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**Some Procedures for Estimating Goods and Service
Trade Between Regions Using the
Trade Reports from IMPLAN**

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**Some Procedures for Estimating Goods and Service
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by

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Introduction

A common theme in policy discussions involving regional economic development is the economic linkage between the rural and urban areas of the regional economy. Such information is useful in understanding how resource policies that affect mainly the rural area can be expected to carry over into the urban economy and vice versa. In empirical models like inter-regional input-output models and inter-regional computable general equilibrium model it is essential to know the economic linkage between rural and urban regions in the form of inter-regional trade and factor flows.

This report describe several approaches to estimating inter-regional trade using the information produced in the IMPLAN Commodity Trade Report and the Commodity Summary Report. In other words, it is assumed that the counties in both the core and periphery regions have been identified and regional input-output accounts for each region have been constructed using IMPLAN Pro 2.0. The methodology uses the same procedures as described in the Praxis Trade Flow Analysis Users Manual (1991). The original procedures became inoperable because of changes in the Reports format in more recent versions of IMPLAN. Those procedures have now been updated to work with the current IMPLAN Pro 2.0 Trade Reports.

Terminology

Special terminology and abbreviations used in this paper are defined below:

Core - The Core region should represent the urban place and dominate the surrounding periphery in supplying higher ordered commodities to both core and periphery regions.

Periphery - The Periphery regions would be expected to have excess demand for the specialized commodities supplied by the core and be in excess supply of raw natural resources used by the core and other areas as intermediate inputs.

Functional Economic Area - The Functional Economic Area is defined as the combined economies of the Core and Periphery.

Total Commodity Imports (TCI) - The sum of competitive and non-competitive imports of a particular commodity.

Domestic Commodity Exports (DCE) - The amount of net commodity supply that is sold to domestic buyers outside the region.

Net Commodity Supply (NCS) - The total amount of a commodity available for consumption by industries or institutions.

Gross Regional Commodity Demand (GRCD) - The total regional demand for a commodity by both industries and institutions. This is the sum of gross intermediate demand plus regional final demand by institutions.

Some of these definitions were taken from the IMPLAN User's Manual. For a detailed description of how Total Commodity Imports, Domestic Commodity Exports, Net Commodity Supply, and Gross Regional Commodity Demand are calculated, refer to IMPLAN Professional Version 2.0 Users Guide, Analysis Guide and Data Guide, Chapter 12.

The Maximum Possible Trade Approach

This approach identifies the maximum possible trade between the core and periphery. The core exports and imports are the Domestic Commodity Exports and Total Commodity Imports, respectively, of the model defined by user to be the core region. The periphery exports and imports are the Domestic Commodity Exports and Total Commodity Imports, respectively, of the model defined by user to be the periphery region. The maximum exports from the core to the periphery are defined as the minimum of core exports and periphery imports of a particular commodity. The maximum periphery exports to the core are defined as the minimum of periphery exports of the commodity and core imports. For example, the data for the core and periphery regions found in the Trade Report are summarized in Table 1.

Table 1. Data from the Commodity Trade and Commodity Summary Reports For the Core and Periphery Regions

		CORE REGION			
CMDTY	NAME	NCS (MM\$)	GRCD (MM\$)	TCI (MM\$)	DCE (MM\$)
1	Dairy Farm Products	22.36	38.60	17.73	1.50

		PERIPHERY REGION			
CMDTY	NAME	NCS (MM\$)	GRCD (MM\$)	TCI (MM\$)	DCE (MM\$)
1	Dairy Farm Products	10.35	1.64	0.77	9.48

Table 2 is an example of the Maximum Possible Trade calculation.

Table 2. Example of Inter-regional Trade Using the Maximum Possible Trade Approach

MAXIMUM POSSIBLE TRADE REPORT

CMDT Y	NAME	CORE IMPORTS		CORE EXPORTS		PERIPH. IMPORTS		PERIPH. EXPORTS	
		From Per.	From US	To Per.	To US	From Core	From US	To Core	To US
1	Dairy Farm Products	9.48	8.25	0.77	0.73	0.77	0.00	9.48	0.00

The core is assumed to export and import from both the periphery and the rest of the US. Total core imports are 17.73 MM\$, but the maximum possible imports from the periphery are 9.48 MM\$ because periphery exports are only 9.48 MM\$ (Table 1). So the maximum possible import by the core from the periphery is 9.48 MM\$. (i.e., the minimum of core TCI and periphery DCE). Then core imports from the rest of the US must be 8.25 MM\$ (= 17.73 - 9.48)

The core is assumed to export to the periphery and the rest of the US. Since total core exports are 1.50 MM\$ and periphery imports are 0.77 MM\$ then maximum core exports to the periphery are 0.77 MM\$ (i.e., the minimum of core exports and periphery imports). That means that core exports the rest of the US are 0.73 MM\$ (= 1.50 - 0.77).

