

**Expansion of the National Interstate Economic Model (NIEMO)**  
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**1. Executive Summary**

We have continued our current program of research, which involves applying spatially disaggregate economic models to estimate the losses following various hypothetical terrorist attacks. Towards this end, we have developed and tested the National Interstate Economic Model (NIEMO), the only operational multi-regional input-output model of the 50 states and the District of Columbia (DC).

We are elaborating NIEMO to assigns trade flows to the infrastructure that supports them. This extended model is called “TransNIEMO.” The application of TransNIEMO involves two steps:

- Estimation of increased costs due to a terrorist event impacting key links (notably bridges and tunnels) the constructed highway network system, and
- State-by-state economic impact analysis of resulting reductions in household expenditures via applications and extensions of NIEMO.

The group has invested considerable attention in identifying meaningful, computationally tractable means of representing the details of the national economy in a way that articulates with the national highway network.

Our group has also been enlisted by DHS to assist in estimating the economic impacts in the New York area of the 9/11 attacks. We have implemented a variety of incrementally more sophisticated econometric approaches to study the available historic economic record.

**2. Research Accomplishments and Their Relevance**

We have maintained and extended our initial program of research, which has involved quantifying the economic impacts associated with various plausible terrorist attacks. This is the first step when assessing the costs and benefits of various programs of mitigation. These impacts should be identified at a spatially disaggregated level. There are three reasons for this. First, spatial aggregation obscures important details. Second, much political decision-making in a federal system is decentralized, and outcomes affecting local populations must be compared. And third, effective decision support for resource will eventually require computationally efficient means of modeling alternative system states so that the policy space can be searched and choices made.

**2.1. TransNIEMO**

We have developed and tested the National Interstate Economic Model (NIEMO), the only operational multi-regional input-output model of the 50 states and the District of Columbia (DC). NIEMO develops results for 47 economic sectors (the “USC Sectors,” easily translated to other U.S. industrial and commodity codes), and is developed with data from the Minnesota Implan Group’s IMPLAN software

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(the best known and most widely used commercial input-output data source) and the U.S. Commodity Flow Survey.

Having successfully modeled interstate commodity trade, the next logical step is to assign trade flows to the infrastructure that supports them. The elaboration of NIEMO that accomplishes this step is called “TransNIEMO.” The first major step in developing this model is to allocate commodity trade flows to the highway network, which accommodates approximately 73 percent of total trade flows. The National Highway Planning Network (NHPN) has about 452,000 miles of roads, of which the Freight Analysis Framework (FAF) contains 245,500 miles. This includes 46,380 miles of Interstate Highways, 162,000 miles of National Highway System (NHS) roads, 35,000 miles of other national roads, and 2,125 miles of urban streets and rural minor arterials. The network also includes thousands of bridges and tunnels. Major facilities are potential bottlenecks that may be targets of attack. The value of each of these facilities cannot be determined without the application of a model that has TransNIEMO’s capabilities. However, rail, air, and water networks cannot be ignored, and we plan to address integrating the other modes in future research.

