Assessing the Costs and Benefits of United States Homeland Security Spending

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ASSESSING THE COSTS AND BENEFITS
OF UNITED STATES HOMELAND SECURITY
SPENDING

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ABSTRACT
An assessment of increased United States federal homeland security expenditure since 2001 and expected lives saved as a result of such expenditure suggests that the annual cost ranges from $64 million to $600 million (or even more) per life saved, greatly in excess of the regulatory safety goal of $1-$10 million per life saved. As such, it clearly and dramatically fails a cost-benefit analysis. In addition, the opportunity cost of these expenditures, amounting to $32 billion per year, is considerable, and it is highly likely that far more lives would have been saved if the money (or even a portion of it) had been invested instead in a wide range of more cost-effective risk mitigation programs.

1.   INTRODUCTION

Terrorism, particularly international terrorism, is a threat that is very salient in the public concerns of Americans. At the end of 1998, fully 84 percent of the public picked international terrorism as a "critical threat" to the country and 79 percent deemed "combating international terrorism" to be a "very important" foreign policy goal. After the terrorist attacks of September 11, 2001, these numbers, of course, soared even higher, to 91 percent in both cases.[1]

Given this concern, decision makers have understandably invested considerable funds to counter the threat, and since 2001 over $300 billion has been spent by the United States government to protect the American homeland from terrorism.[2] In addition, local and state governments have expended significant sums on the problem, and so have private businesses. There have also been opportunity costs: in multi-hazard environments, decisions to invest in risk mitigating measures for one hazard may well come at the expense of others.

For many years now the United States Office of Management and Budget (OMB) has recommended the use of a cost-benefit assessment for all proposed federal regulations, and such assessments are routinely conducted by the Nuclear Regulatory Commission, the Environmental Protection Agency, the Federal Aviation Administration, and other agencies. In addition, the 9/11 Commission report called on the government to implement security measures that reflect assessment of risks and cost-effectiveness.[3] Yet despite the massive expenditures involved, a senior economist at the Department of Homeland Security, Gary Becker (not the Nobel Laureate), recently said that "We really don't know a whole lot about

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[1] *American Public Opinion & Foreign Policy: U.S. Report,* Chicago Council on Foreign Relations, 2002, Figure 2-1.

[2] Veronique de Rugy, *Facts and Figures About Homeland Security Spending*, AEI Online, American Enterprise Institute for Public Policy Research, 14 December 2006.

[3] *The 9/11 Commission Report,* National Commission on Terrorist Attacks Upon the United States, July 22, 2004, p. 391.

the overall costs and benefits of homeland security."[4] So a cost-benefit analysis for United States homeland security expenditure is clearly well overdue.

2. THE VALUE OF A LIFE SAVED

The adverse effects of terrorism are many, but the two dominant consequences are loss of life/injury and economic (monetary) losses. Experience suggests that property damage, loss of business, and other economic losses as a result of terrorism tend to be short-lived, particularly for developed nations which typically have resilient infrastructure, institutions, and economies. Of more concern to these societies, as with most other low probability/high consequence hazards such as nuclear power and chemical process plants, is the potential for terrorism to cause loss of life. This is what captures the imagination of citizens, contributing to the anxiety and dread they often experience. It follows that life-safety is likely to be the main criterion for assessing cost-effectiveness of United States homeland security expenditure.

The OMB recommends the use of value of a statistical life (VSL) for benefit assessment for all proposed federal regulations.[5] Table 1 shows the expenditure per life estimated to be saved for dozens of specific United States government regulations for risk reduction.[6] Clearly, the VSL in terms of cost per life saved varies considerably with the activity or regulation. The median is $42,000, but the maximum is over $10 billion.[7] Society, as represented by the United States government, is often prepared to spend more money per life saved to prevent death from such "dread" risks as exposure to asbestos and arsenic than it is to expend funds for less costly devices to prevent death from more mundane activities such as driving a motor vehicle.

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[4] Troy Anderson, 'Terror May Be at Bay at Port; Shipping Hubs Too Vulnerable', *The Daily News of Los Angeles*, 18 May 2006.

[5] W. Kip Viscusi, 'The Value of Life in Legal Contexts: Survey and Critique,' *American Law and Economic Review*, Vol. 2, No. 1 (2000), pp. 195-222.

[6] Table 1 is adapted from Viscusi, 'The Value.'

[7] T.O. Tengs, M.E. Adams, J.S. Pliskin, et al., 'Five-Hundred Life-Saving Interventions and Their Cost-Effectiveness,' *Risk Analysis*, Vol. 15, No. 3 (1995), pp. 369-390.

