

Chapter 12

Services trade data

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12.1 Introduction

This document explains the data sources and the procedures used to construct the bilateral trade matrices for trade in nonfactor services, and the vector of margins exports, for version 3 of the GTAP data base.

The six nonfactor services sectors in version 3 of the GTAP data base are shown in table 12.1.

Table 12.1 Nonfactor services sectors in version 3 of the GTAP data base

Number	Code	Description
32	egw	Electricity, gas, and water
33	cns	Construction
34	t_t	Trade and transport
35	osp	Other services private
36	osg	Other services (government)
37	dwe	Ownership of dwellings

We treat ownership of dwellings as a non-tradable sector. The trade matrix for this sector thus reduces to an array of zeroes. Trade in electricity, gas, and water is very thin and the bilateral trade matrix is directly adopted from the source data. Less than 3 percent of the cells in this trade matrix

are associated with nonzero flows. This note thus explains the data sources and the procedures used in the construction of trade matrices for the remaining four nonfactor service sectors and the vector of margins exports.

12.2 Data Sources

Table 12.2 summarizes the name of the data source, the type of data contained in the source, and the GTAP data that was created from the data source(s).

Table 12.2 Data sources for trade in services in version 3 of the GTAP data base

Data Source	Type of Data	GTAP Data
1 Mark Gehlhar	Bilateral trade matrix for Electricity, gas, and water	Bilateral trade matrix for Electricity, gas, and water
2 World Bank Country Tables - Socioeconomic Time Series Access and Retrieval System (STARS), 1988-1993	Nonfactor Service Receipts (US\$, BOP), by Country Nonfactor Service Payments (US\$, BOP), by Country	Total Exports of Nonfactor Services, by GTAP region Total Imports of Nonfactor Services, by GTAP region
3 Michigan Model services trade data base	Bilateral Services Trade Matrices for five services sectors for 35 countries/regions	Initial estimates of the matrix elements for the matrix balancing procedure
4 Regional Input Output tables in versions 2 and 3 of the GTAP data base	Exports by Sector and Imports by Sector and by Usage	Export and import shares of service sectors, by GTAP region
5 Merchandise trade data (f.o.b. and c.i.f. arrays) in version 3 of the GTAP data base	Global Exports of Margins	Margins Exports by GTAP region

12.3 Procedures

We describe first the construction of the bilateral trade matrices, then the construction of the margin services vector.

Construction of bilateral trade matrices for sectors 33, 34, 35, and 36

We proceed with the construction of the bilateral trade matrix by sector. We thus have *one* array of size 30¹ by 30 for each service sector. An entry (cell) in this array represents the exports of service sector *i* from source region *r* (row) to destination region *s* (column), valued at f.o.b. prices, and measured in millions of 1992 US dollars. It also represents the value of imports of service sector *i* by destination region *s* from source region *r*, valued at c.i.f. prices, and measured in the same units.

The essence of this is that there is only *one* array of size 30 by 30 associated with each service sector (unlike merchandise trade data, where each merchandise sector is associated with *two* trade arrays, one valued at f.o.b. prices and the other valued at c.i.f. prices). This implies two important issues underlying trade in nonfactor services: zero margins — services are traded with zero freight costs, and free trade — services trade is free from any import or export intervention.

We justify this treatment of nonfactor service trade on the grounds that there are no primary source data available globally for trade in nonfactor services characterized by *both* sectoral detail and bilateral detail. The trade matrix is therefore constructed using a mathematical procedure (RAS — a constrained iterative matrix balancing algorithm). There is no basis, therefore, to incorporate freight costs *or* policy interventions. The availability of better quality data on services trade on a global basis would make it possible, in the future, to improve upon the existing procedures.

As an illustration, we explain the construction of the trade matrix for service sector "construction" in the following. A similar procedure is adopted for constructing trade arrays for "trade and transport", "other services private", and "other services government". This procedure involves using the regional Input-Output (I-O) tables to introduce sectoral detail and using the balancing algorithm to introduce bilateral detail in the source data for nonfactor service trade totals.

Compute services trade shares, by sector

The regional I-O tables contain information on exports by sector, and imports, by usage and by sector. Export (Import) share of service sector *i* in total exports (imports) of all services are computed for each region. Total exports are obtained by summing exports across sectors 32 through 37. Total imports are obtained by summing across the four use categories for each sector and then summing across sectors 32 through 37.

1. This is the number of disaggregate regions in version 3

Compute target totals for services trade, by sector (introduce sectoral detail)

The World Bank source data² contain the total exports and total imports of nonfactor services for 207 countries, measured in U.S.dollars, for the years 1988 through 1993. We select the trade data for the year 1992, which is the reference year for the data base. Missing observations are replaced by the most recent non-zero observation. The countries in the source data are mapped into the 30 GTAP regions in version 3. Using the country mapping, nonfactor service export (import) totals are obtained for the 30 GTAP regions, in millions of 1992 U.S.dollars.

