

The Role of Public and Private Mitigation for Homeland Security Policy
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1 Overview

Our research during year four was initially structured around three objectives:

- Development of research papers based on the surveys and dissemination of the research findings generally
- Investigating extensions to benefits transfer methods for DHS policies
- Planning a workshop on benefit assessment challenges for security policy

1.1 Development of research papers based on the surveys and dissemination of the research findings

Generally, four papers completed and two more were in progress during year four. They are:

- V. Kerry Smith, Mary F. Evans, H.Spencer Banzhaf and Christine Poulos, “Can Weak Substitution be Rehabilitated?” *Environmental and Resource Economics* (received revise and resubmit; revisions completed, awaiting review by co-authors before re-submission)*
- V. Kerry Smith, Carol Mansfield, and Aaron Strong,” Can the Economic Value of Security Be Measured?” draft 5/31/2008 to be shortened and written for a more general audience and then submitted to security journal (we are considering the *Journal of Transportation Security*);*
- V. Kerry Smith, Carol Mansfield, and Laurel Clayton, “Valuing a Homeland Security Policy: Countermeasures for the Threats from Shoulder Mounted Missiles” NBER Working Paper #14325; under review at *Journal of Public Economics* (first round).
- V. Kerry Smith, Carol Mansfield, and Aaron Strong, “Public or Private Production of Food Safety: What Do U.S. Consumers Want?” NBER Working Paper # 14287; under review at *American Journal of Agricultural Economics* (first round)*
- V. Kerry Smith, Carol Mansfield, and Aaron Strong, “Public or Private Production of Food Safety: What Do U.S. Consumers Want?” NBER Working Paper # 14287; under review at *American Journal of Agricultural Economics* (first round)*
- V. Kerry Smith, “Risk Perception, Optimism, and Natural Hazards,” *Risk Analysis*, forthcoming

* partial support for the research was provided by INC project.

Other activities associated with disseminating the research include:

- Dr. Mansfield presented “Smith, V., C.A. Mansfield, and A. Strong. (2008, June). *Health Risks and Food Safety: Preferences for Protection*. Presented at Equity and Efficiency in Health and Healthcare, 2nd Biennial Conference of the American Society of Health Economists, Durham, North Carolina.”

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- We also prepared a set of slides on short documentation of the results of the infrastructure survey to assist Dr. Adam Rose in describing research associated with economic resilience. This was transmitted to him on June 18, 2008.
- Dr. Smith presented, “Non-Market Equilibria and the Evaluation of Security Policy,” at the USC-Create/Wharton Risk Management and Decision Processes Center Conference , “Behavioral Economics and Terrorism.”

In addition, we completed an outline of the analysis plan for a comprehensive selection adjustment (or non-response bias analysis) of the data collected from our two surveys. The plan was submitted to Knowledge Network to obtain data on their web panel needed for the analysis. At the close of the quarter we had submitted this draft to them for review so they would release these data to us.

1.2 Investigating extensions to benefits transfer methods for DHS policies

This activity involved reviewing the literature on indirect tests of the effects of 9/11 and other security threats for firms’ and households’ economic choices. A number of studies have considered used quasi experimental methods and related empirical strategies to evaluate whether land values, vacancy rates for commercial buildings, and other indicators of economic responses to increased threats provided by terrorist events can be detected.

The results of this review are discussed in papers #2 and #3 (above) and we also completed an annotated bibliography contains 18 articles. This work also included completing a brief summary of the papers and a summary of the economic analysis in the DHS RIA’s submitted to OMB for significant rules.

1.3 Planning a workshop on benefit assessment challenges for security policy

Our goal was to frame the topics and people that would participate in workshop on the benefit measurement and transfer challenges for homeland security; we decided to postpone this activity until year 5, saving the budgeted resources so they could be used after more advance planning on topics and format for the workshop had been completed.

2 Research Accomplishments

2.1 Modeling the Role of Private Mitigation as a Substitute for Public Security

The first research paper listed in Section 1 (Smith, Evans, Banzhaf and Poulos) develops an extension to the revealed preference logic of environmental economics to incorporate more specific consideration of different types of mitigation. The paper had three objectives: (1) to develop a graphical approach introduced in Smith and Banzhaf to demonstrate how discrete changes in substitution effects influence the Hicksian price equivalents defined for either weak complementarity or weak substitution.; (2) to demonstrate how weak substitution would be used to derive Hicksian consumer surplus measures.; and (3) to describe the relationship between weak substitution and weak complementarity and the role a more general characterization of weak complementarity and weak substitution could play for non-market valuation in a number of situation where private mitigation is serving as a substitute for public protection.

