15.E

Services Trade Data

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This chapter covers the preparation of several services trade data sets, used in constructing the GTAP Data Base.

15.E.1 Introduction

We document here the preparation of four services trade data sets, covering non-margin services, margin services usage, margin services supply, and travelers' expenditures. The data adjustments for Hong Kong and the Netherlands' re-exports which also have some service aspects, are covered in chapter 15.C; the construction of the modal shares estimates (used in constructing the margin services data set; see below) is described in chapter 15.D.

In terms of the GATS modes, the travelers' expenditures data set corresponds to the GATS mode "consumption abroad", and the non-margin services data set to "cross-border supply" and "temporary presence of natural persons". The margin services data sets deal with international freight transport, which does not fit well within the GATS modes. The fourth GATS mode "commercial presence" is not covered.

The data sets whose construction we describe here all use the GTAP sectoral classification and the GTAP standard country classification (chapter 8). For non-margin services and travelers' expenditures, they comprise collections of bilateral trade matrices; for margin services we do not provide bilateral trade data but separate usage and supply arrays, as discussed further below. The non-margin services data cover all GTAP service commodities except for electricity, gas, water, and ownership of dwellings. Electricity is covered in the merchandise trade data (chapter 15.B); international trade in gas, water, and ownership of dwellings is assumed to be non-existent. The margin services data set covers the three GTAP transport commodities (water, air, other). The travelers' expenditures data set covers all GTAP commodities except for ownership of dwellings.

The main data source is IMF balance of payments statistics data as of September 2003 (IMF 2003), as supplied in CD-ROM version 1.1.85. For margin services, we also use the modal shares estimates (chapter 15.D) and the merchandise trade data (chapter 15.B). The merchandise trade data are relevant because they contain two values for each merchandise trade flow, one at *fob* prices and one at *cif*. The difference between these two valuations must equate to the sum of the margins on the flow. The task then is to deal with any internal problems in the balance of payments statistics data set, to convert it to a GTAP-compatible structure, and to reconcile it with the other data sources.

The IMF source data cover many but not all of the GTAP standard countries. We discuss the filling in of missing countries in section 15.E.3.

Our problems in using the balance of payments statistics data set include:

— internal inconsistencies and missing data (discussed further in section 15.E.2),

— the treatment of travelers' expenditures, and

— the treatment of margin services.

"Travelers' expenditures" includes spending abroad by tourists, people working overseas for short periods, and the like. The balance of payments statistics treat these expenditures as a single services commodity. But to fit in with the I-O accounting framework in the GTAP Data Base, we need to resolve them into the standard GTAP commodities; so if a traveler abroad buys a T-shirt or a train ticket, we treat the expenditure as trade in apparel or in "other transport", not in "travelers expenditures".

In processing the services trade data we follow a general principle that applies across the whole data base construction process, that before combining data sets from different sources, we extend each data set to cover the complete list of GTAP standard countries. Another principle specific to this area, is that where the services trade data and the merchandise trade data are in conflict, we adjust the services trade data to agree with the merchandise trade data. This is because, at the relevant level of detail, we consider the merchandise trade data to be more firmly based.

The work to be done falls into several parts:

— remove any internal defects in the services trade source data, and prepare preliminary data sets for margins services trade, non-margin services trade, and travelers' expenditures (section 15.E.2),

— fill in missing countries (section15.E.3), to expand the country coverage to the GTAP standard country list,

— apportion travelers' expenditures across commodities (section 15.E.4),

— construct and balance the margin services usage data set (section 15.E.5), and

— balance the margin services supply data (section 15.E.6).

That done, we collect the various trade data sets into a single data set, and aggregate from countries to GTAP regions. We discuss that in chapter 15.A, since the boundaries between services and merchandise trade are somewhat blurred (for example, much of travelers' expenditures ends up looking like merchandise trade), and since the aggregation step is common to both services and merchandise trade.

15.E.2 Preparing the Initial Data Sets

As discussed above (section 15.E.1), our task here is to prepare from IMF balance of payments statistics, preliminary data sets for non-margin services, margin services, and travelers' expenditures.