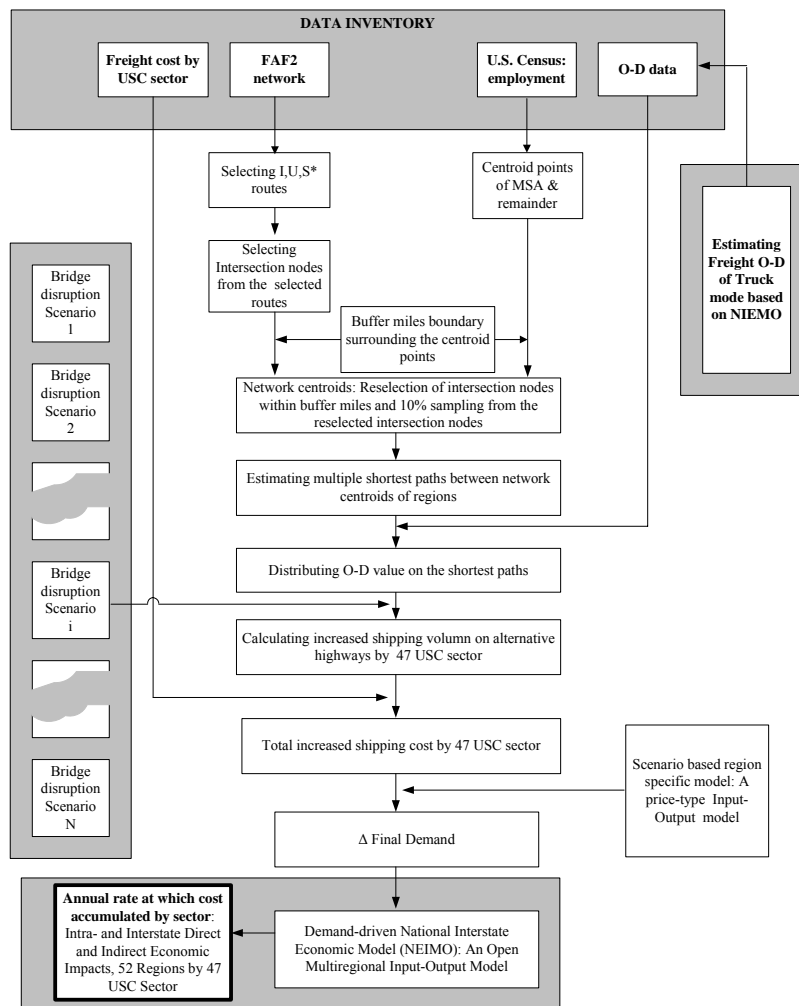
This application of TransNIEMO involves two steps:

- Estimation of increased transportation costs due to a terrorist event impacting key links (notably bridges and tunnels) the constructed highway network system, and
- State-by-state economic impact analysis of resulting reductions in household expenditures via applications and extensions of NIEMO.

The application of TransNIEMO begins with the estimation of increased transportation costs on the highway network system for a plausible scenario. Figure 1 shows the framework for our research model.

Not surprisingly, combining the FHWA FAF network with NIEMO to create TransNIEMO involved many data manipulation and management challenges, because the FAF network seems to have been compiled from multiple sources. In addition, modeling transportation flows on a national network connecting urban centers includes requirements not associated with metropolitan level models. In particular, the national network is very complex. Economic space must be represented in a more aggregate way, making procedures for allocating freight demand to physical facilities much less obvious than in the metropolitan case. The group has invested considerable attention in identifying meaningful, computationally tractable means of representing the details of the national economy in a way that articulates with the national highway network.

Policy makers intending to identify the economic value of a highway must go through these steps to develop a meaningful estimate. The value of highway services can only be measured once they are understood in the context of the network to which they belong.

