

Integrating heterogeneous data sources for better freight flow analysis and planning

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Research Context

Exploratory grant

Interdisciplinary Collaboration

Computer Science: Information Integration

**Social Science: Urban Economics and
Transportation Planning**

**Participation of government agencies:
local, regional, state, and federal**

**Focus: Freight flow estimation in a large
metropolitan area**

Advisory Group

Experts (12) from state, regional and local government agencies including:

State of California Department of Transportation

California Senate Office of Research

Southern California Association of Governments

San Bernardino Association of Governments

LA County Metropolitan Transportation Authority

Ports of Long Beach and Los Angeles

Los Angeles International Airport

LA County Economic Development Corporation

Freight Flow

Significant increases of freight flows

Truck and air increase faster than GNP:

- Intercity truck ton-miles: 1980 555B → 1998 1027B **2x**
- Air ton-miles: 1980 4.5B → 1998 13.8B **3x**

Trucks carry 79% of goods (value B\$331 1998)

Significant Local Impacts

Congestion, Traffic accidents

Roadway deterioration

Air pollution, Noise

Higher Risk: Hazardous materials

Spatial restructuring

Regional Freight Flow Estimation

Current methods are inadequate

Fixed factors based on passenger flows and truck counts at a few locations

Lack of data

- Truck count surveys are expensive
- Private freight transporters data is proprietary

Solution: Secondary Sources

Reliable sources:

- Census employment data
- Local data: airports, seaports, ...

Cost effective

Online Sources: Continuous update

Freight Flow Data Sources (SCAG Region)

Geospatial Data:

Census Tracts, TAZs

Highway network

Census Transportation Planning Package:

Employment data (US)

Regional Science Research Institute:

Input-output transaction table (SCAG region)

Airport data (SCAG region)

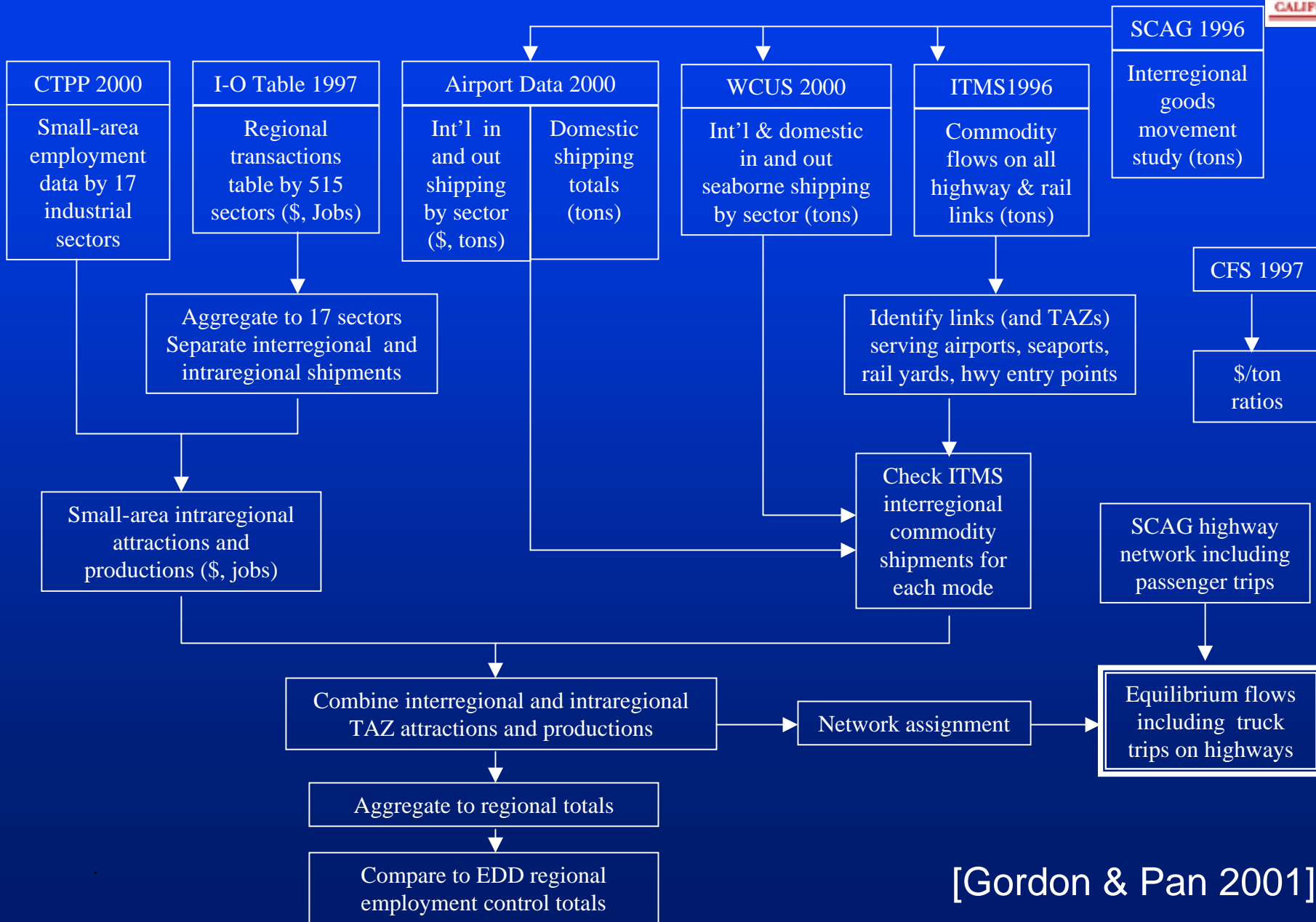
Interregional Goods Movement Study (SCAG)

