced with real-time prices. As an example, in Australia where all electricity is transacted through a spot energy market without any regulatory price caps, most large customers have installed frequency-sensing devices to turn off or reduce power to designated equipment when the system's frequency falls below a preset level, since in periods of high demand when the system's supply capability is stressed, there is a direct inverse correlation between frequency and the price of electricity. It is because these buyers do not want to pay \$40/kWh price spikes that they have installed this equipment. But this past summer when the system suddenly lost three 1,000 MW generators, sufficient load was shed automatically so the system re-stabilized, automatically, within 15 seconds. In this case, an automated, market-based response to high price saved the system and enhanced its reliability!

Furthermore, experiments with human subjects have been conducted on simulated full two-sided electricity markets that are cleared subject to the laws of physics over Cornell's PowerWeb, 30 bus, 6 generator, simulated A.C. power network. The results demonstrate the ability of a small portion (20 percent) of active customers to mute the market-power exercised by sophisticated players representing the generators, all without regulated price caps or strictures against withholding capacity. Furthermore, simulations of electrical flows on individual lines suggest that the capacity needs of the system per MW of overall demand are up to ten percent smaller with active customer participation, compared to a regulated regime, and that would provide more breathing room for existing facilities. Those line flows are also more predictable when customers are actively engaged in power markets, making the job of dispatching and controlling the system easier. So if we want to reap the full benefits of markets for power in the U.S., including enhanced reliability, we need to get the customers into the game as full participants.

ESTIMATING THE NATIONAL
ECONOMIC COSTS OF
FOOD TERRORISM

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ny terrorist incident along America's food supply chain will damage the finances of the agricultural, food processing, and food distribution sectors. Those directly affected will see devastating financial losses and the individual and local impacts will be tragic. But the sizeable personal losses imposed on those who consumed, produced, and marketed the contaminated food products are likely to be small when compared to the losses suffered across the entire national economy. There will be a loss in confidence in the safety of our food supply. The loss of confidence in the safety of food products will reduce demand for food and related items, causing suppliers and producers to cutback production. Those cutbacks will, in turn, spill over to related sectors, further reducing demand. More important, the loss in confidence in the food sector is also likely to spill over into a general loss in consumer confidence. Consumer spending of all types, not just food related spending, is likely to fall after a food terrorism event as household consumption patterns adjust to reflect an increased concern about other possible terrorist activity. Ultimately national economic activity will be reduced. And, unlike the national economic losses which follow a natural disaster, the national economic impacts are likely to be longer term. Even ignoring the losses in productivity which will accompany the inevitable actions to provide additional security for food products, real GDP growth will almost certainly drop below the rate projected prior to the terrorist attack. This paper will present estimates of national economic impacts from a food terrorism event. The national economic losses will be estimated by applying a range of assumptions about changes in key economic variables to a large scale econometric model of the U.S. economy. Estimates of the national economic losses associated with the terrorist attacks of September 11, 2001 will also be reviewed.

RISKS AND COSTS OF A TERRORIST ATTACK ON THE ELECTRICITY SYSTEM

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We estimate the loss of service that might result from terrorist attacks on electric power grids using the New York area as one scenario. The model is based on electricity interruptions caused by factors other than terrorist attacks. The mean value of Gross Domestic Product (GDP) for each American is estimated at \$112 per person per day, and based on prevailing literature estimates, the social loss from a premature death used is \$5.8 million and the value of time lost from transportation-related congestion resulting from a blackout is half the average wage. Using these parameters and combining them with outputs from a statistical analysis of outage events, we estimate the losses from hypothetical blackouts caused by a storm or crime, etc. For example, a winter blackout in New York that lasts 20 hours and affects 2.6 million people is estimated to cost \$245 million in business losses, \$870 million in death and injury, and \$117 million in congestion, resulting in a total loss of \$1.2 billion. Although these estimates are uncertain since the scenario is not defined in detail, the method can be used to estimate the social costs of a range of disruption scenarios from terrorist attacks on electric power.

