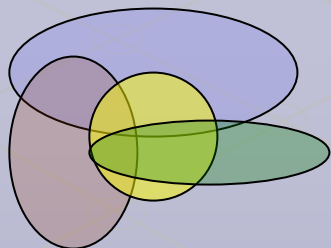


# Tapping IMPLAN'S Data Mine to Identify and Analyze Regional Industries and Industry Clusters for Connecticut



Presented by Dale Shannon CERC, Inc.

# Presentation Overview

- Clusters in Connecticut
- Defining the industry cluster concept
- Methods to identify industry clusters
- Examine industry clusters
- Conclusions

# Connecticut's Industry Cluster Initiative

- Economic development strategy leveraging industry cluster theory developed during the recession in early 1990s.
- Goal of this strategy was to create industry organizations to represent the needs of companies within those industries and encourage communications among the companies.
  - Aerospace component manufacturer's cluster
  - BioScience cluster (Connecticut United for Research Excellence)
  - eBizCT – Software/information technology cluster
  - Metal Manufacturing cluster

# Scope of this Presentation

- Presentation reviews three methodologies used in a larger project to objectively analyze Connecticut's industry structure.
- This larger project assessed Connecticut's existing industry clusters and identified potential industry clusters.
- All three methodologies used input-output data.
- IMPLAN I-O model used based on Connecticut
  - political boundaries
  - economic markets