Regulation	Year	Agency	Cost per Life Saved (millions of 1995 dollars)
Unvented space heater ban	1980	CPSC	0.1
Seatbelt/air bag	1984	NHTSA	0.1
Aircraft cabin fire protection standard	1985	FAA	0.1
Steering column protection standards	1967	NHTSA	0.1
Underground construction standards	1989	OSHA	0.1
Aircraft seat cushion flammability	1984	FAA	0.6
Trihalomethane in drink water	1979	EPA	0.5
Alcohol and drug controls	1985	FRA	0.5
Auto fuel system integrity	1975	NHTSA	0.5
Aircraft floor emergency lighting	1984	FAA	0.7
Concrete and masonry construction	1988	OSHA	0.7
Passive restraints for trucks and buses	1989	NHTSA	0.8
Auto side impact standards	1990	NHTSA	1.0
Children's sleepwear flammability ban	1973	CPSC	1.0
Auto side-impact standards	1990	NHTSA	1.0
Metal mine electrical equipment standards	1970	MSHA	1.7
Trenching and evacuation standards	1989	OSHA	1.8
Hazard communication standard	1983	OSHA	1.9
Trucks, buses and MPV side-impact	1989	NHTSA	2.6
Grain dust explosion prevention	1987	OSHA	3.3
Rear lap/shoulder belts for autos	1989	NHTSA	3.8
Stds for radionuclides in uranium mines	1984	EPA	4.1
Ethylene dibromide in drinking water	1991	EPA	6.8
Asbestos occupational exposure limit	1972	OSHA	9.9
Benzene occupational exposure limit	1987	OSHA	10.6
Electrical equipment in coal mines	1970	MSHA	11.1
Arsenic emission standards for glass plants	1986	EPA	16.1
Cover/move uranium mill tailings	1983	EPA	53.6
Acrylonitrate occupational exposure limit	1978	OSHA	61.3
Coke ovens occupational exposure limit	1976	OSHA	75.6
Arsenic occupational exposure limit	1978	OSHA	127.3
Asbestos ban	1989	EPA	131.8
1,2-Dechloropropane in drinking water	1991	EPA	777.4
Hazardous waste land disposal ban	1988	EPA	4,988.7
Municipal solid waste landfills	1988	EPA	22,746.8
Formaldehyde occupational exposure limit	1987	OSHA	102,622.8
Atrazine/alachlor in drinking water	1991	EPA	109,608.5
Hazardous waste listing for wood-preserving chemicals	1990	EPA	6,785,822.0

Note: 2007 dollars are 1.38 times higher than 1995 dollars.

Table 1. Regulatory Expenditure Per Life Saved.

The level of risk averseness is often a function of psychological and political aspects of risk perception. While many individuals may be risk averse, decision-making bodies (such as government) need to act rationally in the distribution of risk reduction funds to achieve the best outcomes (risk reduction) for society as a whole. Clearly, however, electoral and lobbyist pressure may well circumvent such rationality as evidenced by the high number of government regulations that require expenditure of millions of dollars to save one statistical life, something that generates some of the results documented on Table 1. The lack of coordination and consistency in risk management between federal, state and local agencies also contributes. As Tengs and Graham note, this all leads to "social investments in life saving that appear haphazard….To regulate the flammability of children's clothing we spend $1.5 million per year of life saved, while some 30% of those children live in homes without smoke alarms, an investment that costs about $200,000 per year of life saved."[8]

Elisabeth Paté-Cornell suggests that a risk acceptance criterion based on a VSL of $2 million is appropriate for current practice,[9] and the United States Department of Transport adopts a figure of $3 million.[10] For most activities a VSL of $1-$10 million is typical[11] and is consistent with many studies as well as values currently used by most United States federal agencies. In other words, if the annual cost per life saved exceeds that level, such risk reduction expenditure is deemed to have failed a cost-benefit analysis and is not considered to be cost-effective. If an annual cost per life saved exceeds $1-$10 million, then, it is more rational to divert the expenditure to reduce the risks for other hazards where the benefits (lives saved) will be higher. The opportunity cost of doing otherwise can be great - when we spend resources on regulations that save lives at a higher cost, we forgo the opportunity to spend

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[8] T.O. Tengs, and J.D. Graham, 'The Opportunity Costs of Haphazard Social Investments in Life-Saving,' *Risks, Costs, and Lives Saved: Getting Better Results from Regulation*, Robert W. Hahn (ed.), (Washington, DC: American Enterprise Institute, 1996), pp. 167-182.

[9] M. Elisabeth Paté-Cornell, 'Quantitative Safety Goals for Risk Management of Industrial Facilities,' *Structural Safety*, Vol. 13 (1994), pp. 145-157.

[10] Viscusi, 'The Value.'