The total exports (imports) of sector i by source (destination) region r is obtained as a product of the share of sector i in total exports (imports) of all services from the regional I-O table and the nonfactor service export (import) totals. These derived sectoral export and import totals thus form the targets to be attained by the trade matrix for sector i . Total exports (imports) by source (destination) region r constitute the target row (column) totals in the trade matrix for service sector i . To resolve the inconsistency between the sum of the derived row totals and the sum of the derived column totals, we compute a target matrix total.³ These three targets — vector of row totals, vector of column totals, and the scalar matrix total — are used as inputs in the RAS procedure to produce a balanced matrix.

Construct services trade matrices, by sector (introduce bilateral detail)

The balanced trade matrix is constructed using the RAS algorithm using initial estimates for the matrix elements to achieve the targets for row totals, column totals, and matrix total.

The trade matrices from the Michigan data base, after concordance with GTAP sectors and regions, form the initial estimates matrix. The Michigan data base for services trade consists of 5 arrays of size 35 by 35. The five services sectors in the Michigan data base are mapped into the GTAP service sectors using a simple sectoral mapping rule as shown below:

Table 12.3 Mapping from Michigan to GTAP service sectors

Michigan Sector Number	Michigan Sector Name	GTAP Sector Code
5	Construction	Construction
6	Wholesale and retail trade	Trade and transport
7	Transport storage and communication	Trade and transport
8	Finance, insurance, and real estate	Other services

2. Taiwan's nonfactor services trade data are obtained from Central Bank of China, Taipei, Taiwan, R.O.C., "Financial Statistics, Taiwan District, The Republic of China," February 1994.

3. The target matrix total is the geometric mean of world exports and world imports for sectors cns, osp, and osg. For t_t, we take the minimum of world exports and world imports. By assumption, the source data for exports include trade and transport margin services, while the source data for imports exclude them. We set the target matrix total equal to the sum of the import estimates.

The 35 regions in the Michigan data base are mapped into the 30 GTAP regions using again a regional mapping rule. Fourteen single country regions — Australia, Argentina, Brazil, Chile, Canada, Hong Kong, India, Japan, Mexico, New Zealand, Korea South, Singapore, Taiwan and United States — map directly into their corresponding GTAP regional counterparts. Eleven⁴ countries of the European Union (12) map into the counterpart region, E_U, in GTAP. Three countries — Austria, Sweden, and Finland — map into the corresponding GTAP region EU3. Two countries — Norway and Switzerland — map into the GTAP region EFT. Two countries — Colombia and Venezuela — map into the GTAP region RSM. The remaining three countries including the composite region, ROW, are mapped into a new composite region in GTAP. We thus obtain a direct mapping for eighteen of the 30 GTAP regions. The trade for the remaining twelve GTAP regions that are not mapped is obtained using a rather complicated sharing out rule to share out the trade of the composite new GTAP region. A complete 30 by 30 array is thus obtained for the construction sector, which constitutes the initial values for the elements in the bilateral trade matrix for construction. The trade and transport array is similarly produced. The other services array is used as initial estimates for both other services private and other services government.

The RAS procedure uses the initial estimates for the matrix elements to meet the target row totals, the target column totals, and the target matrix total, thus producing a balanced matrix⁵. We rescale the target row totals and the target column totals so that they are consistent with the target matrix total. RAS is an iterative procedure and the process is complete when the targets have been met. It is conceivable that the balanced trade matrix output by the RAS procedure contains very small (in absolute value) negative numbers and nonzero diagonals. Negative elements in a trade matrix make no sense and are zeroed out. The diagonals in the matrix are selectively zeroed out for regions where intra-regional trade makes no sense either. Such regions include the 19 single country-regions, the European Union, and the former Soviet Union.

Construction of a Vector of Margins Exports

The sector trade and transport in GTAP consists of both margins (shipping services or freight costs) and nonmargins (other transport and retail trade) components. The trade matrix for trade and transport constructed above consists of only the nonmargins component, by assumption. The margins component of trade and transport forms the vital task of balancing global exports (c.i.f.

4. The composite region “Belgium and Luxembourg” in the Michigan data base maps into the individual countries “Belgium” and “Luxembourg” that make up the composite GTAP region E_U.

5. The presence of zeroes in the matrix elements or target totals is known to cause some numerical problems. We therefore “smear” such entries by replacing them with a small positive number, without affecting the target matrix total. The targets for the row and column totals are rescaled to make them consistent with the target matrix total.

value) with global imports (f.o.b values). Global exports of margins (a single number) is derived as the difference between global merchandise imports and global merchandise exports. The global value of imports (exports) is the element sum of the version 3 merchandise trade arrays valued at c.i.f (f.o.b.) prices for GTAP sectors 1 through 31 in the GTAP data base. The global margins exports is shared out across the 30 regions in the version 3 GTAP data base using the share of nonmargins exports of a region in the global exports of nonmargins exports. (This is the share of each row total in the element total of the trade and transport matrix.).