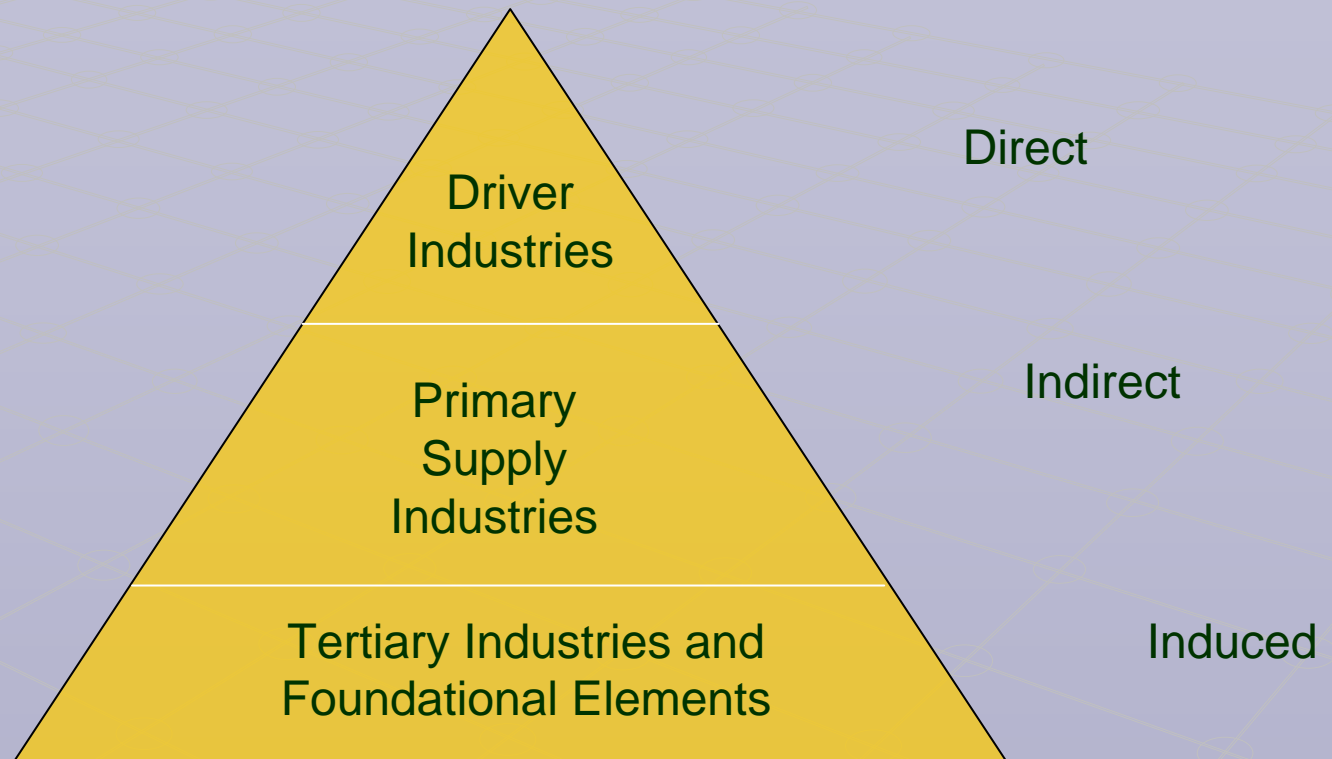
# Acknowledgements

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- William Lott and Stan McMillan of the *UCONN Connecticut Center for Economic Analysis*
- Jeff Blodgett, Alissa DeJonge and Dale Shannon of **CERC, Inc**