2.2 Estimating Households' Values of Policies to Develop Countermeasures for the Threats from Shoulder Mounted Missiles

In manuscripts 2 and 3 listed in Section 1 (Smith, Mansfield, and Strong, and Smith, Mansfield and Clayton), our analysis focuses on the marginal willingness to pay (MWTP) for anti-missile laser jamming countermeasures mounted on commercial aircraft compared with two other policies as well as the prospect of remaining with the status quo. Our findings are based a stated preference conjoint survey conducted in 2006 and administered to a sample from Knowledge Networks' national internet panel. The estimates range from \$100 to \$220 annually per household. Von Winterfeldt and O'Sullivan's [2006] analysis of the same laser jamming plan suggests that the countermeasures would be preferred if economic losses are above \$74 billion, the probability of attack is larger than 0.37 in ten years, and if the cost of the measures is less than about \$14 billion. Our results imply that, using the most conservative of our estimates, a program with a cost consistent with their thresholds would yield significant aggregate net benefits.

Figure1 below describes the systems evaluated in a national survey to evaluate the choices households would make among alternative plans to protect the security of the commercial airline system, including the option of doing nothing and working within the status quo.

Figure 1: Description of Missile Defense Systems

Detect & Divert	Preventing Fires & Landing Safely	Patrolling Around Airports
<ul style="list-style-type: none"> • All U.S. airplanes install system to detect and divert heat-seeking missiles. • Very effective as soon as it is installed. • Only works for heat-seeking missiles. • Heat-seeking missiles most common. 	<ul style="list-style-type: none"> • All U.S. airplanes install fuel tank fire suppression systems • Additional pilot training to safely land missile-damaged plane • Moderately effective with sufficient time to develop systems and training • Works for all types of missiles 	<ul style="list-style-type: none"> • Guards would patrol the area around 20 largest airports • Moderately effective • Works for all types of missiles as well as other threats to airports

Table 1 summarizes estimates off the marginal willingness to pay for each the plans based on one of the two payment vehicles considered in the research. In this case a randomly assigned group of the sample were told the plans would be paid for by an increased "security tax" on gasoline.

Table 1: Estimated Willingness to Pay for Security of Commercial Airlines to Terror Related Threats^a

Plan	Model [†]					
	(1)	(2)	(3)			
			INC1	INC2	INC3	INC4
A. Gas Tax						
Jamming Device for Infrared Missiles (Man Pad)	220.8 (4.90)	221.8 (4.93)	149.0 (3.72)	210.1 (3.80)	266 (3.54)	394.8 (1.55)
Fuel Tank Protection and Pilot Training	133.4 (2.93)	134.8 (2.97)	91.9 (2.73)	129.6 (2.70)	164.1 (2.67)	243.5 (1.45)
Increased Patrols	22.2 (0.41)	23.4 (0.44)	21.9 (0.64)	30.9 (0.64)	39.1 (0.65)	58.1 (0.61)

^a The numbers in parentheses are the asymptotic Z statistics for a test of zero marginal willingness to pay.

The results reported in this paper suggest that people can make choices over security choices when they are described using specific plans. The results also indicate that the tradeoffs their choices imply are economically consistent. While some might argue that specific security policies are too complicated for the public to understand, public opinion plays an important role in Congressional support for different policies. Public opinion about government policies also affects the degree to which individuals change their own behavior, and thus the costs and benefits of the policy. The range of MWTP estimates indicates that the heterogeneity in these measures for the tradeoffs respondents would make is consistent with their circumstances and opinions about the nature of terrorist threats. The estimated MWTP also seems reasonable compared to the costs of a successful attack and relative to other insurance payments such as automobile and home insurance.

2.3 Estimating Household Willingness to Pay to Enhance Food Safety

This research project sought to estimate consumers' preferences for plans to improve food safety (paper 4 listed in Section 1, Smith, Mansfield, and Strong). The plans were distinguished based on whether they address the *ex ante* risk of food borne illness or the *ex post* effects of the illness. They were also distinguished based on whether they focus on a public good –reducing risk of illness for all consumers or allowing individual households to reduce their private risks of contracting a food borne pathogen. Based on a national survey conducted in 2007 using the Knowledge Network internet panel our findings indicate consumers favor *ex ante* risk reductions and are willing to pay approximately \$250 annually to reduce the risk of food borne illness. Moreover, they prefer private to public approaches and would not support efforts to reduce the severity of cases of illness over risk reductions.

A number of other aspects of the choice process were evaluated –including an assessment of whether the respondents understood the risks of contamination. It also evaluated how they responded to plans to protect food safety if they felt the threat was due to terrorist activities. Figure 2 illustrates how probabilities were presented.

Figure 2 Illustration of Presentation of probabilities for three different situations.