For our purposes, the IMF data set has several major advantages: it covers a large set of countries; the commodity classification is more than adequately detailed; it covers the GTAP 6 reference year, 2001. As always, there are also various disadvantages: it provides no bilateral detail, its treatment of travelers' expenditures is incompatible with GTAP's, it is non-uniform, in that there is a great deal of variation between countries in the level of commodity detail provided, it is subject to missing reports (that is, not all countries report for all years), and there are some internal inconsistencies (data reported for a more detailed level of commodity classification do not always agree with the corresponding data at a less detailed level).

The data set covers many years, from 1945 to 2002 (with data very scarce in the early years), but we extract just 1995 to 2001. Of these, we use mostly just 1997 to 2001; the two earlier years are used only in calculating moving averages to remove negative flows, as described below. In extracting multiple years, we aim to use reports from earlier years to fill in missing reports for later years.

The IMF defines 198 country codes. Some of these are for groups of countries, such as "Euro Area", "Europe" or "Developing Countries". Deleting these, we find 185 codes that match closely to standard GTAP countries. These are almost but not quite as disaggregated as the GTAP countries; the most significant difference is that Belgium and Luxembourg are combined.

The data set covers many service commodities, in a hierarchical system, with data very scarce for some of the detailed commodities. At the top is a single "services" commodity; beneath that are eleven first-level commodities such as "transportation", "travel", and "communications"; and some of these are divided in turn into second- and third-level commodities. For example, the first-level commodity "other business services" is divided into three second level commodities, merchanting, operational leasing, and miscellaneous; and "miscellaneous" is subdivided into legal, advertising, research, and so on.

For transportation, there are in principle two cross-cutting classifications. The first-level commodity "transportation" is subdivided in two different ways, by function and by mode. By function it is divided into passenger, freight, and other; by mode, into sea, air, and other. (It is because of these two complementary second-level systems that we describe the overall system as almost rather than strictly hierarchical.) Then cross-classifying these there are nine third-level commodities, from "passenger transport by sea" to "other"-mode other transport". In practice, we find data scarce for the mode classification, but abundant for the functional classification and the mode-by-function cross-classification. For simplicity, we ignore the few modal classification observations that are available, and use just the functional and mode-by-function data.

Not all the IMF commodities map into the GTAP framework. "Travel" refers to travelers' expenditures, and as discussed above (section 15.E.1) this needs to be mapped to the commodities

that travellers actually purchase. “Royalties and license fees” are, in the GTAP framework, not a trade flow but an income flow. We keep royalties in the data set, however, until we have completed initial data filling and balancing.

Much of this detail is unnecessary for the GTAP sectoral classification, and, as noted above, data are scarce for many of the more detailed commodities. We extract data for 27 commodities, as listed in table 15.E.1, from various levels of the hierarchical classification, so that less detailed data may be used where more detailed data are unavailable.

Table 15.E.1 Service Commodities Extracted from IMF BOP Data

200	Services			
	205	Transportation		
		850	Passenger transportation	
			207	Sea passenger transportation
			211	Air passenger transportation
			215	Other passenger transportation
		851	Freight transportation	
			208	Sea freight transportation
			212	Air passenger transportation
			216	Other passenger transportation
		852	Other transportation	
			209	Other sea transportation
			213	Other air transportation
			217	Other transportation
	236	Travel		
	245	Communications		
	249	Construction		
	253	Insurance		
	260	Financial		
	262	Computer and information		
	266	Royalties and license fees		
	268	Other business services		
		269	Merchanting and other trade-related	
		272	Operational leasing services	
		273	Miscellaneous business, professional, and technical services	
	287	Personal, cultural and recreational		
	291	Government, not included elsewhere		

There is a good deal of inconsistency in reporting between countries, so that not all countries report for all years or for all commodities. So, for example, 131 countries report total services exports for our reference year, 2001, 140 for 2000, 147 for 1999. For the more detailed category “transport services”, we have slightly fewer reports, 127 for 2001, 137 for 2000, and 143 for 1999; for the still more detailed category “passenger transport services”, we have many fewer, 102, 106, and 111 respectively.