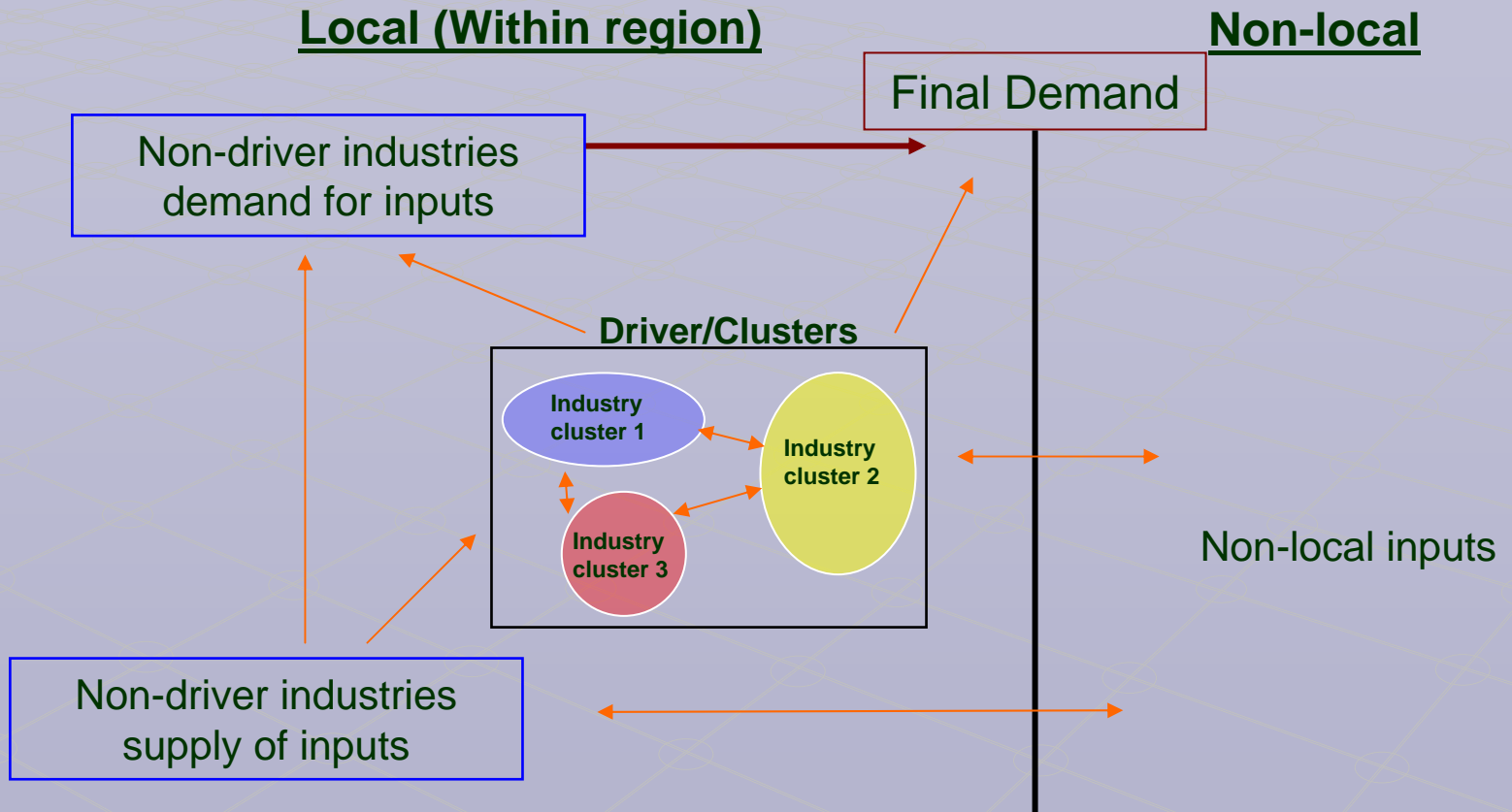
# IMPLAN I-O Data and Clusters

- Clusters in Connecticut
- Defining the Industry Cluster Concept
- Identifying Industry Clusters
- Exploring Industry Clusters
- Conclusions

# Basic Regional Economic Model



# I-O Regional Economic Model



# Industry Cluster Definitions:

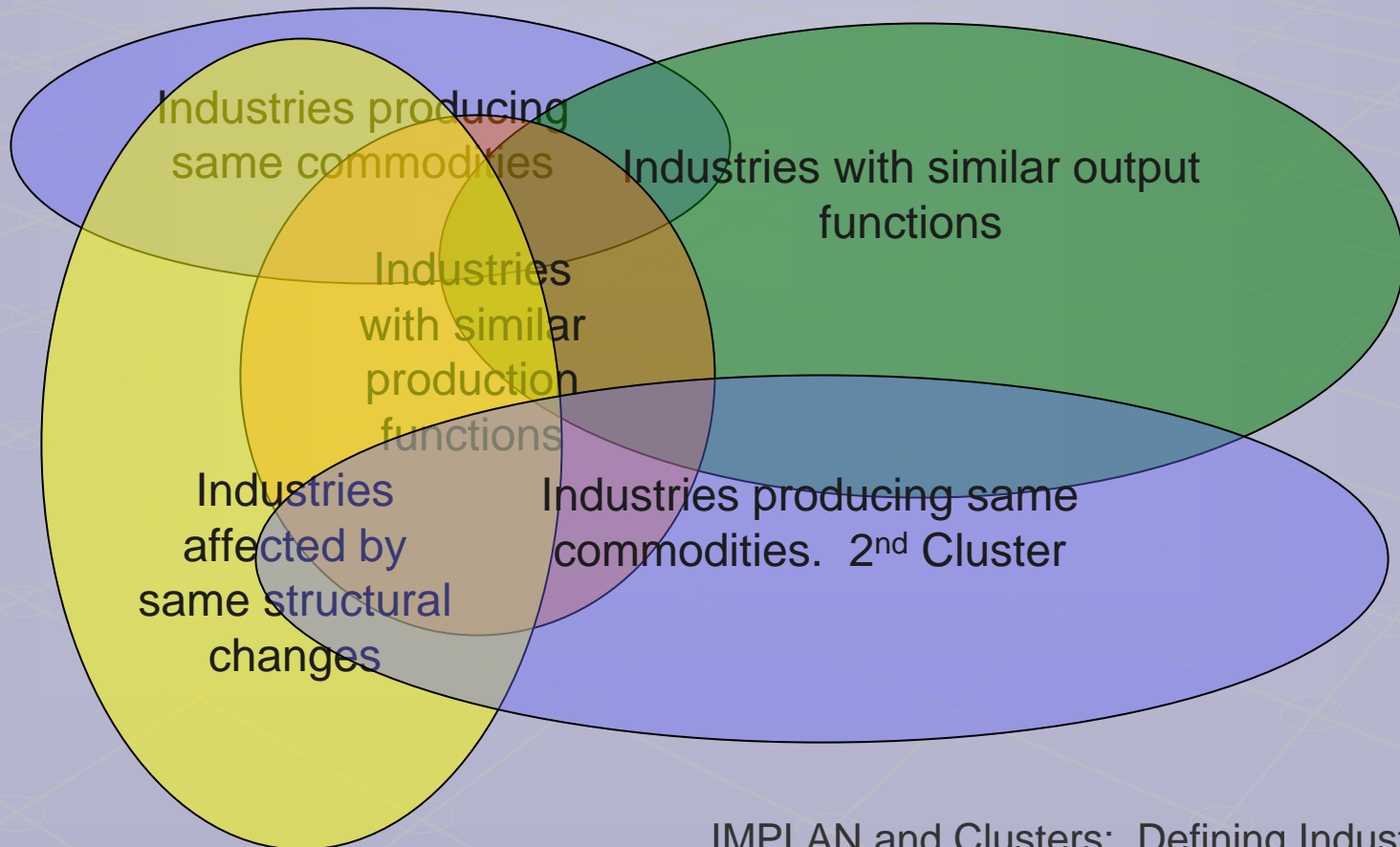
- Industries affected by the same changes in the structure of the regional or national economy
- Industries with the similar labor requirements
- Industries needing similar capital/technology investments
- Industries that produce the same commodities
- Industries with similar production or distribution functions
- Industries with similar resource requirements
- Industries linked through input or output requirements