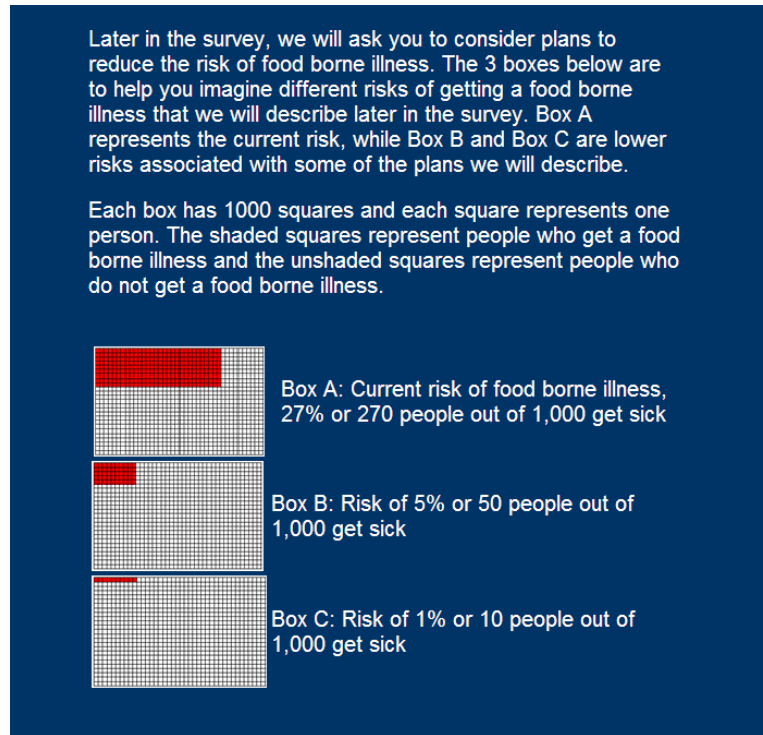


Table 2 compares the estimates of the marginal willingness to pay for plans to improve food safety across different groups in the 2007 survey and Table 3 describes how the MWTP increases for the sample of respondents who indicate they would be willing to pay more for plans if the threat was due to terrorism affecting the food supply.

Table 2: Marginal Willingness to Pay Estimates for Food Safety – Sub-Samples for Different Consumer Groups^a

	Experience Food Borne Illness	Primary Food Shopper	Consider the Survey Consequential
Plan Models			
Test Kit	241.1 (1.06)	256.6 (1.05)	253.2 (1.33)
Food Inspectors	259.1 (1.09)	211.6 (1.12)	256.4 (1.39)
Medicine	-154.1 (-0.66)	-227.7 (-0.71)	-50.3 (-0.51)
Opportunity Cost of Time	27.4 (0.82)	29.5 (0.82)	19.5 (0.97)

^a Numbers in parentheses are asymptotic Z statistics for null hypothesis of zero marginal willingness to pay.

Table 3: Estimated Marginal Willingness to Pay for Food^a

Plans	Full Sample	Pay More if Terrorism
Test Kit	195.2 (2.11)	277.0 (2.94)
Food Inspectors	156.6 (2.35)	255.1 (3.22)
Medicine	-118.0 (-1.15)	166.8 (3.97)
Opportunity cost of time	37.7 (1.60)	7.39 (1.26)

^a Numbers in parentheses are asymptotic Z statistics for null hypothesis of zero marginal willingness to pay.

3 Research Products

Research Products		#
7a	# of peer-reviewed journal reports published	1
7a	# of peer-reviewed journal reports accepted for publication	1R&R
7a	# of non-peer reviewed publications and reports	3
7a	# of scholarly journal citations of published reports	
7b	# of scholarly presentations (conferences, workshops, seminars)	2
7b	# of outreach presentations (non-technical groups, general public)	
7c	# of products delivered to DHS, other Federal agencies, or State/Local	
7c	# of patents filed	
7c	# of patents issued	
7c	# of products in commercialization pipeline (products not yet to market)	
7c	# of products introduced to market	

3.1 Publications and Reports

Publications	Ref.	Not Ref.
1. Smith, V. K., Evans, M., Banzhaf, H., Poulos, C., "Can Weak Substitution be Rehabilitated?" <i>Environmental and Resource Economics</i> , under revision	x	
2. Smith, V. K., Mansfield, C., Clayton, L., "Valuing a Homeland Security Policy: Countermeasures for the Threats from Shoulder Mounted Missiles," NBER working paper #14325; under review at <i>Journal of Public Economics</i>	x	
3. Smith, V.K., Mansfield, C., Strong, A., "Public or Private Production of Food Safety: What Do U.S. Consumers Want?" NBER working paper #14287; under review at <i>American Journal of Agricultural Economics</i>	x	
4. Smith V. K., Hallstrom, D., "Adjusting to Natural Disasters," <i>CREATE Annual Economics Symposium</i> , Vol 3, Richardson, H., Gordon, P., Moore II, J. (eds.) <i>Economic and Risk Assessment of Hurricane Katrina</i> , forthcoming		x
5. Smith, V. K., "Risk Perception, Optimism, and Natural Hazards," <i>Risk Analysis</i> , forthcoming	x	

6. Smith, V. K., Mansfield, C., Strong, A., “Can the Economic Value of Security Be Measured?” May 2008		x
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4 Education and Outreach Products in Year

Education and Outreach Initiatives	#
# of students supported (funded by CREATE) undergraduates paid at an hourly rate ¹	3
# of students involved (funded by CREATE + any other programs)	
# of students graduated	
# of contacts with DHS, other Federal agencies, or State/Local (committees)	
# of existing courses modified with new material	

¹ An important limitation to this strategy for research support is that minimal payment must be made to undergraduates even if there is not work directly related to the project available for them to do in order to keep them engaged in the project and available for activities when work is ready for them to undertake. Some of this work can serve as contributing indirectly to the research thru training activitie.