[11] Viscusi, 'The Value.'

those same resources on regulations and processes that can save more lives at the same, or even at a lower, cost.[12]

A cost-benefit analysis is used here to measure the effectiveness of increased United States federal government homeland security expenditure since 9/11. As recommended by the OMB, the measure of risk for cost-effectiveness evaluation is annual cost per life saved. This requires estimating of the number of lives saved in the United States as a result of increased expenditure on United States homeland security. Such estimates can be inferred from scenario analysis and fatality rates of international and domestic terrorism. A value of a statistical life of $1 million to $10 million provides a reasonably accurate reflection of societal considerations of risk acceptability and willingness to pay to save a life. The concept of applying an annual cost per life saved to assess the cost-effectiveness of security measures, while novel, is not completely new. For example, Robert Hahn has estimated that the cost of heightened airport security measures implemented soon after the mid-air explosion and crash of TWA flight 800 in 1996 (the probable cause later turned out not to be terrorism related) resulted in an annual cost per life saved of $200-$300 million, well in excess of the $1-$10 million regulatory safety goal.[13]

Cost per life saved is a very robust indicator of societal risk acceptability because it considers costs and benefits in a logical and transparent manner. However, a regulatory safety goal such as this should be interpreted with some flexibility as the regulatory safety goal is a "goal" only and other non-quantifiable criteria may be important also in judging the overall acceptability of risks.[14] For example, some risks may be deemed unacceptable under any conditions based on morality[15] or based on their symbolic value to society. Nonetheless, the cost per life saved is

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[12] Tengs and Graham, 'The Opportunity.'

[13] Robert W. Hahn, 'The Cost of Antiterrorist Rhetoric,' *Regulation,* Vol. 19, No. 4 (1996).

[14] For a detailed review and discussion of risk acceptance criteria see Mark G. Stewart and Robert E. Melchers, *Probabilistic Risk Assessment of Engineering Systems* (London: Chapman & Hall, 1997); Stuart R. Reid, 'Acceptable Risk Criteria,' *Progress in Structural Engineering and Materials*, Vol. 2 (2000), pp. 254-262; and Robert E. Melchers, 'On the ALARP Approach to Risk Management,' *Reliability Engineering and System Safety*, Vol. 71 (2001), pp. 201-208.

[15] Bruce Schneier, *Beyond Fear: Thinking Sensibly About Security in an Uncertain World* (New York: Copernicus, 2003).

a useful metric for assessing trade-offs, which can provide a starting point for further discussion and perhaps more detailed and complex analysis of how to manage the often conflicting societal preferences associated with assessments of risk, cost and benefits.

While risks are seldom acceptable, they are often tolerable (or accepted reluctantly) if the benefits are seen to outweigh them. Although the private passenger car is a necessary cause of tens of thousands of deaths each year, Americans apparently are content to pay this enormous cost rather than abandon their vehicles. Nearly all activities bear some risk, and this risk can usually be reduced, though at increasing cost. A cost-benefit analysis provides a means to measure the cost associated with avoiding the risk to help determine whether the cost is excessive and fails to be a productive utilization of society's resources.

3. INCREASED EXPENDITURE ON HOMELAND SECURITY

There is no doubt that some expenditure on homeland security is warranted, and we do not question the $20.1 billion spent in fiscal year 2001.[16] That is, we assume the homeland security measures in place before 9/11 continued on without enhancement.[17] We are concerned only about the cost-effectiveness of *increased* expenditure on American homeland security *after* the 9/11 attacks in 2001.

The OMB defines homeland security expenditure as encompassing six main objectives:

1. intelligence and warning
2. border and transportation security
3. domestic counter terrorism

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[16] A fiscal year (FY) runs from October 1 through September 30. So fiscal year 2001 ran from October 1, 2000, through to September 30, 2001.

[17] In addition, we are assuming that the wars in Afghanistan and Iraq took place. Therefore, if it is true the Afghan war severely disrupted al-Qaeda, that would happen as well under our scenario. To the extent there is anything to the "we are fighting them there so we don't have to fight them here" argument on Iraq, that would still hold as well—as would, however, the argument that Iraq has been a boon for al-Qaeda.

4. protection of critical infrastructure and key assets

5. defence against catastrophic threats

6. emergency preparedness and response.

OMB data assessed by Bart Hobijn and Erick Sager show that United States federal government spending on the six homeland security measures increased from $20.1 billion in 2001 to $54.3 billion in 2005, and this expenditure is budgeted to increase to $58.3 billion for fiscal year 2007.[18] The FY2007 federal government spending on homeland security is thus $38.2 billion per year higher than in 2001. The majority of homeland security expenditure is on border and transportation security and on critical infrastructure protection. The OMB data also includes the Department of Homeland Security's Homeland Security Grant Program (HSGP) to state and local government. Most intelligence expenditures, however, do not fall directly under the classification and jurisdiction of homeland security and are not included in the OMB data.

There is little doubt, as Veronique de Rugy notes, that "homeland security spending continues to be an elusive figure to quantify."[19] However, her analysis of the Budget of the United States Government for FY2007 reveals that $27.8 billion of the Department of Homeland Security 2007 budget will be spent on activities that meet the executive branch's definition of "homeland security."[20] An additional $30.4 billion is budgeted to be spent by homeland security activities by other United States agencies such as the Department of Defense, the Department of Transportation, NASA, the Department of Agriculture as indicated in Table 2.[21] De Rugy estimates that planned federal expenditure on homeland security will be $58.2 billion for FY2007, very much in agreement with the Hobijn and Sager estimate of $58.3 billion.