Since data may be reported at multiple levels, the question arises whether data reported at different levels are consistent. For example, for the countries that report both total transport services and the separate categories of passenger, freight, and “other” transport, is trade in “transport services”

equal to the sum of “passenger”, “freight”, and “other” services”? We find that, with very few exceptions, the data are consistent across levels.

Finally there are some negative flows. These occur mainly in insurance, where the value of trade is calculated as premiums less payouts, so that when payouts exceed premiums, the reported value is negative. A few negative flows are also encountered in category 269, “merchanting and other trade-related”, and a few randomly scattered about the commodity classification. From the IMF documentation, it appears that negative reports are legitimate for insurance and merchanting, but not elsewhere. The initial negative report count is:

	export	import
insurance	17	12
merchanting	9	0
other	11	6

On the hypothesis that the negative flows reflect extraordinary variations in returns in individual years, we calculate cross-year moving average flows. We do this for insurance and merchanting in all countries, and for other commodities for just those countries where negative flows occur. We smooth at the most detailed level at which data are available. This reduces the negative flows to the following count:

	export	import
insurance	7	10
merchanting	5	0
other	7	2

All remaining negative entries are then purged from that data set. That is, they are treated as missing values. Furthermore, wherever a lower-level commodity is deemed missing, so are the corresponding higher level commodities. So, for example, if insurance is deemed missing, so likewise is total services.

At this point, we discard data for the first two years of the initial range, 1995 and 1996. We then purge from the data set all countries for which no reported data remain, for the truncated year range 1997 to 2001. Of the 185 country codes initially extracted, we have data for just 153.

Next we fill in missing values, where possible, from the data set itself. We use an entropy-based approach. Consider just services exports, and just the first level service commodities, that is, the commodities which come immediately under the general “services” heading, “transportation”, “travel”, and so forth. The corresponding data form an array of rank three, indexed by country, year, and commodity, with some entries present and some missing. If all the data were present, we could extract as much pattern as possible from the data by constructing the minimum-entropy array that agreed with the data array for all marginal subtotals.

This array, the *pattern array*, would have the same array total as the data array. It would also have the same rank 1 totals. That is, summing over years and commodities, it would have the same totals for each country; summing over countries and commodities, it would have the same total for each year; summing over countries and years, it would have the same total over each commodity.

Finally it would also have the same rank 2 totals. That is, summing over commodities, it would have the same total for each (country, year) pair, and so forth.

Each individual element of the pattern array may be considered as the product of seven factors. One is an array-wide factor that applies to all elements in the array. There are also a country-specific, a year-specific, and a commodity-specific factor. Finally, there are factors specific to the year-by-commodity, country-by-commodity, and country-by-year pairs. Each factor may be regarded as an instrument to force the pattern array to match the corresponding data array subtotal. Thus the country-specific factor reflects the relative sizes of countries in the data set, the year-by-commodity factor reflects the typical pattern of trade by commodity and year, averaged over countries, and so on. These factors are derived from the same construction process as the pattern array itself.

Thus each element in the pattern array reflects a great deal of information from the data array: the scale of the country, year and commodity it represents, the typical pattern of trade by commodity and country, averaged across years, the evolution through time of total trade for each country, and the evolution of total trade for each commodity. In short, it reflects all the information present in the data array's various marginal totals. The only information it lacks is that which can be gained only from the individual elements of the data array.

If we lacked some elements of the data array, the corresponding element of the pattern array would provide an estimate of the missing entries. As we have defined the pattern array, however, to construct it we need all elements of the data array, so no entries may be missing. But if we can broaden the definition of the pattern array to cover data arrays with missing entries, we can use the pattern array to fill in missing entries in the data array.