Port of Long Beach

Waterborne Commerce of the United States

**Intermodal Transportation Management System
(Caltrans)**

Freight OD Data Collection and Processing

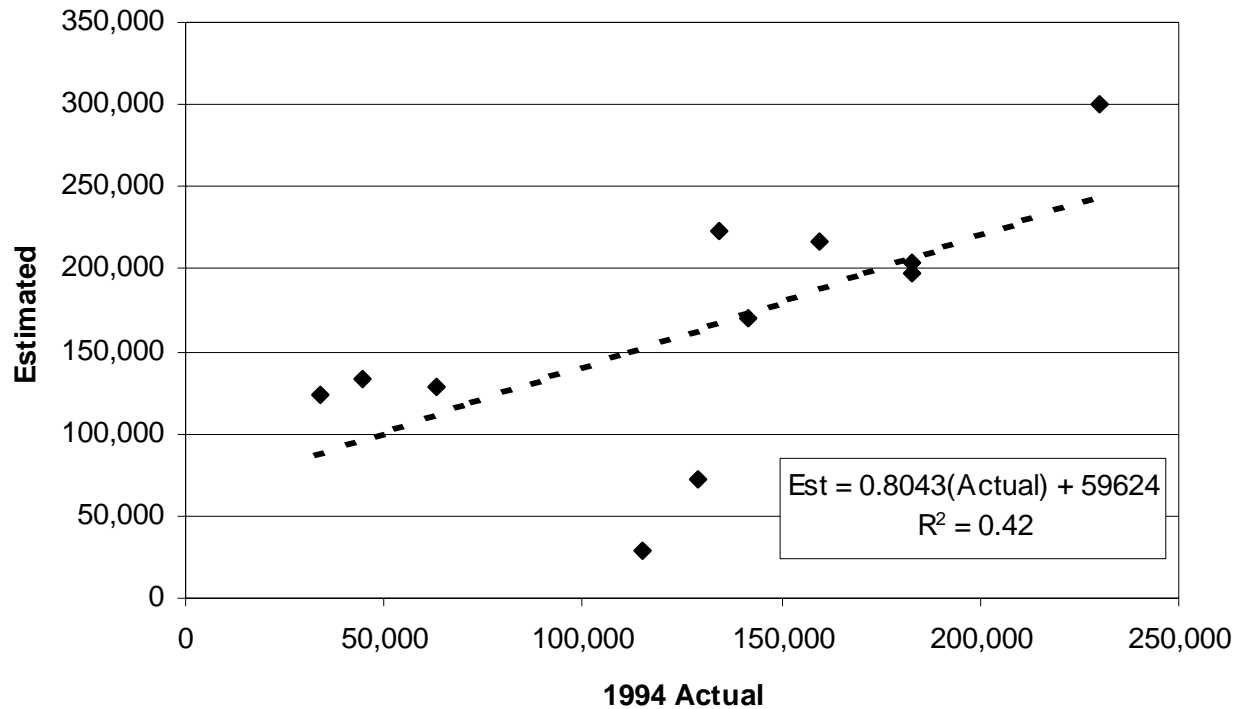


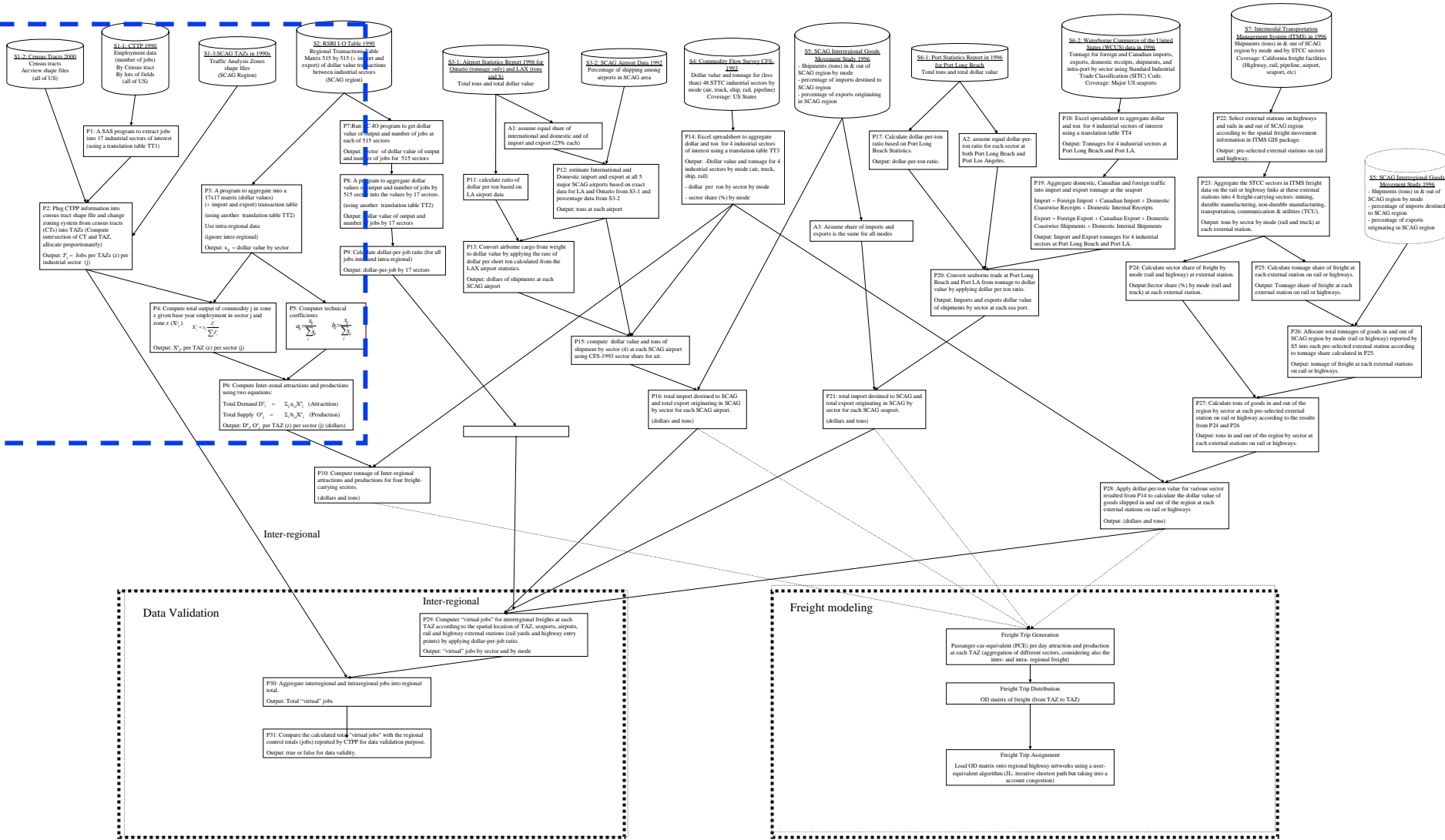
Experiment: Screenline Truck Counts



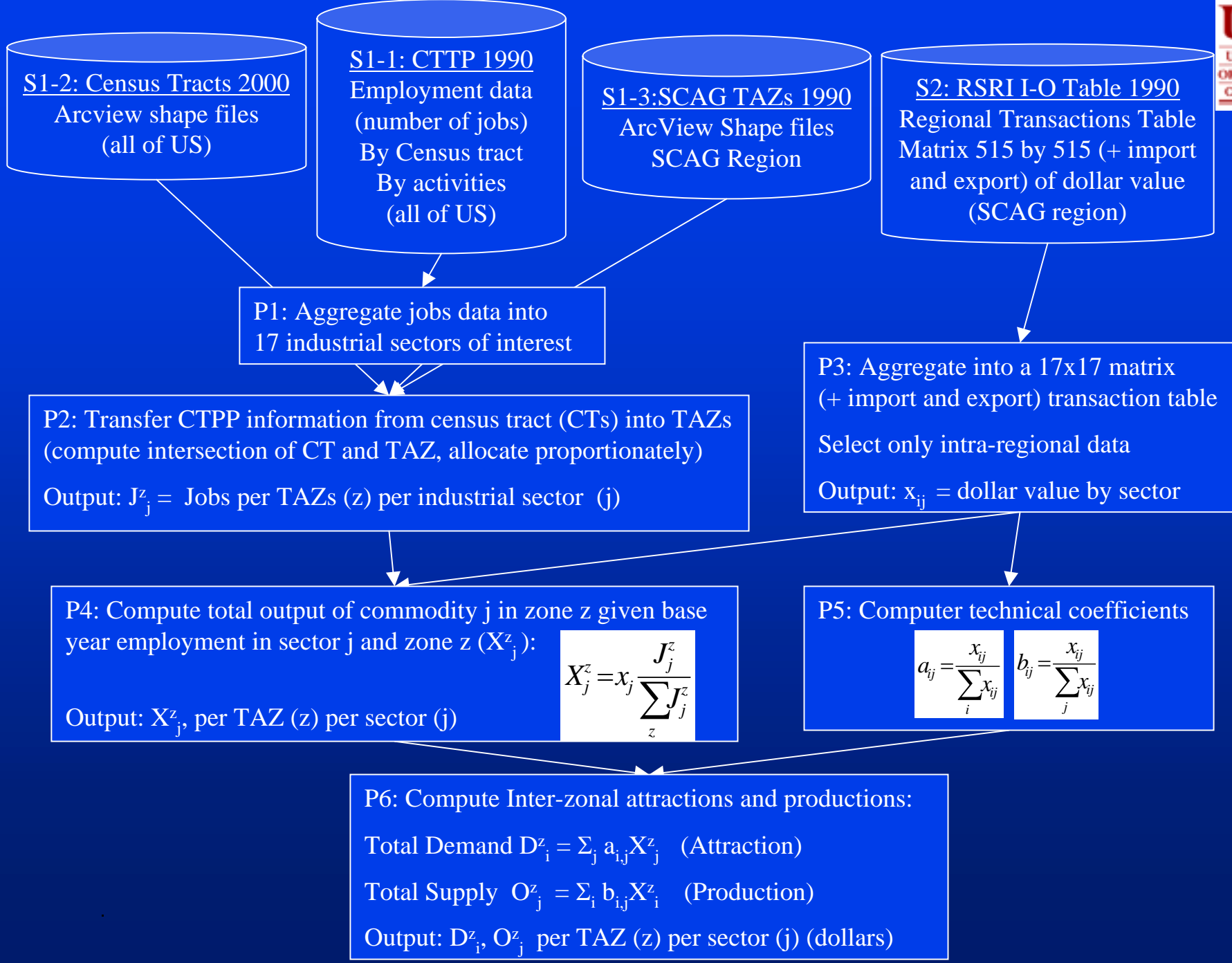
Experiment: Screenline Truck Counts

Estimated and Actual Screenline HDT, 24 hour, in PCEs





[Ambite, Giuliano, Gordon, Pan & Bhattacharjee 2002]



S1-2: Census Tracts 2000
Arcview shape files
(all of US)

S1-1: CTPP 1990
Employment data
(number of jobs)
By Census tract
By activities
(all of US)

S1-3: SCAG TAZs 1990
ArcView Shape files
SCAG Region

S2: RSRI I-O Table 1990
Regional Transactions Table