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[18] Bart Hobijn and Erick Sager, 'What Has Homeland Security Cost? An Assessment: 2001-2005,' *Current Issues in Economics and Finance*, Federal Reserve Bank of New York, Vol.13, No. 2 (2007), pp. 1-7.

[19] Veronique de Rugy, *What Does Homeland Security Spending Buy?*, AEI Working Paper #107, American Enterprise Institute for Public Policy Research, 1 April 2005, p. 8.

[20] de Rugy, *Facts*.

[21] Adapted from de Rugy, *Facts*, Table 1.

Inflation as measured by the Consumer Price Index for the period 2001 to 2007 is 19%.[22] Thus, a gross increase in homeland security expenditure of $38.2 billion per year in 2007 is equivalent to $32.1 billion per year in inflation adjusted terms. We will apply this figure.

Department	FY2007 request (billions of $)
Homeland Security	27.8
Defense	16.7
Health and Human Services	4.6
Justice	3.3
Other Departments and Agencies	5.8
Total	58.2

Table 2. Homeland Security Funding by Department: Budget Authority.

We do not include state and local government outlays as these expenditures are not systematically reported. Increased outlays by these governments after 9/11 are likely to be large, although this would be partly offset by HSGP grants. Between 2001 and 2005, the private sector expenditures on security related measures rose from approximately $36 billion to $45 billion[23], but these increases are most likely unrelated to anti-terrorism measures and will be excluded. Nor do we include the terror-related wars in Iraq and Afghanistan that cost approximately $170 billion per year in FY2007.[24] Also excluded are government imposed fees, such as the Transportation Security Administration's $2.50 per enplanement fee and the Aviation Security Infrastructure Fee which in 2005 totalled $1.9 billion.[25] And we also ignore hidden and indirect costs associated with implementing government homeland security regulations. For example, lost output or "dead weight losses" associated with some security-related regulations amounted to at least $5 billion in 2006.[26]

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[22] CPI figures obtained from U.S. Department of Labour - www.bls.gov/cpi/

[23] Hobijn and Sager, 'What.'

[24] Amy Belasco, *The Cost of Iraq, Afghanistan, and Other Global War on Terror Operations Since 9/11*, CRS Report for Congress, Congressional Research Service, 9 November 2007, Table 1.

[25] Jerry Ellig, Amos Guiora and Kyle McKenzie, *A Framework for Evaluating Counterterrorism Regulations*, Policy Resource No. 3, Mercatus Center, George Mason University, September 2006, p. 31.

[26] Ellig, *Framework*, p. 31.

Hence, the increase in annual federal government outlays of $32.1 billion in 2007 to be used in this cost-benefit analysis will underestimate increased total public and private sector expenditures on homeland security by tens of billions of dollars. Accordingly, it is a very conservative measure of the increase in homeland security expenditure since 9/11.

4.   HOW MANY LIVES HAVE BEEN SAVED?

After estimating how much additional money is being spent in an attempt to save lives from a terrorist attack in the United States, the next step would be to tackle the knotty problem of estimating how many lives have been saved in the United States by those efforts. A cost-benefit analysis requires, of course, not only an estimate of costs, but also of benefits, although, as Hobijn and Sager appropriately warn, in this case "estimating the benefits is very difficult - involving, as it does, speculations about counterfactuals, or what *would* have happened if the spending had not taken place."[27]

One possible estimate of lives saved might be zero, or, at any rate, near-zero. No one has been killed by international terrorists within the United States in the several years since 2001 when the extraordinary expenditures have taken place, but also no one was killed by them in the country in the several years before 2001 and therefore before the escalation of expenditures. That is to say, history strongly suggests one should not normally expect there to be very many deaths from terrorism within the United States.

This, however, leaves out 9/11 itself. That terrorist event was massively off the charts both in direct financial costs and in the loss of life when it took place, and that continues to be true today: there has never been a terrorist attack of remotely that magnitude. The University of Maryland's Global Terrorism Database defines terrorism as "the threatened or actual use of illegal force and violence by a nonstate actor to attain a political, economic, religious, or social

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[27] Hobin and Sager, 'What.'

goal through fear, coercion, or intimidation." Applying this definition, it estimates that there were 3,338 fatalities from domestic and international terrorist incidents within the United States 1970 through 2001.[28] However, the 9/11 attacks in 2001 represented almost all of these and the attack on the Murrah Federal Building in Oklahoma City in 1995 most of the rest: 3,194 in total. Obviously, the fatalities from other terrorist attacks within the United States have been few. As Todd Sandler and Walter Enders note, using State Department data, "the casualties on 9/11 represent a clear outlier with deaths on this single day approximately equal to all transnational terrorist-related deaths recorded during the entire 1988-2000 period."[29]

One could potentially remove the 9/11 outlier from consideration on the grounds that it may well remain a (horrific) aberration with little relevance to the future. As Russell Seitz puts it, "9/11 could join the Trojan Horse and Pearl Harbor among stratagems so uniquely surprising that their very success precludes their repetition," and accordingly "al-Qaeda's best shot may have been exactly that."[30] In this regard, one might look to the very large number of terrorist (or insurgent) attacks since 2001 in war zones like Iraq, Afghanistan, and Israel, many of which have which have taken place in a permissive terrorist-favouring condition of essential anarchy. Nonetheless, *none* of these has managed to kill remotely as many people as the 9/11 attacks.