To explain the broader definition, it is convenient to call elements of the array structure *present* or *absent* according as the corresponding data array entries are present or absent. When some data are absent, then we define the pattern array as the minimum-entropy array such that all marginal totals, summed over present elements, agree with the corresponding totals in the pattern array. In constructing the pattern array, again, we obtain a set of scaling factors, and these generate values for the pattern array entries for the absent elements. These may then be used as cell value estimates to fill in the missing entries in the data array.

Suppose, for example, that some country lacks data for the three components of "other business services" for the last data year. The pattern array will fill these in, in a way that takes account both of the country's trade pattern for previous years, and of the way that other countries' trade patterns vary between previous years and the last year.

This procedure is convenient in many ways for our purpose, but it has of course some limitations. In particular, although one of the indices of our arrays is a year index, the procedure is oblivious to country-specific time trends. There is nothing in it that says that the trade pattern for the a given country for the last data year is likely closer to the pattern for the second-to-last than to the first; unless this happens to hold not only for individual countries but globally. So, for example, if trade globally is growing at 5 per cent per year for the observable data, but for some particular

country it is growing at 10 per cent; then if that country lacks all data for the last data year, the procedure will use the 5 per cent rather than the 10 per cent trend to fill in the data. Thus, the procedure is unsuitable for long time series; this is one reason why we restrict ourselves to the five years of data for balancing purposes.

For level one services, for exports, this procedure supplies estimates totaling US$470 billion, or 6.7 per cent of the initially present entries. For imports similarly it adds US$450 billion or 6.8 per cent. We apply it also to fill in missing estimates at lower levels. Here it fills in a greater share of the data, since for many countries lower level entries are altogether missing. For such countries, the estimated lower level composition of services in each year is the composition typical of reporting countries for that same year.

At this point we discard the data for earlier years, it having served its purpose in filling in missing values, and retain only data for the GTAP Data Base reference year, 2001.

Up to this point the export and import estimates have been handled separately. At this point however we have eliminated their internal inconsistencies, and are ready to reconcile them with each other (we can also simplify the data set by deleting all but the bottom-level commodities). We also need to combine them to generate bilateral trade estimates. We handle these two tasks together.

First we set a world trade target for each commodity, calculated as the geometric mean of the estimates for world exports and world imports. Table 15.E.2 shows the initial estimates for world exports and imports, and the world trade targets. The biggest relative difference is for “other”-mode passenger transport, where the export estimate is almost 90 per cent greater than the import estimate. The biggest absolute difference is for freight transport by sea, where the import estimate exceeds the export estimate by almost $50 billion.

We rescale the export and import estimates for individual countries to match the common world target. We also construct a bilateral trade matrix for each commodity, by mutually pro-rating the rescaled exports and imports estimates. We then zero out the diagonal entries (that is, impose zero intra-country trade), and rebalance against the export and import estimates using the RAS procedure.

It would of course be desirable to obtain a statistical base for constructing the bilateral trade flows. Since bilateral trade statistics are indeed available, notably from EUROSTAT, this is a priority for future work.

This completes the internal reconciliation of the services trade data. The final stage in the initial preparation is recasting it in a more GTAP-compatible form. This includes mapping from the original service classification to the GTAP sectoral classification, and dividing the data into three data sets, for non-margin services, margin services, and travelers’ expenditures.

In mapping to the GTAP sectoral classification, we exclude two of the original sectors. “Royalties and license fees” is not recorded as trade in the GTAP framework, but as factor payments; so we simply discard it. “Travel” represents travelers’ expenditures (not passenger transport services,

Table 15.E.2 Derivation of World Trade Targets (US$ billion)