# Identifying Industry Clusters Using I-O Regional Modeling Systems

- Ability to define a unique economic region
- Data estimates for a large number of industries
- Ability to examine commodities made by industries
- Summary economic data consistent with industry data
- Estimates for production and distribution functions
- Regional shares and exports
- National industry data for benchmarking
- Data available through a robust database (MS Access)

# Multiple definitions of industry clusters

- Overlapping and Intertwining industry groupings
- Each industry cluster methodology identifies multiple clusters



# Overlapping and Intertwining Industry Groupings

## IMPLICATIONS

- Choose industry definitions carefully at start of project.
- Limit the number of definitions as much as possible.
- Don't expect common industry groupings across different definitions.
- Consider working with only specific industry sectors.
- Consider focusing on regionally important industries.
- Be willing to apply qualitative measures.

# IMPLAN I-O Data and Clusters

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# 3 Cluster Identification Methodologies

## Applying I/O Data

- Target Missouri II
- Hill and Brennan
- Feser and Bergman

# Target Missouri II: A Regional Approach to Economic Development

- Research and Planning Department of the Missouri Department of Economic Development
- On the Internet at [http://www.ecodev.state.mo.us/research/pubs/tm2/centreg/tm2\\_centreg\\_rpt.pdf](http://www.ecodev.state.mo.us/research/pubs/tm2/centreg/tm2_centreg_rpt.pdf)
- A simple but comprehensive methodology using a variety of economic variables to identify the most important regional industries.

# Methodology of Target Missouri II

- 6 variables developed that measured various aspects of each of the regional industries.
- An Index number between 0 and 100 was created for each industry.
- The variables used for this index were weighted according to perceived importance of each measure.

# Target Missouri II Variables

## Variables included:

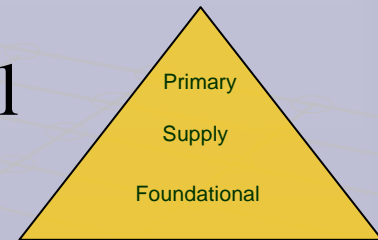
- Specialization ratio (LQ)
- Regional shift measure (shift share analysis)
- Skills-mismatch index
- Industrial mix measure (shift share analysis)
- Current employment level
- Economic impact measure