However, it could plausibly be argued that, although 9/11s are very difficult to pull off and are likely to be rare, they remain entirely possible, and therefore that removing a repeat from consideration would bias the analysis substantially. Muslim plotters exposed in Britain in 2006 planned, it appears, to try to down as many as 10 transatlantic airliners with liquid explosives. Doubts have been expressed about the magnitude and the feasibility of the plot, and certainly about its imminence (several of the plotters did not yet have passports). However, few would maintain that a terrorist attack like that - one which could result in as

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[28] *Global Terrorism Database*, National Consortium for the Study of Terrorism and Responses to Terrorism, The University of Maryland.

[29] Todd Sandler and Walter Enders, 'Transnational Terrorism: An Economic Analysis,' *The Economic Impact of Terrorist Attacks*, H.W. Richardson, P. Gordon, and J.E. Moore II (eds.), Elgar, 2005, pp. 11-34.

many deaths as on 9/11 - while very difficult to pull off, would be impossible within the United States. Similarly, the alleged 2007 plot to ignite a series of gas fires in and around JFK airport could have resulted in a considerable number of deaths, although the feasibility of that specific plot has also been called into question. It appears reasonable, then, at least for the purposes of this argument, to assume there could be another major terrorist event like 9/11 every several years and that, absent enhanced American security measures, some of these might take place in the United States.

As noted earlier, the Global Terrorism Database estimates total fatalities suffered for the 1970-2001 period (which would include both 9/11 and Oklahoma City) to be 3,338, and this comes out to be 104 per year. For the entire world, estimate Sandler and Enders, the fatality rate for international terrorist attacks from 1968 through 2003 was 411 per year.

American authorities claim to have foiled a number of terrorist attacks since 9/11.[31] Table 3 lists these foiled attempts, and for each we have provided an estimate of the number of lives saved for each foiled plot. The August 2006 transatlantic plot to detonate liquid explosives on up to 10 commercial aircraft is not included as this plot was disrupted by British police and security services and was not a direct threat to the American homeland. While it can be argued that some estimates of lives saved could be higher, not all of these threats would have caused maximum (worst case) fatalities, and therefore a best estimate is reasonable. Further, not all threats and their intended targets were proven as some suspects are still awaiting trial. Nonetheless, Table 3 shows that the total estimated lives saved as a result of thwarting these planned terrorist attacks over the years (assuming each had been successful) is 1500, approximately half of the casualties inflicted by the 9/11 attacks and some 250 per year.

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[30] Russell Seitz, 'Weaker Than We Think: Al-Qaeda May Have Already Fired Its Best Shot,' *The American Conservative*, 6 December 2004. See also John Mueller, 'Harbinger or Aberration? A 9/11 Provocation,' *National Interest*, Fall 2002, pp. 45-50.

[31] 'Plots Since 9/11,' wcbstv.com, 3 June 2007.

Date	Description	Estimate of lives saved	Comments
Dec 2001	"Shoe bomber" Richard Reid foiled as a suicide bomber on an American Airlines flight from Paris to Miami.	200	prompt action by flight attendants and passengers averted the plot, not the security services.
May 2003	Iyman Faris convicted of planning to destroy the Brooklyn Bridge.	100	average death toll for bridge collapse is not high as evidenced by the Minneapolis I35W bridge collapse in 2007 with 13 fatalities.
Aug 2004	Two men convicted of plotting to attack the New York Stock Exchange and other financial institutions in New York.	200	cf. VBIED attacks on Murrah Federal Building in Oklahoma City in 1995 killed 187 people, 1993 bombing of WTC killed 6.
Aug 2004	Two men convicted of plotting to blow up a subway station in New York.	100	cf. 2005 London underground bombings killed 39 subway commuters.
Aug 2005	Four men indicted for allegedly conspiring to attack Los Angeles-area military targets.	100	high level of armed security at U.S. military bases.
June 2006	Seven men indicted for allegedly plotting to blow up the Sears tower.	200	cf. VBIED attacks on Murrah Federal Building in Oklahoma City in 1995 killed 187 people, 1993 bombing of WTC killed 6.
July 2006	One man arrested for allegedly plotting to bomb New York City train tunnels and flood the financial district.	100	cf. 2005 London underground bombings killed 39 commuters. Flooding unlikely to cause mass casualties.
May 2007	Six men were charged with plotting the shooting of U.S. soldiers in an armed assault on Fort Dix.	100	high level of armed security at U.S. military bases.
June 2007	Four men planned to destroy JFK international airport by blowing up jet fuel lines.	500	mass casualties very unlikely as jet fuel is flammable, not explosive in nature
TOTAL		1500	

Table 3. Terrorist Plots that United States Authorities Claim They Have Foiled and Expected Lives Saved.

