Advancing Computable General Equilibrium Analysis of the Economic Consequences of Terrorism

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Advancing Computable General Equilibrium Analysis (CGE) of the Economic Consequences of Terrorism

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Executive Summary

CREATE has evaluated several modeling approaches to estimating the national and regional consequences of terrorist attacks. In 2008 we utilized the leading regional/national econometric package, REMI, to analyze the economic impacts of a shutdown of the US borders to trade, travel, and tourism in the face of a public health threat or terrorist attack. Unfortunately, we found REMI to have significant shortcomings for cases of major shocks to the economy that involve issues of interregional and international competition. Progress has been made by CREATE researchers in improving input-output models in the areas of interregional interactions (NIEMO) and some incorporation of resilience considerations (primarily Flex-NIEMO). However, I-O remains limited in many applications due to its inherent linearity, lack of behavioral content, and inability to represent the detailed workings of markets. On the other hand computable general equilibrium (CGE) modeling has been successfully applied to a number of terrorist scenarios and has the capability to be applied to a broader range of applications than any of the alternatives. Peter Dixon at the Centre of Policy Studies (CoPS) at Monash University, Australia, has pioneered many advances in CGE modeling (Dixon et al., 1982; 2002). More recently, he has performed studies for the International Trade Commission and for DHS (Dixon et al., 2009, 2010). The latest generation of his CGE models has dynamic elements and can be run on a quarterly rather than annual basis. Moreover, a top-down algorithm has been developed to allocate the national results to various regions (Dixon et al., 2007). At the same time, CREATE has pioneered the inclusion of resilience into CGE models and has successfully constructed and applied bottom-up regional models to terrorist attacks. However, the CREATE CGE models are annual and static. Much can be accomplished by a collaboration between CREATE and CoPS. This is being accomplished by interactive research at each site and through visits by Peter Dixon to CREATE on an annual basis, and by James Giesecke, as well as by a visit to Monash University by Adam Rose.

Subsequently a program of specific deliverables for the Monash participants in the project was established. These are listed below.

1. Visit by Dr James Giesecke (Senior Research Fellow, CoPS) to CREATE for four months, November 2008 to March 2009.

2. Visit by Professor Peter Dixon (Sir John Monash Distinguished Professor, CoPS) and Professor Maureen Rimmer (CoPS) to CREATE for ten days, December 2008.

3. Visit by Professor Peter Dixon (Sir John Monash Distinguished Professor, CoPS) and Professor Maureen Rimmer (CoPS) to CREATE for five days, May 2009.

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4. Visit by Dr James Giesecke (CoPS) in March 2010 to participate CREATE workshop on Risk Perception and Risk-Related Behaviors.

5. Work in Melbourne by Professor Peter Dixon, Dr James Giesecke and Professor Maureen Rimmer, January 2009 to January 2011.
   (a) Preparation of 70 sector terrorism related version of the dynamic USAGE model incorporating features of CREATE’s static model.
   (b) Preparation of a paper on the effects of a hypothetical H1N1 epidemic.
   (c) Completion of work on border closure carried out mainly by Dr Giesecke during his visit to CREATE.
   (d) Completion of work on the LA County model carried out mainly by Dr Giesecke during his visit to CREATE.
   (e) Preparation of a hundred sector bottom-up regional model of the U.S.
   (f) Research on the regional economic consequences of a hypothetical dirty bomb attack.
   (g) Research on the regional economic consequences of a hypothetical chlorine gas attack.

All of these activities were successfully completed. The collaboration between CoPS and CREATE produced the following papers.


Summary
We use a CGE model to simulate the effects of a one-year U.S. border closure. Relative to previously used input-output modeling, CGE modeling offers a flexible framework for capturing bottleneck and labor-market effects. Our analysis suggests that the costs of a prolonged closure could be much greater than indicated by input-output studies. We find that cutting all imports by 95 per cent in an environment of sticky real wages would reduce GDP by 48 per cent. However, if bottleneck imports (mainly oil) were exempt and workers accepted real wage cuts then the GDP reduction would be only 11 per cent.

