

Regional Economic Modeling: Tools for Economic Development Decisions

Andrew J Cassey

School of Economic Sciences
Washington State University

November 2009

Andrew J Cassey

- ▶ Ph.D., economics, University of Minnesota, 2008
 - Dissertation: *State Export Behavior and Policy*
 - Advisors: Sam Kortum and Tom Holmes
- ▶ Primary research interest in regional development through exportation
 - Informational barriers to trade, costs to begin to export
 - Export promotion policy
- ▶ Originally from Delaware
- ▶ Contact information
 - cassey@wsu.edu
 - 509 335 8334
 - <http://www.ses.wsu.edu/People/cassey.htm>
 - PO Box 646210, Hulbert Hall 101, Pullman WA 99164

Regional Economic Modeling

- ▶ Methodology & tools yielding data-based predictions for a particular geographic or political area
- ▶ Useful for simulating economic activity
 - Outcomes from different policies
 - Outcomes from shocks (good and bad) to region
- ▶ Compare counterfactual to real-world data
 - Counterfactual is alternative reality that did not happen (shock or policy)
 - Real-world data (baseline or benchmark) is what actually occurred
- ▶ Relatively easy (don't have to hire consultants) and quick

Types of Questions

- ▶ Population projections
- ▶ Migration estimates
- ▶ Location analysis
- ▶ Land use
- ▶ Resource management
- ▶ Economic impacts (from policy or shocks)
 - Income, revenue, sales
 - Employment
 - Value-added of production
- ▶ Economic impact analysis also refers to studies of how important a particular industry is to the income or employment of a region

Tools for Economic Impact Analysis

- ▶ Input-Output Analysis
 - Simpler
 - Models interconnectedness of sectors and market transactions
 - (Can be) Useful if geographic issues are important
 - No price changes
- ▶ Computable General Equilibrium (CGE, AGE) Modeling
 - More complicated
 - Models interconnectedness of sectors, institutions, factors, and nonmarket transactions
 - Explicitly accounts for price changes
 - (May have) Difficulty with spatial issues
- ▶ Both methods are based on the measuring the flow of expenditures around the economy

Not Optimizing Tools

- ▶ Gives predictions but not recommendations
 - Tells you overall impact of a shock (good or bad)
 - Does not say how resources should be managed
- ▶ Policy makers must decide what to do based on various predictions among other political factors
- ▶ Different from Cost-Benefit Analysis (CBA)
 - Impact analysis avoids need for survey to determine costs or benefits
 - CBA is more useful to measure outcomes over long periods of time
- ▶ Building a new road vs. subsidizing new factory

Multipliers

- ▶ Economic Impact measures how a change in income or employment in one sector flows around to all other sectors
- ▶ Compare ratio of income from a counterfactual (policy or shock) to actual data
 - Direct: affect on immediate sector or industry
 - Indirect: affect on upstream or downstream sectors from direct sector
 - Induced: affect on secondary sectors
- ▶ Net economic impact CAN be expressed as a multipleir
 - $\text{Direct} + \text{Indirect} + \text{Induced} = x$
 - For each \$1 (or 1%) change in direct sector, the total economic impact to region is \$x (or x%)

Steps to Policy Analysis

- ▶ Choose geographic scope
What is your region?
- ▶ Choose time frame
Impacts from now on or just for one year?
- ▶ Choose model type
Input-output or CGE?
- ▶ Choose data source and modeling software
- ▶ Choose counterfactual
What is the shock or policy to be compared against data?
- ▶ Can be done before event (*ex ante*)
or after the event (*ex poste*)

Geographic Scope

- ▶ Supra-national
- ▶ National
- ▶ State
- ▶ County
- ▶ ZIP code

- ▶ Choose BOTH model & data appropriately

- ▶ Few pre-built models or standard data below county level
- ▶ Multi-state & multi-county models possible
Must be customized at high time cost

Time Frame & Model Type

- ▶ One year counterfactual compared to real world data
Use input-output or CGE
- ▶ Present value of outcomes extending into future
Use cost-benefit analysis
- ▶ Model Type
 - Input-Output
 - CGE

Data Source

- ▶ IMPLAN 2008 input-output data, <http://implan.com>
 - Collected from national agencies: BLS, BEA, Census
 - 440 sectors (as of 2007)
 - Specialized by region
 - * \$1840 for WA and all counties
 - * \$565 per county
 - Software free or cheap with data purchase
- ▶ IMPLAN data and software all that is needed for input-output analysis
- ▶ Expensive and time intensive to collect own data or for different geographic unit (city)
- ▶ Extra data for CGE models also in IMPLAN data
Data on interactions between institutions and factors