We do not include weapons of mass destruction issues in these considerations because we are concerned here only with enhanced expenditures for domestic homeland security. Protecting the population against such an attack, particularly a nuclear one, is a rather hopeless enterprise of course, though some homeland spending devoted to mitigation and port inspections may be relevant. The vast bulk of expenditures designed to deal with such attacks, however, is focused on the need to prevent them in the first place, and it accordingly stresses policing efforts (mostly international) and the control of fissile and other potentially dangerous materials, particularly abroad. Such spending is not included in our analysis; effectively, we assume that these efforts would have been carried out for better or worse in exactly the manner they have been, both before and after 9/11.

Another approach might be to look at the number of fatalities caused by terrorism in places that do not appear to have the enhanced (and expensive) security provisions established in the United States since 2001. The kind of terrorism that really concerns people in the developed world is that committed by Muslim extremists outside of such war zones as Iraq, Israel, Chechnya, Sudan, Kashmir, and Afghanistan, whether that violence be perpetrated by domestic terrorists or by ones with substantial international connections. Included in the count would be terrorism of the much-publicized sort that occurred in Bali in 2002 and 2005, in Saudi Arabia, Morocco, and Turkey in 2003, in the Philippines, Madrid, and Egypt in 2004, and in London and Jordan in 2005. Two publications from Washington think tanks have independently provided lists of such incidents - one authored by Anthony Cordesman of CSIS, the other by Brian Jenkins of RAND.[32] Although these tallies make for grim reading, the total number of people killed in the four or five years after 9/11 in such incidents comes to about 1000 - that is, some 200-300 per year.

One might also focus on Israel which underwent a set of attacks in the intifada that began in 2000 (despite considerable security defences). These attacks became so frequent that they might more appropriately be labelled insurgency rather than terrorism. And, of course, that

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[32] Anthony H. Cordesman, *The Challenge of Biological Weapons* (Washington, DC: Center for Strategic and International Studies, 2005), pp. 29-31. Brian Michael Jenkins, *Unconquerable Nation: Knowing Our Enemy and Strengthening Ourselves* (Santa Monica, CA: RAND Corporation, 2006), pp. 179-84

kind of sustained conflict is not of primary concern for the United States. Nonetheless, it is instructive to note that the total number of Israeli civilians who died in these attacks was 705, with the highest yearly fatality rate being 269 in 2002.[33]

Among terrorist groups, al-Qaeda is pretty much the only one that actually advocates attacking the United States itself.[34] Accordingly, it understandably gets considerable attention in America. Even if one assumes homeland security measures have been able to keep the group from operating within the United States, they have had plenty of space in the rest of the world in which to operate. The group (or its allies) have invested in the anti-US and anti-government insurgency in Iraq and, to a lesser extent, in Afghanistan, and sorting out their efforts from other insurgents in these wars would be exceedingly difficult. But they are free to operate in the entire rest of the world as well, and a RAND study points out that the number of terrorist attacks outside of war zones that are "known to have been perpetrated or directed by al-Qaeda" has been "relatively small." Indeed, according to this study's tally, from 2002 through 2004 there were nine such attacks, resulting in some 542 deaths, or well under 200 per year.[35] Even if all such effort, in the absence of enhanced homeland security measures, had been focused on the United States, the death tally would hardly be likely to be of a greater order of magnitude.

However sorted through, estimates of fatalities inflicted by terrorists, particularly international terrorists, resonate at around the same magnitude - roughly in the low, or possibly middle, hundreds per year. Assuming there were no enhanced homeland security measures in place in the United States and assuming, further, that al-Qaeda and its allies would have both the desire and the ability to strike the United States under that comparatively permissive condition, one might expect a few hundred Americans to die at their hands each year. Additionally, if it is assumed that one attack every several years achieves the destructive

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[33] Statistics obtained from B'Tselem, The Israeli Information Center for Human Rights in the Occupied Territories, Jerusalem.

[34] Fawaz A. Gerges, *The Far Enemy: Why Jihad Went Global* (New York: Cambridge University Press, 2005).

[35] Martin C. Libicki, Peter Chalk, Melanie Sisson, *Exploring Terrorist Targeting Preferences*, RAND Homeland Security Report, RAND Corporation, Santa Monica, 2007.

magnitude at 9/11, the expected number of terrorism deaths might reach 400 or 500 per year. Conceivably, one might be able to justify a somewhat higher number although that really begins to strain credulity, and it should not be forgotten that a number at, or very close to, zero is also a distinct possibility - indeed, given the terrorist track record that could quite possibly be the most reasonable estimate of all.

