

Updating IMPLAN's Econometric Regional Purchase Coefficients

Jenny Thorvaldson, Doug Olson, and Greg Alward

MIG, Inc.



Presentation Outline

- Brief overview of IMPLAN
- Regional Purchase Coefficients
 - What are they?
 - How are they estimated?
 - Why did they need updating?
- Methodology for creating new econometric RPCs
- Comparison between RPCs
- Conclusions and ideas for future developments

IMPLAN

- ▶ IMPLAN is a data and software system that describes the structure and function of an economy
- ▶ By showing the linkages between industries, households, and government institutions, IMPLAN helps analysts answer questions related to:
 - Economic Structure
 - Economic Impacts

Regional Purchase Coefficients

- Reliable estimates of inter–regional trade flows are integral to this process
 - Economic Structure: Show possibilities for import substitution, etc.
 - Economic Impact: Influence the size of multiplier effect
- RPCs describe the proportion of local demand for a commodity that is purchased from local producers
 - RPCs are region and commodity specific
 - Higher RPCs = less leakage = greater multiplier effect
- 2 methods for estimating RPCs in IMPLAN:
 - National tradeflow model (a gravity model)
 - Econometrics (regression analysis)



TradeFlow RPCs

- Based on “observed” trade flows as opposed to statistical estimation
- Internally consistent: sum of all states’ domestic imports = sum of all states’ domestic exports
- Fixed: not responsive to edits to the underlying study area data
- Not currently available at zip-code level



Econometric RPCs

Procedure:

1. Use a proxy for trade flows as dependent variable
2. Use data from IMPLAN as explanatory variables
3. Estimate the coefficients on those explanatory variables
4. In IMPLAN software: Combine the estimated coefficients with any model's data to calculate RPCs "on-the-fly"

Pros:

- As model data is edited, RPCs change accordingly
- Can be used for regions without trade flow data (e.g., zip-codes)



Econometric RPCs

- Current methodology: Uses current IMPLAN data to calculate the RPCs, but coefficients estimated in 1988 (by Alward and Despotakis) using 1977 data
 - Outdated coefficients
 - Available for 84 shippable (i.e., manufactured) commodities only
- New Methodology: Also uses current IMPLAN data to calculate the RPCs, but coefficients estimated using 2009 data
 - Updated coefficients
 - More observations:
 - More commodities (425 vs. 84)
 - Larger sample size (3,142 vs. 51)
 - Enhanced variable set

Dependent Variable – Old Method

$$\begin{aligned} \text{RPC}_i^L &= \frac{X_i^{LL}}{\text{Gross Demand}_i^L} \\ &= \frac{X_i^{LL}}{(X_i^{LL} + M_i^{UL} + M_i^{WL})} \end{aligned}$$

Dependent Variable: M_i^{UL} / X_i^{LL}

Explanatory Variables – Old Method

$$\frac{\text{EmpComp}_i^L}{\text{Employment}_i^L}$$

Included to help explain differences in consumption and production patterns

$$\frac{\text{Employment}_i^L}{\text{Employment}_i^{\text{ROUS}}}$$

Proxy for supply

$$\frac{\text{Employment}_i^L / \text{TotalEmployment}^L}{\text{Employment}_i^{\text{ROUS}} / \text{TotalEmployment}^{\text{ROUS}}}$$

Proxy for establishments

$$\frac{\text{LandArea}^L}{\text{LandArea}^{\text{ROUS}}}$$

Proxy for transportation costs



Explanatory Variables – **New Method**

$$\frac{\text{EmpComp}_i^L}{\text{Employment}_i^L}$$

$$\frac{\text{LaborIncome}_i^L}{\text{Employment}_i^L}$$

$$\frac{\text{Employment}_i^L}{\text{Employment}_i^{\text{ROUS}}}$$

$$\frac{\text{Supply}_i^L / \text{Demand}_i^L}{\text{Supply}_i^{\text{ROUS}} / \text{Demand}_i^{\text{ROUS}}}$$

$$\frac{\text{Employment}_i^L / \text{TotalEmployment}^L}{\text{Employment}_i^{\text{ROUS}} / \text{TotalEmployment}^{\text{ROUS}}}$$

Same

$$\frac{\text{LandArea}^L}{\text{LandArea}^{\text{ROUS}}}$$

Same

$$\frac{\text{PopDensity}^L}{\text{PopDensity}^{\text{ROUS}}}$$



Dependent Variable – **New** Method

Dependent Variable: **Trade**flow RPC

Econometric RPCs – Comparison

- 3 Econometric RPCs for comparison:
 - Old Method: IMPLAN's Current Methodology
Old variable set, coefficients estimated with 1977 data, RPCs calculated with 2009 data
 - Intermediate Method: Same Variables, Updated Coefficients
Old variable set, coefficients estimated with 2009 data, RPCs calculated with 2009 data
 - New Method: New Variables, Updated Coefficients
New variable set, coefficients estimated with 2009 data, RPCs calculated with 2009 data

Comparison – Model Fit

- Manufactured Commodities

	Old Method	Intermediate Method	New Method
Observations	4,284	983,446	983,446
Adjusted-R ²	0.32	0.92	0.94
Statistical Significance of Individual Variables	All but Employment ratio	All but Land Area ratio	All

- Non-Manufactured Commodities

	Old Method	Intermediate Method	New Method
Observations	n/a	351,904	351,904
Adjusted-R ²	n/a	0.5291	0.8831
Statistical Significance of Individual Variables	n/a	All	All

Comparison – Model Fit

Commodity	Adjusted-R ²	Intermediate Method RPC	New Method RPC	Tradeflow RPC
<i>Wild game products, pelts, and furs</i>	0.16	0.82	0.52	0.58
<i>Agriculture and forestry support</i>	0.20	0.10	0.11	0.22

Comparison to TradeFlow RPC

- New Econometric RPCs closer than Intermediate Econometric RPCs to TradeFlow RPCs in 93% of all cases
- Of the remaining 7% of cases:
 - The commodities that were farthest off did not show up very often
 - The commodities that showed up most often were not very far off
- Average absolute difference between econometric RPCs and TradeFlow RPC:
 - Intermediate Method: 0.5232
 - New Method: 0.0134

Conclusions

- Updating the data used for estimation and improving the set of variables used in the equation both improved RPC estimation
- Would be worthwhile to investigate further those cases in which the new method did not improve upon the old method
- Questions? Comments?
- www.implan.com



Tradeflow Model

Import and export flows between regions are thought to be directly related to the “mass” of their economies and inversely related to the “distance” between them

$$\text{Gravity} = G \left[\frac{(Mass_i \times Mass_j)}{(Distance_{ij})^2} \right]$$

Trade flow Model – “Mass”



IMPLAN commodity supply and demand by county

“

TradeFlow Model – “Distance”