The periphery exports and imports from both the core and the rest of the US. By definition, core imports from the periphery must equal periphery exports to the core. In addition, core exports to the periphery must equal periphery imports from the core. In this case, the periphery imports a total of 0.77 MM\$ of Dairy Farm Products. The periphery is able to meet all its demand for Dairy Farm Products by imports from the core (Table 2).

The Supply-Demand Pool Approach

The approach assumes trade will only take place between two regions when one of the regions is in excess supply and the other region is in excess demand of a particular commodity. Excess supply is defined as net commodity supply being larger than gross regional commodity demand. Excess demand is defined as gross regional commodity demand exceeding net commodity supply. Ordinarily we would expect that the core would have an excess supply of higher ordered commodities in which it is specialized and an excess demand for natural resource based commodities that are used as intermediate inputs in resource processing or consumed by households. The periphery would be expected to have an excess supply of the natural resource commodities and an excess demand for higher ordered commodities.

The Supply-Demand Pool Approach determines only the levels of exports and assumes that trade will flow from the region of excess supply to the region of excess demand. The Supply-

Demand Pool Approach does not allow for transshipments between the core and periphery for a given commodity. If the core region has an excess demand for natural resource commodities and the periphery has excess supply of those commodities, then the expected trade would be from the periphery to the core. Likewise, if the periphery has an excess demand for higher ordered commodities and the core has excess supply, then the expected trade flow would be from the core to the periphery.

The Supply-Demand Pool Approach calculates the exports using three steps. The first step calculates the excess demand and supply of commodities from both the core and the periphery. The core's Net Commodity Supply and Gross Regional Commodity Demand are taken from the Commodity Trade and Commodity Summary reports for the core region. The periphery's Net Commodity Supply and Gross Regional Commodity Demand are likewise taken from the Commodity Trade and Commodity Summary reports for the periphery region.

The second step identifies the imports and exports of the core and the periphery (Domestic Commodity Exports and Total Commodity Imports, respectively)

Table 3 again summarizes the data for the core and periphery regions found in the Commodity Trade and Commodity Summary reports.

Table 3. Data from the Commodity Trade and Commodity Summary Reports For the Core and Periphery Regions

		CORE REGION			
CMDTY	NAME	NCS (MM\$)	GRCD (MM\$)	TCI (MM\$)	DCE (MM\$)
1	Dairy Farm Products	22.36	38.60	17.73	1.50

		PERIPHERY REGION			
CMDTY	NAME	NCS (MM\$)	GRCD (MM\$)	TCI (MM\$)	DCE (MM\$)
1	Dairy Farm Products	10.35	1.64	0.77	9.48

The final step calculates the exports between the core and periphery. If the core is in excess supply and the periphery is in excess demand, the core will export to the periphery **but** the periphery will not export to the core. If the periphery is in excess supply and the core is in excess demand, the periphery will export to the core **but** the core will not export to the periphery.

The Supply-Demand Pool Approach uses two different methods for determining these exports. The Strong approach uses the minimum of excess demand and excess supply to determine the export levels. The Weak approach first identifies whether the core exports to the periphery or the periphery exports to the core. If the core exports to the periphery, the exports are defined as the minimum of core exports and periphery imports. If the periphery exports to the core, the exports are defined as the minimum of the periphery exports and the core imports.

The Strong Approach

The core has excess demand for Dairy Farm Products of 16.21 MM\$ (= 38.60 - 22.36). The periphery has an excess supply of 8.71 MM\$ (= 10.35 - 1.64). Since the core has an excess demand and the periphery has an excess supply, the periphery will export to the core **but** the core will not export to the periphery. Table 4 is an example of the report generated for the Strong Supply-Demand Pool Approach:

Table 4. Example of Inter-regional Trade Using the Strong Supply-Demand Pool Approach.

STRONG SUPPLY-DEMAND POOL APPROACH

CMDT Y	NAME	CORE IMPORTS		CORE EXPORTS		PERIPH. IMPORTS		PERIPH. EXPORTS	
		From Per.	From US	To Per.	To US	From Core	From US	To Core	To US
1	Dairy Farm Products	8.71	9.02	0.00	1.50	0.00	0.77	8.71	0.77

Under the Strong approach, the core would import as much of the periphery's excess supply as possible to satisfy its excess demand. In this case, the core would import all the periphery's excess supply. Since the core imports a total of 17.73 MM\$ of Dairy Farm Products and of that it imports 8.71 MM\$ from the periphery, the core must import 9.02 MM\$ (= 17.73 - 8.71) from the rest of the US. By definition, the core would not export any of this commodity to the periphery. Therefore, all of the core's exports of this commodity will be to the rest of the US.