CGE Model Construction

- ▶ Models use standard economic theory
 - Consumers max utility given income and prices
 - Firm max profit given technology and prices
- ▶ Professionals build generic CGE models
 - Updated annually
 - EXTREMELY time and resource consuming to build from scratch
- ▶ Take these off the shelf and trust they are correct
- ▶ Customize generic model to meet particular study of interest
- ▶ *Note:* Exports can be outside of region, outside of U.S., or both

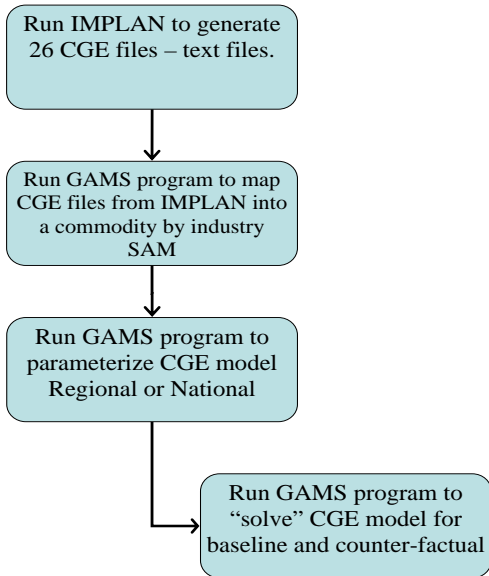
Washington State CGE Model

- ▶ Constructed by David Holland (WSU), Leroy Stodick (UI), and Steven Devadoss (UI)
http://www.agribusiness-mgmt.wsu.edu/Holland_model/index.htm
- ▶ Very flexible and general
- ▶ Available for free
- ▶ Written in GAMS programming language
<http://www.gams.com>
 - GAMS files available for free download
 - GAMS compiler and solver (PATH) cost \$ 640 academic
 - Customize WA model to region or industry using GAMS

Social Accounting Matrix & Counterfactual

- ▶ Use IMPLAN data and software with CGE GAMS code to produce a Social Accounting Matrix (SAM)
- ▶ GAMS code translate IMPLAN files into a SAM suitable for CGE model
 - GAMS code then parameterizes CGE model based on SAM
 - Benchmark
- ▶ Choose counterfactual
 - Policy or shock that is manually entered into one (or more) sectors
 - Use one year: what economy would have looked like in that year if policy or shock occurred
 - * All other variables fixed
 - * Capital is assumed fixed, labor flexible

Procedure to Create CGE Models from IMPLAN Data



Example: Holland et al. 2004

- ▶ Shock: Mad cow disease (BSE) in WA Dec 23, 2003
 - Japan, Korea, Mexico, Canada ban or limit beef imports: exports down 90%
 - U.S. Demand remains constant
- ▶ *Ex poste* counterfactual:
In 2004, what would beef industry and state be like if BSE was **not** present?
 - Direct: WA beef industry and ranchers
 - Indirect: cattle feeders, beef processors, retailers
 - Induced: consumers, restaurants where ranchers eat

Results: Output & Prices

Sector	Output (%)	Producer Price (%)	Consumer Price (%)
Ranch	-6.68	-7.18	
Feedlot	-6.60	-8.44	
Meatpacking	-6.20	-5.78	-1.75

- ▶ Change from counterfactual to benchmark
- ▶ Could compare 2004 data to 2003 data to infer impact, but not a controlled experiment

Results: Revenue (Sales)

Sector	Benchmark (\$)	Counterfactual (\$)	Change (%)
Ranch	11,398	13,133	-13.2
Feedlot	17,283	20,211	-14.5
Meatpacking	52,980	59,952	-11.6
Total	87,585	100,167	-12.6

- ▶ Total includes other sectors not shown in table
- ▶ Similar results for returns to labor and capital

Suggested Reading

- ▶ Davis, Craig H. 1993. *Regional Economic Impact Analysis & Project Evaluation*
 - For non-technical audience
 - Many examples and case studies
- ▶ Isard, Walter, et al. 1998. *Methods of Interregional & Regional Analysis*
- ▶ Leontief, Wassily. 1986. *Input-Output Economics*.
 - Collection of papers justifying input-output analysis
 - Very mathematical and technical
- ▶ IMPLAN Pro Manual. Version 3, 2009.

Conclusion

- ▶ Regional Economic Modeling
- ▶ Economic Impact Analysis
 - Economic impact predictions from policy or shock in a counterfactual compared to actual data
 - Relatively quick, easy, and cheap for any policy analyst to do
- ▶ Types of models
 - Input-output: simpler, no prices
 - CGE: more complicated, with prices
- ▶ Useful tool for policy analysis when there are alternatives
- ▶ Not an optimizing tool: no recommendations
- ▶ Disadvantages
 - Poor at long run predictions, one year only
 - No forecasting
 - “Black box” criticism-take a general model and trust it