IO-Snap

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The IO-Snap Crosshauling Adjustment Mechanism

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Abstract. Nearly all rows-only input-output (IO) regionalization methods fail to account for, or in some cases effectively eliminate the possibility that a commodity can be imported into and exported from a given region during the same time period, a phenomenon known as cross-hauling. Unlike most other IO software, IO-snap uses a supply-demand pooling approach to national accounts regionalization. In addition to its greater data intensity, the inability to deal with cross hauling has been perhaps the most severe criticism of the supply-demand pooling method for regionalizing national tables. However, Jackson's (1998) approach to regionalizing CxI national IO accounts introduced a mechanism for building crosshauling into the supply-demand pooling approach. This Technical Document describes the mechanism used for this purpose in the IO-Snap software.

1 Preliminaries: Common Notation

IO-Snap follows the notational conventions of the commodity-by-industry input-output accounting framework shown in Figure 1, adapted from United Nations (1968).

Figure 1: The Commodity-Industry Framework

	Commodities	Industries	Final Demand	Totals
Commodities		U	e	q
Industries	V			g
Primary Inputs		va		
Totals	q’	g’		

- U = the *Use* table: row commodities used by column industries
- V = the *Make* table: column commodities produced by row industries
- e = column final demand activities use of row commodities
- q = column vector of total commodity use
- g = column vector of total industry output
- va = column industry payments to row value added components, typically compensation, payments to governments, and gross operating surplus
- **i** is a summing vector of appropriate dimension
- $'$ indicates transpose
- ˆ indicates diagonalization
- i, j => row and column sector subscripts. When used in combination, subscripts denote a from–to relationship, e.g., $z_{i,j}$ denotes a flow from source i to destination j
- r, s, N => superscripts denoting regions r and s, or national variables, N. When used in combination, superscripts denote origin and destination regions, e.g., z^{rs} denotes a flow from region r to region s

2 Regional Interindustry Accounts

As a point of reference, we begin with the general foundations for regionalizing interindustry IO accounts. Traditional regionalization methods in industry-by-industry space rely on the concept of regional supply percentages (RSP) that express a region's ability to satisfy its own demands. If we assume zero re-exports (exported imports) and let A be the matrix of interindustry direct requirements coefficients, where z_{ij} denotes industry j purchases from industry i and $a_{ij} \in A = \frac{z_{ij}}{X_j}$, regional output for *export* demand can be expressed as

$$(I - \hat{P}A)^{-1}E \tag{1}$$

and regional output for *regional* demand will be

$$(I - \hat{P}A)^{-1}\hat{P}(C + I + G), \tag{2}$$

where variables C, I, and G are regional consumption, investment, and government expenditures by industry, and regional supply percentages, P, are defined by

$$P = (\widehat{X - E + M})^{-1}(X - E). \tag{3}$$

Variables E, M, and X are regional industry exports, imports, and output, respectively. The complete regional industry output balance equation, combining equations 1 and 2 can now be expressed as

$$X = (I - \hat{P}A)^{-1}(\hat{P}(C + I + G) + E), \tag{4}$$

which establishes the fundamental accounting relationships that form the basis of the standard interindustry impacts formulation,

$$\Delta X = (I - \hat{P}A)^{-1}[\hat{P}\Delta(C + I + G) + \Delta E] \tag{5}$$

Equation 5 might be useful for some in clarifying an area of common confusion in application, namely when and how to modify demands by RSP; they should modify all but export final demand. The confusion arises in part due to a tendency in many presentations to focus only on *components* of equation systems, e.g., coefficients matrices, multiplier matrices, and so on, without placing them in the context of the complete accounting systems equations. In the following section, we shift the focus to open regional economies and corresponding commodity by industry (CxI) accounts and regionalization methods.

3 IO Regionalization Methods and Crosshauling

Nearly all rows-only IO regionalization methods fail to account for, or in some cases effectively eliminate the possibility that a commodity can be imported into and exported from a given region during the same time period, a phenomenon known as cross-hauling. Kronenberg's (2009) CHARM method is perhaps the most notable exception, but Jackson and Court (2015) report some remaining conceptual issues that accompany CHARM.

In addition to its greater data intensity, the inability to deal with cross hauling has been perhaps the most severe criticism of the supply-demand pooling method for regionalizing national tables. However, Jackson's (1998) approach to regionalizing CxI national IO accounts introduced a mechanism for building crosshauling into the supply-demand pooling approach.

3.1 Supply-Demand Pooling

In the supply-demand pooling method, total regional production is compared to total regional demand by industry or by commodity. This is generally accomplished in two parts, as discussed in Jackson (1998). One part identifies intermediate demand by applying national technical coefficients to estimates of industry output, and the other focuses on the estimation of regional final demands. With total demands and total supply in hand, excess and deficit production by industry or commodity can be identified. Where supply exceeds demands, the excess output is added to exports and, where demand exceeds supply, the deficit is added to imports.

This method clearly omits any consideration of crosshauling, implying that local production first satisfies local demand and only then becomes available for export. Likewise, only when demand exceeds production will product be imported. Initial imports and exports estimates thus reflect a no-crosshauling situation.

3.2 Crosshauling Adjustments

Crosshauling that does take place adds the same value to imports and to exports. In the absence of empirical research to estimate commodity-specific crosshauling, we need some means of estimation. Conceptually, crosshauling is expected to increase as regional production increases, and also to increase with initial, zero crosshauling exports estimates that only arise when supply exceeds demands. In the IO-Snap regionalization process, we have arrived at what has proven to be a workable approach to generating initial crosshauling estimates, consistent with these conceptual expectations. We also provide direct access to analysts who wish to modify the IO-Snap default crosshauling estimates.

Let crosshauling for commodity i be defined as

$$\chi_i = (ChRatio)(\alpha q_i^R + (1-\alpha) ex_i^R) \tag{6}$$

In this default equation, ex_i^R is the no-crosshauling estimate of regional commodity exports and q_i^R the column sum of the regional Make matrix. Based solely on simulation and experimentation, default values of $ChRatio = \alpha = 0.1$ have been assigned. As noted, IO-Snap enables the user to modify crosshauling estimates directly. This direct modification can be implemented in two ways. First, the global control value of $ChRatio = 0.1$ can be modified in the preferences dialog. Second, individual estimates by commodity can be directly edited to result in superior data crosshauling values that might be known to the analyst.

Note that while the IO-Snap default values for parameters $ChRatio$ and α apply to all commodities, the ratio of crosshauling to regional output varies substantially.

4 Future Developments

A thorough analysis of state-to-state trade flow data is underway. The data are limited to a subset of IO-Snap commodities, and few one-to-one relationships between commodity codes and BEA summary sectors can be established. Nevertheless, these data should allow us to derive relationships that correspond to lower bound estimates for several commodities, and should provide additional information for generalizing to sectors for which data are lacking. The result is expected to be a significant improvement over the current relationships that are not based on empirical data.

References

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