Since core exports to the periphery must equal periphery imports from the core, the periphery imports from the core would be 0.00 MM\$. Therefore, the imports of this commodity by the periphery must come from the rest of the US. Since core imports from the periphery must

equal periphery exports to the core, periphery exports to the core are 8.71 MM\$. Since total periphery exports of this commodity are 9.48 MM\$, the periphery must export 0.77 MM\$ (= 9.48 - 8.71) of this commodity to the rest of the US.

The Weak Approach

Table 5 is an example of the report generated for the Weak Supply-Demand Pool Approach:

Table 5. Example of Inter-regional Trade Using the Weak Supply-Demand Pool Approach.

WEAK SUPPLY-DEMAND POOL APPROACH									
CMDT Y	NAME	CORE IMPORTS		CORE EXPORTS		PERIPH. IMPORTS		PERIPH. EXPORTS	
		From Per.	From US	To Per.	To US	From Core	From US	To Core	To US
1	Dairy Farm Products	9.48	8.25	0.00	1.50	0.00	0.77	9.48	0.00

The Weak approach first identifies whether the core exports to the periphery or the periphery exports to the core. Since the periphery exports to the core, the maximum periphery exports to the core are defined as the minimum of the periphery exports and the core imports, namely 9.48 MM\$ (see Table 3). Therefore the core imports 9.48 MM\$ of this commodity from the periphery. Since the total core imports of this commodity are 17.73 MM\$, the core must import 8.25 MM\$ (= 17.73 - 9.48) from the rest of the US. By definition, the core will not export any of this commodity to the periphery. Therefore, all the core exports of this commodity must be to the rest of the US. Since core exports to the periphery must equal periphery imports from the core, the periphery must import 0.77 MM\$ from the rest of the US. Since core imports from the periphery must equal periphery export to the core and the periphery total exports are 9.48 MM\$, the periphery will not export any of this commodity to the rest of the US.

The Three Region Approach

This approach uses the trade information from the core, periphery, and the functional economic area to estimate trade between the core and periphery. The functional region is simply the sum of core and periphery regions. A separate model is estimated in IMPLAN for the functional region.

The approach is based on the idea that if the exports from each of the three regions are known, the exports between the core and periphery can be estimated as a residual after exports out of the combined region have been estimated.

This approach is similar to the Supply-Demand Pool approach in that it assumes that trade will only take place between two regions when one of the regions is in excess supply and the other region is in excess demand of a particular commodity.

The Three Region Approach calculates the exports using three steps. The three steps are best examined using an example. Table 6 contains the data from the Trade Reports of the core, periphery and functional economic area.

Table 6. Data from the Commodity Trade and Commodity Summary Reports For the Core, Periphery Regions and Functional Economic Area.

CORE REGION					
CMDTY	NAME	NCS (MM\$)	GRCD (MM\$)	TCI (MM\$)	DCE (MM\$)
1	Dairy Farm Products	22.36	38.60	17.73	1.50

PERIPHERY REGION					
CMDTY	NAME	NCS (MM\$)	GRCD (MM\$)	TCI (MM\$)	DCE (MM\$)
1	Dairy Farm Products	10.35	1.64	0.77	9.48

FUNCTIONAL ECONOMIC AREA					
CMDTY	NAME	NCS (MM\$)	GRCD (MM\$)	TCI (MM\$)	DCE (MM\$)
1	Dairy Farm Products	32.71	40.24	13.83	6.30

The first step calculates the excess demand and supply of commodities from the core, the periphery and the functional economic area. In this example the core has an excess demand for the commodity of 16.24 MM\$ (= 38.60 - 22.36). The periphery has an excess supply of the commodity of 8.71 MM\$ (= 10.34 - 1.63). The functional economic area has an excess demand for commodity of 7.53 MM\$ (= 40.24 - 32.71).

The second step identifies the imports and exports of the core and the periphery (Table 6). Core exports and imports are Domestic Commodity Exports of 1.50 MM\$ and Total Commodity Imports of 17.73 MM\$, respectively. The periphery exports and imports are the Domestic Commodity Exports of 9.48 MM\$ and Total Commodity Imports of 0.77 MM\$, respectively. The functional economic area exports and imports are the Domestic Commodity Exports of 6.30 MM\$ and Total Commodity Imports of 13.83 MM\$, respectively.