# Target Missouri Economic Impact Variable

- Using the REMI Model impact each industry with 100 new jobs
  - average of the change in total employment over 5 years
  - net present value of the total wages and salaries over 5 years from all new jobs

# Results of Target Missouri II Methodology

- Indexing industries suggests relative importance of each industry in the regional economy
- Cut off values could classify industry groups
  - primary/driver industries, secondary industries and general/foundational industries
- Examining industry structure based on rankings of each of the variables may suggest potential industry clusters



# Identifying Clusters: Hill and Brennan

## A Methodology for Identifying the Drivers of Industrial Clusters: The Foundation of Regional Competitive Advantage

Published by Edward W. Hill and John F. Brennan in *Economic Development Quarterly*, Vol 14 No.1, February 2000 pp 65-96.

# Data used in the Hill and Brennan Methodology

- Eleven industry variables based on four concepts:
  - Competitiveness
  - Exports
  - Centrality
  - Employment specialization
- Some of these eleven variables used trend data

# I-O Data used in the Hill and Brennan

● 4 of the 11 variables were from an I-O model

- Exports

- Share of industry's output shipped out of the region
- Share of local exports accounted for by industry

- Centrality

- Forward linkages (industry's share of local sales)
- Backward linkages (industry's share of local purchases)

# Hill and Brennan Methodology

- Agglomerative hierarchical cluster analysis creates industry cluster solutions.
- Stepwise discriminant analysis applied to these industry cluster solutions identifies specific variables responsible for the agglomerations.

# Results and Observations of the Hill and Brennan Methodology

- Identified industries that are most similar in the various economic measures.
  - For example Insurance Carriers and Aircraft and Missile Engines industries were grouped together in Connecticut because of high industry export shares and declining employment shares
- Most of the variables are not based on industry linkages.
- The variables that do use I-O data only measure local linkages

# Identifying Clusters: Feser and Bergman

## National Industry Cluster Templates: A Framework for Applied Regional Cluster Analysis

Published by Edward J. Feser and Edward M. Bergman in *Regional Studies*, Vol 34 No.1, 2000, pp. 1-19.

# Overview of Feser and Bergman Data and Methodology

- Only data used is derived from an I-O transactions matrix.
- The methodology identifies industries with similar I-O requirements.
- Regional results compared to the nation to identify gaps and emerging clusters.

# Data Preparation and Methodology - Feser and Bergman

(1 of 5)

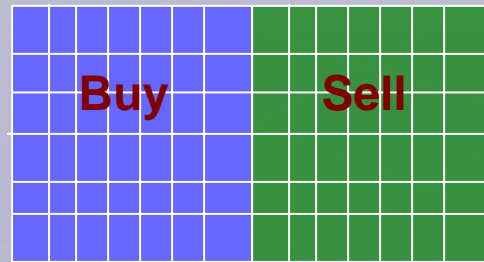
- Create two coefficient matrices based on the transactions matrix
  - “Buy” matrix: shares of the purchases of each industry by all other industries
  - “Sell” matrix: the transpose of shares of the sales of each industry to all other industries



# Data Preparation and Methodology - Feser and Bergman

(2 of 5)

- Create a double Industry-x-Industry matrix of both buy (production functions) and sell (distribution functions) by placing the “sell” matrix next to the “buy” matrix

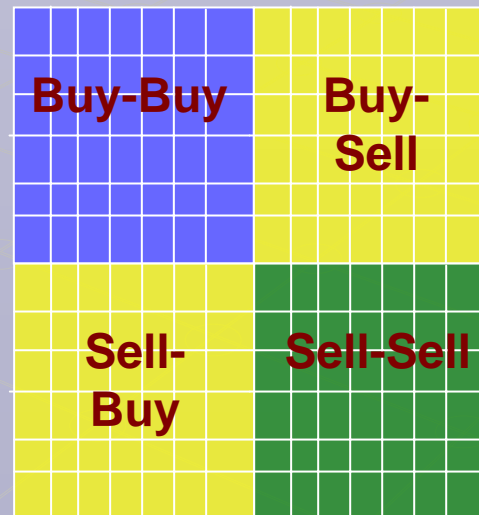


- Correlate this buy sell coefficients matrix.