As discussed above, it is credible to rely on scenario based approaches that incorporate and compare existing fatality statistics in order to help quantify how many lives may have been saved by the implementation of increased expenditure on homeland security. As this process is no doubt speculative and subject to some uncertainty, we propose three estimates of the number of lives saved:

1. Best estimate

As noted, the underlying United States fatality rate due to terrorism within the United States during the period 1970-2001 (including 9/11 attacks as well as the attack in Oklahoma City) is 3,338, or 104 fatalities per year. While United States authorities claim to have foiled a number of terrorist plots as arrayed in Table 3, not all could be solely attributed to protection provided by increased federal outlays on homeland security. For example, the "shoe bomber" on a flight from Paris to Miami was foiled and apprehended by the prompt action on concerned citizens, not by any United States security agency. Others have relied on state and local law enforcement assistance and on the FBI and other federal agencies not included in our expenditure increase estimate. The amount of risk reduction and lives saved by *increased* federal government expenditure on homeland security is thus likely to be modest. A best estimate might be that long-term terrorism risks have been halved by enhanced efforts and expenditures, and therefore that the expected lives saved per year is half of 104, that is, 52 per year. As noted above, a case could be made that this number actually could be quite close to zero.

2. Conservative estimate

To be conservative, it may be assumed that additional homeland security measures have completely eliminated the threat of terrorism, reducing the post-2001 fatality rate for terrorism activities in the United States from 104 fatalities per year to zero. Hence, the expected number of lives saved per year is 104.

3. Upper bound estimate

There have been no terrorist attacks in the United States since 2001, and this may be construed as evidence of the effectiveness of increased homeland security expenditure and vigilance. However, there is little evidence to suggest that any of the foiled terrorist attacks in the United States planned since 2001 would have reaped anywhere near the devastation and loss of life of the 9/11 attacks. Indeed, a very generous estimate of lives saved in the period 2002 to 2007 from such plots would be 1500, as suggested in Table 3. Assuming that in the six years since 9/11 it was additional (as opposed to pre-existing) federal outlays on homeland security that prevented these fatalities, 250 lives were saved annually by the enhanced expenditures. However, if instead of attacks like those, one of the magnitude of 9/11 (3,000 fatalities) was deterred or foiled during this time period, the number of lives saved would be 500 per year—though there is, of course, little (if any) evidence to suggest that such high consequence attacks were averted during the period. This would also be equivalent to the destruction of two commercial aircraft per year assuming each flight carries 250 passengers and crew. In all cases, an upper bound estimate is 500 lives saved annually.

5.   RESULTS AND DISCUSSION

Increased expenditure on homeland security is expected to reduce fatality risks. It follows that the annual cost per life saved is the increase in annual United States homeland security federal government expenditure (in 2007) divided by the expected annual lives saved as a consequence of this increased expenditure.

If we accept increased expenditure on United States homeland security in 2007 to have totalled $32.1 billion per year, a number likely to be a *considerable* underestimate, annual costs per life saved come out to be:

1. Best estimate: $617.3 million per life saved

2. Conservative estimate: $308.7 million per life saved

3. Upper bound estimate: $64.2 million per life saved

In all estimates, the annual cost per life saved is greatly in excess of the regulatory safety goal of $1-$10 million per life saved. Hence, the increase in homeland security expenditure since 2001 rather dramatically fails a cost-benefit analysis: even accepting an underestimate of that enhanced spending, the cost is 6 to 60 times higher than that generally accepted by society as appropriate for risk reduction. To be sure, the annual costs per life saved are estimates only, but the magnitude of the costs are so large that, even a 100% error will not change the central conclusion that a $32.1 billion per year increase in homeland security expenditure since 2001 is not cost-effective.

It might be useful to put this discussion in somewhat wider context. An annual fatality rate of 104 per year is equivalent to an annual fatality risk of 3.5×10^{-7} which is considerably less than one in a million.[36] If a risk assessment for a new chemical process plant, nuclear power plant, or other potentially hazardous facility or activity concluded the annual fatality risk to be less than one in a million, most regulatory agencies in Australia, the United States, and elsewhere would deem the risk to be negligible and would judge further regulation (and risk mitigation expenditure!) to be unwarranted.[37] Or there are other comparisons: each year some 300-400

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[36] Calculated as 104 fatalities divided by the U.S. population of 300 million.