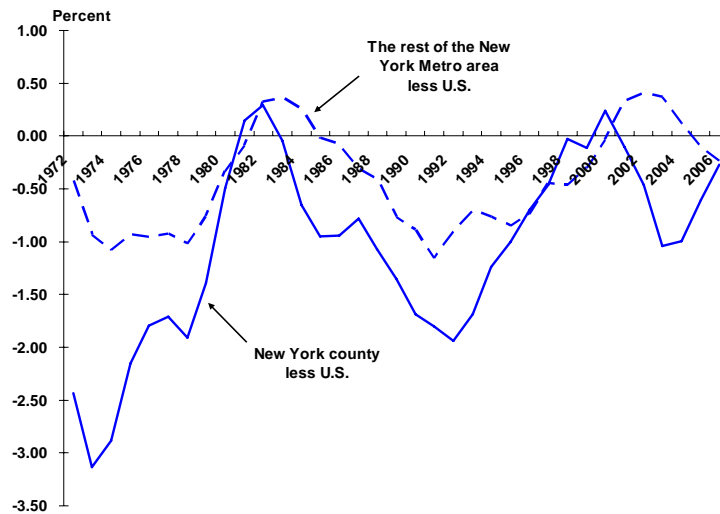


**Figure 1 TransNIEMO: Data and Modeling Process**

I: Interstate highway, U: U.S. Route, and S: State Route

## 2.2. Estimating the New York Regional Economic Impacts of the 9/11 Attacks

Our group has also been enlisted by DHS to assist in estimating the economic impacts in the New York area of the 9/11 attacks. We have implemented a variety of incrementally more sophisticated econometric approaches to study the available historic economic record. Separating the effects of the 9/11 attack from the concurrent economic recession is a difficult research challenge. Our approach involves identifying subregional and sectoral shifts, and understanding these in light of the competing influences of concurrent events. The national economic impact *appears* to have been both modest and short-lived. At the regional level, the impacts seem to be more in the form of regional relocation shifts. Some relevant background trends appear in Figure 2, which indicate that Manhattan (New York County) leads the rest of the region even in the 1980s, not only in 2001. Our work shows that these trends remain observable even as the proper model specification is refined and tested.



**FIG 2. Private Employment Growth Rates (3-year moving ave.)**

Differences in Rates with Respect to the U.S. for New York County (Manhattan) and the Rest of the NY Metropolitan Area, 1969-2006

Source: Regional Economic Information System, Bureau of Economic Analysis

### 3. Collaborative Research

A California-based proof of concept application of the TransNIEMO modeling approach was prompted by interest from the California Department of Transportation in concert with the National Center for Metropolitan Transportation Research (METRANS), which Caltrans supports.

The 9/11 impact study involves a broad working group of researchers from a variety of institutions and agencies who share their findings and insights on a bi-weekly basis. These are identified in the roster of the Economic Modeling Impact Forum (EMIF) led by Prof. Adam Z. Rose.

### 4. Research Products

#### Books

*Global Business and the Terrorist Threat*, Harry W. Richardson, Peter Gordon, and James E. Moore, II (eds.) Edward Elgar Publishing: Cheltenham and Northampton, forthcoming.

*Natural Disaster Analysis After Hurricane Katrina: Risk Assessment, Economic Impacts, and Social Implications*, Harry W. Richardson, Peter Gordon, and James E. Moore, II (eds.) Edward Elgar Publishing: Cheltenham and Northampton, 2008.

#### Journal Articles

Bumsoo Lee, Peter Gordon, James E. Moore, II, and Harry W. Richardson, "Simulating the Economic Impacts of a Hypothetical Bio-terrorist Attack: A Sports Stadium Case," *Journal of Homeland Security and Emergency Management* **5**, 1 (2008): Article 39, <http://www.bepress.com/jhsem/vol5/iss1/39>.

Jiyoung Park, Peter Gordon, James E. Moore, II, and Harry W. Richardson, "A Two-Step Approach Estimating State-by-State Commodity Trade Flows," forthcoming in the *Annals of Regional Science* **42**, 4 (2008) or **43**, 1 (2009).

Jiyoung Park, Peter Gordon, James E. Moore, II, and Harry W. Richardson) "The State-by-State Economic Impacts of the 2002 Shutdown of the Los Angeles-Long Beach Ports," forthcoming in *Growth and Change* **39**, 4 (2008).

#### Book Chapters

Peter Gordon, James E. Moore, II, Jiyoung Park, and Harry W. Richardson, "The Economic Impacts of International Border Closure: A State-by-State Analysis," forthcoming in *Global Business and the Terrorist Threat*, Harry W. Richardson, Peter Gordon and James E. Moore, II (eds.) Edward Elgar Publishers: Cheltenham and Northampton, forthcoming.

Qisheng Pan, Peter Gordon, James E. Moore, II, and Harry W. Richardson) "Economic Impacts of Terrorist Attacks and Natural Disasters: Case Studies of Los Angeles and Houston," forthcoming in *Geospatial Technologies and Homeland Security*, David Z. Sui (ed.) Springer Verlag: New York (2008): 35-65.

Jiyoung Park, Peter Gordon, James E. Moore, II, and Harry W. Richardson) "Estimating the Economic Impacts of WMD Attacks," forthcoming in *WMD Terrorism: Science and Policy Choices* (Working Title), edited by Stephen M. Maurer and Christine Hartmann-Siantar, MIT Press: Cambridge, 2008.

#### **5. Conference Presentations**

Gordon, P., "Expansion, Testing, and Application of NIEMO," CREATE Scientific Advisory Committee Meeting, July 24-25, 2008.