# Data Preparation and Methodology - Feser and Bergman

(3 of 5)

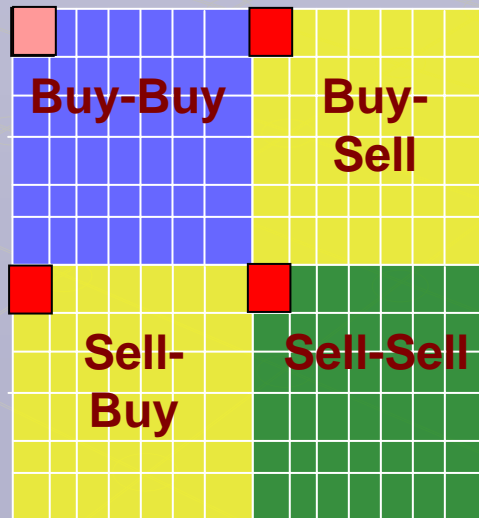
- Resulting correlation matrix has four industry-x-industry sub-matrices
  - Buy-buy
  - Buy-sell
  - Sell-buy
  - Sell-sell



# Data Preparation and Methodology - Feser and Bergman

(4 of 5)

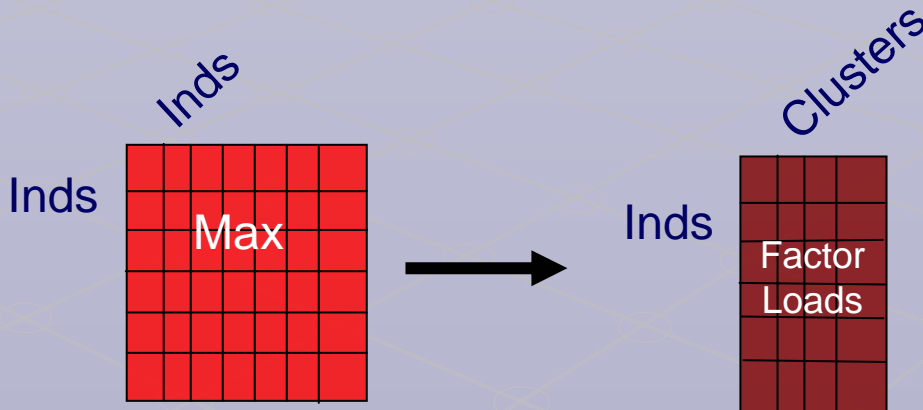
- From each of these four matrices the largest Industry-by-Industry correlation is identified and used to create a matrix that has a measure of the maximum of any industry-by-industry linkage (the diagonal of 1.00s is excluded)



# Data Preparation and Methodology - Feser and Bergman

(5 of 5)

- Apply factor analysis using principal components to maximum correlations matrix.



# Identifying Industries in each Cluster – Feser and Bergman

- Each industry's factor loading value reveals how strongly that industry is associated with that factor (cluster).
- Industries clustered based on factor loads for each factor.
- Factor analysis identifies the groups of industries with the similar input-output linkages

# Results and Observations of the Feser and Bergman Methodology

- Industry clusters identified are clearly based on similar industry linkages
- Regional and national comparisons for gaps and emerging clusters.
- Industries with similar input or output functions do not necessarily have strong direct links.

# IMPLAN I-O Data and Clusters

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# Exploring industry clusters:

- What share of a cluster's total input requirements are supplied from other identified clusters?
- What are important non-cluster industries supplying all the clusters?
- What industries supply goods to the secondary industries?
- What industries produce similar commodities?

# Gathering the data—One example

- Export the IMPLAN transactions or coefficient matrices and import the tables into Access.
  - Regional Industry-x-Industry Direct Coefficients
  - Regional Industry-x-Industry Transactions
- Create a set of queries that run through the data tables to gather the necessary data.