(2) Peter B. Dixon, Bumsoo Lee, Todd Muehlenbeck, Maureen T. Rimmer, Adam Z. Rose and George Verikios “Effects on the U.S. of an H1N1 epidemic: analysis with a quarterly CGE model” Journal of Homeland Security and Emergency Management: Vol. 7 : Iss. 1, Article 75, 2010

Summary
We simulate the effects of a hypothetical H1N1 epidemic in the U.S. using a quarterly CGE model. Quarterly periodicity allows us to capture the short-run nature of an epidemic. We find potentially severe economic effects in the peak quarter. Averaged over the epidemic year the effects are considerably damped. Our results indicate that the macroeconomic consequences of an epidemic are more sensitive to demand-side effects such as reductions in international tourism and leisure activities than to supply-side effects.
effects such as reductions in productivity. This suggests that demand stimulus policies might be an appropriate economic response to a serious epidemic.

(3) Giesecke, J.A. (forthcoming) “Development of a large-scale single U.S. region CGE model using IMPLAN data: A Los Angeles County example with a productivity shock application” *Spatial Economic Analysis.*

**Summary**

This paper details the construction of a large-scale computable general equilibrium (CGE) model for a single U.S. region. The model contains detailed treatment of margins and taxes, features not typically given prominence in U.S. regional CGE models. The starting point for the core of the CGE model’s data base is information from IMPLAN, producers of regional I/O data at the U.S. county and state levels. IMPLAN’s I/O tables, however, are in producer prices with aggregated treatment of margins and taxes. The methods for reconfiguring the I/O data into basic price flows with direct allocation of imports and a disaggregated treatment of taxes and margins are described. The method is applied to construction of a Los Angeles County model. An illustrative simulation of a productivity improvement in the Los Angeles County economy is then discussed.


**Summary**

We investigate the regional economic consequences of a hypothetical catastrophic event – attack via radiological dispersal device (RDD) – centered on the downtown Los Angeles area. We distinguish two routes via which such an event might affect regional economic activity: (i) reduction in effective resource supply (the resource loss effect) and (ii) shifts in the perceptions of economic agents (the behavioral effect). The resource loss effect relates to the physical destructiveness of the event, while the behavioral effect relates to changes in fear and risk perception. Both affect the size of the regional economy. RDD detonation causes little capital damage and few casualties, but generates substantial short-run resource loss via business interruption. Changes in fear and risk perception increase the supply cost of resources to the affected region, while simultaneously reducing demand for goods produced in the region. We use results from a nationwide survey, tailored to our RDD scenario, to inform our model values for behavioral effects. Survey results, supplemented by findings from previous research on stigmatized asset values, suggest that in the region affected by the RDD, households may require higher wages, investors may require higher returns, and customers may require price discounts. We show that because behavioral effects may have lingering long-term deleterious impacts on both the supply-cost of resources to a region and willingness to pay for regional output, they can generate changes in regional GDP much greater than those generated by resource loss effects. Implications for policies that have the potential to mitigate these effects are discussed.

**Publications and Reports**
### Presentations – Outreach

Peter Dixon presented a seminar on an H1N1 epidemic at the Center for Advanced Modeling in the Social, Behavioral and Health Sciences (CAM), Johns Hopkins University, December 6, 2010. This seminar created considerable interest and Josh Epstein and Blair Chapman have made enquiries about follow-up research opportunities.

Peter Dixon presented a seminar on an H1N1 epidemic at CREATE, December 9, 2010.

The research by Dixon and colleagues on an H1N1 epidemic in the U.S. economy has led to work by Australian economists, see for example Verikios, G., McCaw, J.M., McVernon, J. and Harris, A.H. (2011), ‘H1N1 Influenza and the Australian Macroeconomy.’ *Journal of the Asia Pacific Economy* (forthcoming).

James Giesecke presented a paper on the regional economic consequences of a hypothetical RDD attack at the CREATE workshop on Risk Perception and Risk-Related Behaviors, March 5-6, 2010.

### REFERENCES