[37] This is based on the 'de-minimis' concept from common law where the court does not concern itself with trivia. See Stewart and Melchers, *Probabilistic*.

people drown in bathtubs in the United States, and around 100 are killed by accident-causing deer, by lightning, and by severe allergic reaction to peanuts.[38]

Risk reduction measures that cost tens or hundreds of millions of dollars per life saved cannot be justified on rational life-safety grounds. Moreover, even if these expenditures have saved 50 to 500 lives per year from terrorism, there are considerable opportunity costs. If the additional federal government spending on homeland security had been invested instead in other hazard or risk reduction programs, many more lives would have been saved. For example, Marty Ahrens estimates that 890 lives could be saved annually if all homes had a working smoke alarm.[39] Moreover, estimate Tengs and Graham, an investment of $200,000 per year in smoke alarms will save one life: that is, that it would take an expenditure of $178 million per year to save those 890 lives. Similar examples can be found in other risk reduction measures or regulations.

While these numbers are approximate, they do illustrate that the opportunity costs of additional federal government spending on homeland security could be immense. In a multi-hazard environment, homeland security expenditure invested in a wide range of more cost-effective risk reduction programs - such as flood protection; vaccination, screening and other health programs; vehicle and road safety; occupational health and safety - would result in far more lives being saved.

And there is more. Some of the enhanced homeland security measures may actually *cost* lives. Thus, increased delays and added costs at airports due to new security procedures provide incentive for some short-haul passengers to drive to their destination rather than flying. Since driving is far riskier than air travel, the extra automobile traffic generated by increased airport

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[38] John Mueller, *Overblown: How Politicians and the Terrorism Industry Inflate National Security Threats, and Why We Believe Them* (New York: Free Press, 2006), p. 13.

[39] Marty Ahrens, *U.S. Experience with Smoke Alarms and Other Fire Detection/Alarm Equipment*, National Fire Protection Association, April 2007.

security screening measures has been estimated to result in up to 516 extra road fatalities per year.[40]

In addition to life-safety considerations, economic criteria such as reduced property damage and reduced GDP are other benefits of security measures. It has been estimated in a RAND report by Benjamin Zycher that these types of economic benefits are approximately equal to the value of lives saved[41]. Zycher also recommends that the total economic cost of security measures is at least twice the direct public expenditure due to the fact that "government must obtain such resources, whether now or in the future, through the tax system (or through such explicit taxation as inflation), which imposes indirect costs upon the economy in the form of resource misallocation".[42] Hence, in this case allowing for the marginal cost of government spending and the doubling of benefits due to inclusion of economic criteria results tend to cancel each other out, resulting in little change in annual costs per life saved calculated in the present analysis. Hence, it is expected that more comprehensive cost-benefit analyses that consider economic and financial matters will not change the conclusions of this paper.

It might be argued that some expenditure on homeland security may increase the efficiency of live-saving activities in non-terror roles such as natural disaster relief. If this is the case, then any enhancement of live-saving ability by emergency services as a direct result of increased homeland security expenditure is likely to be minimal at best. Considering that the homeland security costs we have used in the analysis conservatively underestimates increased total public and private sector expenditures on homeland security by tens of billions of dollars, then including the potential for some additional lives to be saved will not change the findings of the paper.

The findings of this cost-benefit analysis focus on the total homeland security budget. This is not to say, however, that all specific security measures fail to be cost-effective. For example,

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[40] For review of these studies see Ellig, *Framework*, pp. 35-36.

[41] Benjamin Zycher, *A Preliminary Benefit/Cost Framework for Counterterrorism Public Expenditures*, RAND, Santa Monica, 2003, p.17.

[42] Zycher, *A Preliminary*, p. 19.

strengthening cockpit doors may have done more to improve airline security than the raft of costly airport passenger and baggage screening measures, and at a comparatively modest cost.[43]

Some risk-based approaches to cost-benefit analysis that consider economic and life-safety criteria for the protection of buildings, bridges and other built infrastructure have been developed, with cost-effectiveness contingent on the likelihood, cost, and effectiveness of security/protective measures and consequence of terrorist attacks on such infrastructure.[44] There may be other security measures that are cost-effective, but these are not at all obvious and so have yet to be identified. In all cases, a detailed analysis of each security measure that considers their cost and effectiveness with respect to expected lives saved is appropriate and potentially instructive, enabling as it does a meaningful assessment of the merits of each security measure in a rational, consistent, and transparent manner. There is an urgent need for such detailed analyses.

ACKNOWLEDGEMENTS

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[43] Bruce Schneier, 'Airplane Security and Metal Knives,' *Sydney Morning Herald*, 30 November 2005.

[44] Mark G. Stewart, 'Life Safety Risks and Optimisation of Protective Measures for Terrorist Threats to Built Infrastructure,' *International Forum on Engineering Decision Making: Optimal Strategies for Disaster and Hazard Mitigation* (Sydney University Press, 2007), pp. 19-30. Mark G. Stewart, 'Cost-Effectiveness of Risk Mitigation Strategies For Protection of Buildings Against Terrorist Attack,' *Journal of Performance of Constructed Facilities*, American Society of Civil Engineers, Vol. 22, No. 2, pp. 115-120. (2008).