Using Probabilistic Terrorism Risk Modeling For Regulatory Benefit-Cost Analysis

Application to the Western Hemisphere Travel Initiative Implemented in the Land Environment

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SUMMARY

This report presents a framework for using probabilistic terrorism risk modeling in regulatory analysis. We describe an approach for conducting a break-even benefit-cost analysis in which the benefit of a proposed terrorism security regulation is the reduction in overall terrorism risk, where risk is expressed in terms of the annualized loss from damage caused by terrorist attacks. We demonstrate the framework with an example application involving a regulation under consideration (the Western Hemisphere Travel Initiative for the Land Environment, (WHTI-L)), and discuss how this type of analysis can be further integrated into the regulatory review process.

Our approach uses probabilistic terrorism risk modeling to estimate the overall risk from terrorist attacks in the U.S. The overall risk comprises the risk from numerous individual attack scenarios reflecting a wide variety of different attack types and individual targets. Risk is conveyed in terms of annualized loss by combining estimates of the consequences (casualties and property damage) for each scenario with estimates of the annual probability that that scenario will occur.

In our example application we estimate annualized loss from terrorist attacks with the Risk Management Solutions (RMS) Probabilistic Terrorism Model, a model developed for use by the insurance industry to estimate terrorism risk. Because the model focuses on the commercial property and casualty insurance market, its scope is limited to loss categories, such as commercial property, business interruption, and casualties to workers, that are normally covered under these insurance lines. The modeled losses exclude indirect economic losses, government property and workers, non-commercial property, non-employee casualties, psychological injuries, and liability losses. Despite these assumptions, the RMS model constitutes a new tool for incorporating probabilistic terrorism risk modeling into regulatory analysis.

We use our analysis to determine the critical risk reduction, which is the risk-reducing effectiveness of WHTI-L needed for its benefit, in terms of reduced terrorism loss in the U.S., to exceed its cost.
analysis indicates that the critical risk reduction depends strongly on uncertainties in the terrorism risk level, but also on uncertainty in the cost of regulation and how casualties are monetized.

For a terrorism risk level based on the RMS standard risk estimate, a regulatory cost based on the WHTI-L option preferred by CBP, and a range of casualty cost estimates based on the willingness to pay approach, our estimate for the expected annualized loss from terrorism ranges from $2.7 billion to $5.2 billion. For this range in annualized loss, the critical risk reduction for WHTI-L ranges from 7% to 13%. Using casualty costs based on the cost of injury approach leads to a lower annualized loss and a greater required risk reduction. However, cost of injury estimates are generally considered to greatly underestimate the value of casualties because they do not account for the associated private welfare losses (e.g., Tolley et al., 1994).

The terrorism risk level reflects perceptions about the probability of attack, stemming from terrorist intentions and capabilities, and the anticipated consequences of attacks. Basing results on a lower risk level that results in halving the annualized terrorism loss would double the critical risk reduction (14% to 26%), and a higher risk level that results in a doubling of the annualized terrorism loss would cut the critical risk reduction in half (3.5% to 6.6%).

Our break-even analysis is based on a benefit achieved through reducing the overall terrorism risk, where the overall risk is the combined risk across thousands of potential scenarios involving different attack types and targets. An alternative approach of expressing benefit in terms of the number of times per year that a particular scenario is avoided does not include an assessment of the probabilities of different scenarios happening. Such an approach is generally less informative for measures like WHTI-L that are not directed toward preventing a specific mode of attack.

Ultimately, a break-even analysis tells us only what a regulation needs to achieve, not what it actually will achieve. Ideally, decisions about terrorism security regulations and policies would be informed by true benefit-cost analyses in which the estimated benefits are compared to costs. Such analyses for terrorism security efforts face substantial
impediments stemming from the great uncertainty in the terrorist threat and the very low recurrence interval for large attacks.

Several approaches can be used to estimate how a terrorism security program or regulation reduces the distribution of risks it is intended to manage. But, continued research to develop additional tools and data is necessary to support application of these approaches. These include refinement of models and simulations, engagement of subject matter experts, implementation of program evaluation, and estimating the costs of casualties from terrorism events.