

## Economic Consequence Estimation Using a Reduced Form Tool (RFT)

### Software tool allows for the rapid estimation of property damage and business interruption loss associated with earthquakes

The CREATE Reduced Form Economic Consequence Estimating Tool (RFT) allows for the rapid calculation of property damage and business interruption associated with earthquake events. The tool is intended for use by federal, state, and local emergency management officials to help quickly gauge their need for mobilization of their own resources and requests for potential transfer of resources between jurisdictions. CREATE has been the leader in developing state of the art models to estimate the economic consequences of terrorism and natural hazards. However, these models are complex and take weeks to construct and implement. RFT is a tool that can produce rapid approximate estimates of economic consequences.

### How it works

The Reduced Form Tool is based on a regression analysis of an extensive data base on characteristics of natural disasters in the U.S. This is supplemented by the translation of property damage estimates to direct and indirect business interruption impacts utilizing standard principles of regional economic analysis. The RFT is intended to maximize the effectiveness of resource allocation in the aftermath of disasters, as well as to provide insight into benefit-cost analysis decisions regarding mitigation.

The RFT is a self-contained program that requires only two user-input data entries. These entries are then linked to county-related variables inside the program that are used in the internal regression equation for property damage estimation. Property damages are then converted through internal algorithms to direct and indirect business interruption losses.

### User Inputs

The two user inputs are:

1. Earthquake magnitude (Richter scale)
2. County affected

These inputs are linked to internal algorithms that stipulate the associated population and per capita income of the affected county. The model then calculates the distance between the epicenter and county population center and inserts all of the data into the regression equation to determine property damage. The property damage estimate is then linked to business interruption calculations. Capital-output ratios translate property damage to loss of gross domestic product (GDP) as the measure of direct business interruption losses. County-specific multipliers are then applied to determine the indirect effects.

### Outputs

The outputs of the software are:

1. Property damage (millions of dollars)
2. Direct, indirect, and total business interruption (millions of dollars)

To show the user the impact of the earthquake magnitude on the damage estimates, results are presented not only for the earthquake magnitude specified, but also for magnitudes 0.5 above and 0.5 below this value.

### Benefits of using RFT

- Rapid loss estimation estimates for resource mobilization and mitigation analysis
- Minimal input requirements on the part of the user
- Straightforward outputs with uncertainty bands

### Future enhancements

At the moment, the RFT is formulated only for earthquake risks, and for impacts in a single county. CREATE is in process of enhancing the earthquake module to include multiple-county events. More importantly, CREATE is exploring the extension of the RFT to other natural hazards and to terrorism events.

### CREATE achievements in consequence analysis

CREATE has been the leader in developing state of the art tools for economic consequence analysis and for developing an overall framework for application to this area. The framework advances previous ones by including aspects of resilience (activities that mute business interruption impacts and speed recovery) and by including behavioral responses (changes in perception stemming from the social amplification of risk and from stigma effects). These advances have been applied successfully to establishing a definitive estimate of the economic consequences of 9/11, attacks on the City of Los Angeles water and power systems, an H1N1 epidemic, closing the U.S. borders to a terrorist or public health threat, tradeoffs between urban security and commerce, impacts of a dirty bomb attack on the Los Angeles financial district, a major earthquake, a severe winter storm, and a tsunami event in California. CREATE researchers have also utilized the new economic consequence analysis framework in a report to Congress on the benefits of FEMA hazard mitigation grants. The CREATE economic research team has advised the DHS Policy Office, FEMA, TSA, CBP, Cal EMA, California Energy Commission, Los Angeles Department of Water and Power, Metropolitan Water District, U.S. Geological Survey, and the U.S. Departments of Agriculture, Commerce, Energy, and Treasury.