# One series of examples

## ● Data Structure for exploring cluster linkages

<b>Industry-to-Industry Transactions</b>			
<b>Ind_i</b>	<b>Ind_K</b>	<b>Gross Inputs</b>	<b>Rgn Inputs</b>
1	1	\$23,290	\$4,712
1	2	\$17,186	\$3,477
1	3	\$3,004	\$608
1	4	\$239	\$48
1	5	\$493	\$100
1	6	\$123	\$25
1	7	\$381	\$77
1	9	\$38,247	\$7,738
1	11	\$85,297	\$152
1	12	\$593,961	\$21,141
1	13	\$10,992,019	\$391,234
1	14	\$24	\$5

Ind\_i is Column  
Industry

Ind\_k is Row  
Industry

# Table of Major Driver-clusters

## Inputs Required By Industries in Connecticut

Ranking	Driver-Cluster Name	Input Values		RPC	Share of Connecticut Total		Share of CT Regional Inputs
		Total	Regional		Total	Regional	
	<b>Total All Industries</b>	<b>\$79,485</b>	<b>\$43,526</b>	<b>54.8%</b>	<b>100.0%</b>	<b>54.8%</b>	<b>100.0%</b>
	<b>Total for All Drivers</b>	<b>\$44,094</b>	<b>\$24,951</b>	<b>56.6%</b>	<b>55.5%</b>	<b>31.4%</b>	<b>57.3%</b>
1	Transportation & Distribution	\$6,506	\$4,079	62.7%	8.2%	5.1%	9.4%
2	Business Support Services	\$6,291	\$3,554	56.5%	7.9%	4.5%	8.2%
3	Infrastructure Health & Human	\$5,203	\$3,435	66.0%	6.5%	4.3%	7.9%
4	Tech Mfg	\$5,943	\$2,774	46.7%	7.5%	3.5%	6.4%
5	Aerospace/Defense	\$5,760	\$2,712	47.1%	7.2%	3.4%	6.2%
6	Local Financial Services	\$2,908	\$2,074	71.3%	3.7%	2.6%	4.8%
7	Insurance	\$3,913	\$1,577	40.3%	4.9%	2.0%	3.6%
8	Tourism Entertainment Leisure	\$2,526	\$1,527	60.4%	3.2%	1.9%	3.5%
9	Financial	\$2,173	\$1,276	58.7%	2.7%	1.6%	2.9%
10	Drugs	\$1,408	\$1,015	72.0%	1.8%	1.3%	2.3%
11	Private Education Export Base	\$966	\$715	74.0%	1.2%	0.9%	1.6%
12	Agriculture, forestry, & fishing	\$496	\$213	42.9%	0.6%	0.3%	0.5%
	<b>All non-driver Inds</b>	<b>\$35,391</b>	<b>\$18,575</b>	<b>52.5%</b>	<b>44.5%</b>	<b>23.4%</b>	<b>42.7%</b>

Source: IMPLAN 1997 Data Matrices. Millions of dollars, nominal.