The final step calculates the exports between the core and periphery. If the exports from

the functional economic area (i.e., 6.30 MM\$) are less than the sum of exports from the core and periphery (i.e., 10.98 MM\$ = 1.50 + 9.48), this implies that the core must have exported to the periphery and the periphery must have exported to the core to account for the additional exports associated with the core and periphery total. These interregional exports (i.e., 4.68 MM\$ = 10.98 - 6.30) must be accounted for by core exports to the periphery plus periphery exports to the core. If the interregional exports equal zero (i.e., the exports from the functional economic area are equal to the sum of the exports from the core plus the periphery), this implies that all the exports from the core and periphery were shipped outside the functional economic area. In other words there would be no core exports to the periphery and no periphery exports to the core.

Cases could arise where the interregional exports are less than zero (i.e., the exports from the functional economic area are greater than the sum of the exports from the core plus the periphery). Currently, the best explanation of this anomaly is that the underlying data are inconsistent and/or IMPLAN miscalculates the trade flows. IMPLAN calculates the trade flows using Regional Purchase Coefficients (RPC). If exports from the functional economic area are greater than the sum of exports from the core plus the periphery the three region trade flow procedure described in this paper will not work. The user should then examine the data and calculations used by IMPLAN. External data sources should be used to check and modify the data or the RPCs. The trade flow table generated for The Three Region Approach contains an additional column labelled "Negative Interregional Exports". If interregional exports are negative for a commodity then an "*" will appear in this column.

The basic rule in determining the exports is that if one region has an excess supply and the other has an excess demand then the interregional exports flow from the region with excess supply to satisfy the other region's excess demand. For example, the core has an excess demand for Dairy Farm Products and the periphery has an excess supply of the same commodity. Therefore in this example, the periphery exports this commodity to the core. The interregional exports of 4.68 MM\$ are the core imports from the periphery and the periphery exports to the core (see Table 7).

Table 7. Example of Inter-regional Trade Using the Three Region Approach.

THE THREE REGION APPROACH

CMDT NAME Y	CORE IMPORTS		CORE EXPORTS		PERIPH. IMPORTS		PERIPH. EXPORTS		Negative Interregional Exports
	From Per.	From US	To Per.	To US	From Core	From US	To Core	To US	
1 Dairy Farm Products	4.68	13.05	0.00	1.50	0.00	0.77	4.68	4.80	

Since the total domestic imports of this commodity by the core are 17.73 MM\$, the core

must import 13.05 MM\$ (= 17.73 - 4.68) from the rest of the US. By assumption, the core does not export any of this commodity to the periphery. Therefore, the core's exports of this commodity (i.e., 1.50 MM\$) would be to the rest of the US. Periphery imports from the core are 0.00 MM\$, since core exports to the periphery equal periphery imports from the core. Therefore, the periphery's imports of this commodity (i.e., 0.77 MM\$) must come from the rest of the US. Core imports from the periphery must equal periphery exports to the core. Since total domestic exports of this commodity by the periphery are 9.48 MM\$, the periphery would export 4.80 MM\$ (= 9.48 - 4.68) to the rest of the US. Note, the total domestic exports from the functional economic area, 6.30 MM\$, are the sum of core exports to the US and periphery exports to the US.

Summary

The previous discussion describes four different methods that may be used to estimate inter-regional trade flows using the regional input-output account reports that are generated from IMPLAN Pro 2.0. For goods and services that are specialized and would be expected to trade nationally and internationally it may be appropriate to use the three region approach. For central place type goods where considerable one way trade is expected it may be appropriate to use the supply-demand pool approach. The maximum trade approach is most useful to simply get an idea of the maximum extent that trade could take place given the constraints on trade placed on regional supply and demand from the input-output equations.

Appendix

Special terminology used in this paper is defined below:

Core - The Core region should represent the urban place and dominate the surrounding periphery in supplying higher ordered commodities to both core and periphery regions.

Periphery - The Periphery regions would have excess demand for the specialized commodities supplied by the core and be in excess supply of raw natural resources used by the core and other areas as intermediate factor requirements.

Functional Economic Area - The Functional Economic Area is defined as the combined economies of the Core and Periphery.

Total Commodity Imports (TCI) - The sum of competitive and non-competitive imports of a particular commodity.

Domestic Commodity Exports (DCE) - The amount of net commodity supply that is sold to domestic buyers outside the region.

Net Commodity Supply (NCS) - The total amount of a commodity available for consumption by industries or institutions.

Gross Regional Commodity Demand (GRCD) - The total regional demand for a commodity by both industries and institutions. This is the sum of gross intermediate demand (total demand from endogenous as well as exogenous industries) plus final demand by institutions net of foreign exports.

Some of these definitions were taken from the MicroIMPLAN Software User's Manual. For a detailed description of how Total Commodity Imports, Domestic Commodity Exports, Net Commodity Supply, and Gross Regional Commodity Demand are calculated, refer to IMPLAN Professional Version 2.0 Users Guide, Analysis Guide and Data Guide, Chapter 12.