Matrix 515 by 515 (+ import
and export) of dollar value
(SCAG region)

P1: Aggregate jobs data into
17 industrial sectors of interest

P2: Transfer CTPP information from census tract (CTs) into TAZs
(compute intersection of CT and TAZ, allocate proportionately)
Output: $J_j^z = \text{Jobs per TAZs (z) per industrial sector (j)}$

P3: Aggregate into a 17x17 matrix
(+ import and export) transaction table
Select only intra-regional data
Output: $x_{ij} = \text{dollar value by sector}$

P4: Compute total output of commodity j in zone z given base
year employment in sector j and zone z (X_j^z):
Output: X_j^z , per TAZ (z) per sector (j)

$$X_j^z = x_j \frac{J_j^z}{\sum_z J_j^z}$$

P5: Compute technical coefficients

$$a_{ij} = \frac{x_{ij}}{\sum_i x_{ij}} \quad b_{ij} = \frac{x_{ij}}{\sum_j x_{ij}}$$

P6: Compute Inter-zonal attractions and productions:

Total Demand $D_i^z = \sum_j a_{i,j} X_j^z$ (Attraction)

Total Supply $O_j^z = \sum_i b_{i,j} X_i^z$ (Production)

Output: D_i^z, O_j^z per TAZ (z) per sector (j) (dollars)

Conclusions

General framework for data integration and processing: Automated Workflow

Estimation from secondary sources:

- Reliable sources**

- Cost-effective**

- Continuous update (if live sources available)**

- Automatic Validation and Calibration**

Current Focus: Freight flow

Interdisciplinary work

**Close collaboration with government agencies
(both data producers and planners/users)**