# Table of Inputs for Transportation and Distribution Cluster

## Inputs Required By Connecticut's Transportation and Distribution Cluster

Ranking	Driver-Cluster Name	Input Values		RPC	Share of Connecticut Total		Share of CT Regional Inputs
		Total	Regional		Total	Regional	
	<b>Total All Industries</b>	<b>\$6,506</b>	<b>\$4,079</b>	<b>62.7%</b>	<b>100.0%</b>	<b>62.7%</b>	<b>100.0%</b>
	<b>Total for All Drivers</b>	<b>\$4,256</b>	<b>\$2,821</b>	<b>66.3%</b>	<b>65.4%</b>	<b>43.4%</b>	<b>69.2%</b>
1	Transportation & Distribution	\$1,791	\$1,382	77.1%	27.5%	21.2%	33.9%
2	Business Support Services	\$1,507	\$885	58.8%	23.2%	13.6%	21.7%
3	Infrastructure Health & Human	\$371	\$252	67.9%	5.7%	3.9%	6.2%
4	Tech Mfg	\$298	\$158	53.0%	4.6%	2.4%	3.9%
5	Aerospace/Defense	\$159	\$81	50.6%	2.5%	1.2%	2.0%
6	Local Financial Services	\$39	\$26	66.9%	0.6%	0.4%	0.6%
7	Insurance	\$29	\$17	57.9%	0.4%	0.3%	0.4%
8	Tourism Entertainment Leisure	\$51	\$14	26.8%	0.8%	0.2%	0.3%
9	Financial	\$8	\$5	58.0%	0.1%	0.1%	0.1%
10	Drugs	\$3	\$2	80.0%	0.0%	0.0%	0.1%
11	Private Education Export Base	\$2	\$1	47.4%	0.0%	0.0%	0.0%
12	Agriculture, forestry, & fishing	\$1	\$0	65.6%	0.0%	0.0%	0.0%
	<b>All non-driver Inds</b>	<b>\$2,249</b>	<b>\$1,258</b>	<b>55.9%</b>	<b>34.6%</b>	<b>19.3%</b>	<b>30.8%</b>

Source: IMPLAN 1997 Data Matrices. Millions of dollars, nominal.

# Table of Non-Driver Inputs for Driver Clusters

**Table 5--Non-Driver Industry Detail of Requirements from All Driver Industries**

Ranking	Driver-Cluster Name	Input Values		RPC	Share of Connecticut Total		Share of CT Regional Inputs
		Total	Regional		Total	Regional	
	<b>Total</b>	<b>\$15,063</b>	<b>\$6,955</b>	<b>46.2%</b>	<b>19.0%</b>	<b>8.8%</b>	<b>34.2%</b>
1	Construction	\$1,496	\$1,403	93.8%	1.9%	1.8%	3.4%
2	Motor freight & warehousing	\$554	\$419	75.6%	0.7%	0.5%	1.3%
3	U.S. Postal Service	\$545	\$409	75.0%	0.7%	0.5%	1.2%
4	Electronic components and accessories	\$888	\$360	40.5%	1.1%	0.5%	2.0%
5	Research and testing services	\$461	\$303	65.6%	0.6%	0.4%	1.0%
6	Advertising	\$363	\$290	80.0%	0.5%	0.4%	0.8%
7	Services to buildings	\$356	\$285	80.0%	0.4%	0.4%	0.8%
8	Engineering & architectural services	\$292	\$233	79.7%	0.4%	0.3%	0.7%
9	Paperboard Containers & Boxes	\$203	\$195	96.1%	0.3%	0.2%	0.5%
10	Newspapers	\$241	\$187	77.5%	0.3%	0.2%	0.5%
11	Search and navigation equipment	\$302	\$167	55.4%	0.4%	0.2%	0.7%
12	Misc. equipment rental & leasing	\$233	\$139	59.4%	0.3%	0.2%	0.5%
13	Misc. Repair Shops	\$170	\$136	80.0%	0.2%	0.2%	0.4%
14	Motion Pictures	\$209	\$130	62.2%	0.3%	0.2%	0.5%
15	Periodicals	\$183	\$130	71.0%	0.2%	0.2%	0.4%

Source: IMPLAN 1997 Data Matrices. Millions of dollars, nominal.

# Conclusions

- Multiple definitions of industry cluster concept
- Complex regional industry structures
- Regional geography problems
- Value of industry linkage data from I/O models
- Value of robust hooks into I/O database

# Clusters and IMPLAN

- IMPLAN's data available through MS Access database links gives ability to
  - Easily aggregate industry data to match SIC or other data classifications
  - Examine different industry cluster groups
  - Create standardized tables
  - Export, import or change data quickly
  - Get your IMPLAN model really messed up

**Thank**

**You**