Service Sectors	Exports	Imports	Trade
Passenger transport by sea	5.8	3.6	4.6
Freight transport by sea	82.2	135.0	105.4
Other sea transport services	34.3	37.1	35.7
Passenger transport by air	76.6	76.6	76.6
Freight transport by air	20.7	23.7	22.2
Other air transport services	24.1	27.1	25.6
Passenger transport by other	5.2	3.8	4.4
Freight transport by other	43.0	48.1	45.5
Other transport by other	33.5	27.3	30.3
Travel	443.4	396.0	419.1
Communications	33.5	33.8	33.7
Construction	30.5	23.1	26.5
Insurance	30.2	41.7	35.5
Financial services	92.4	43.1	63.1
Computer and informn services	41.5	26.2	33.0
Royalties and license fees	80.0	78.6	79.1
Trade	73.9	60.3	66.7
Operational leasing	13.9	21.2	17.2
Miscellaneous business services	279.7	279.6	279.6
Personal and recreatl services	20.3	19.8	20.1
Government services, n.e.i.	43.2	57.5	49.8
Total	1507.8	1463.1	1473.5

which are classified elsewhere). As noted in the introduction, we do not treat these as a commodity, but seek to record them against the goods and services purchased (see further section 15.E.4). The remaining service sectors are mapped to the GTAP sectoral classification as shown in table 15.E.3. The mapping is fairly straightforward - not fortuituously, since the GTAP sectoral classification in the services area was designed with this data source in mind.

In dividing the data into margin and non-margin data sets, we treat freight transport services as margin services, and all other transport services as non-margin services. We don’t present bilateral trade matrices for the margin services, since these are not required for the GTAP Data Base; instead we provide separate arrays for exports and imports.

Areas for future work include exploiting bilateral trade statistics from other sources, and exploiting data from earlier years in filling in missing data for the GTAP reference year.

Table 15.E.3 Mapping Service Sectors to GTAP Sectors

Service Sector	GTAP Sector
Passenger transport by sea	Water transport (non-margin)
Freight transport by sea	Water transport (margin)
Other sea transport services	Water transport (non-margin)
Passenger transport by air	Air transport (non-margin)
Freight transport by air	Air transport (margin)
Other air transport services	Air transport (non-margin)
Passenger transport by other	Other transport (non-margin)
Freight transport by other	Other transport (margin)
Other transport by other	Other transport (non-margin)
Communications	Communication
Construction	Construction
Insurance	Insurance
Financial services	Other financial services
Computer and informn services	Other business services
Trade	Trade
Operational leasing	Other business services
Miscellaneous business services	Other business services
Personal and recreatl services	Recreational and other services
Government services, n.e.i.	Public administration etc

15.E.3 Filling in Missing Countries

As discussed above (section 15.E.1), the services trade data set has its own country classification. This classification omits some countries included in our standard country classification, and treats groups together some countries separately identified in the standard GTAP country set. So we need to fill in data for the missing countries, and disaggregate the aggregated countries. Disaggregation increases the number of countries from 153 to 163, by separating Belgium and Luxembourg, and splitting out some other small areas separately identified as standard GTAP countries: Liechtenstein from Switzerland, Monaco from France, and so on, as shown in table 15.E.4. Filling in missing values for another 63 countries generates the full 226-country classification (see chapter 2).

In filling in the missing data for non-margin services we assume that the value of trade between any two countries depends on the scale of their economies. More specifically, estimated trade between any two countries is directly proportional to the scale of each country's economy. We use GDP as the scale variable. So our estimate for trade in a service commodity between two countries is equal to the product of their GDPs, multiplied by a commodity-specific proportionality factor. We estimate the proportionality factors as the average ratio of the trade value to the product of GDPs for the countries for which we have services trade data. In disaggregating grouped countries such as Belgium and Luxembourg, we likewise used GDP shares.

Table 15.E.4 Disaggregation of IMF Countries to Standard GTAP Countries

IMF Countries	GTAP Countries
Belgium-Luxembourg	Belgium
	Luxembourg
Switzerland	Switzerland
	Liechtenstein
France	France
	Guadeloupe
	French Guiana
	Monaco
	Martinique
	Réunion
Italy	Italy
	San Marino
United States of America	Guam
	Puerto Rico
	Virgin Islands (U.S.)

We take a similar approach for margin services. But since the margin services trade data are not bilateral, we estimate each country's margin services exports or imports as equal to the product of its GDP and a commodity-specific proportionality factor. As with non-margin services, we split grouped using GDP shares.

For non-margin services, this step increases the estimated global value of trade from US$802 billion to $811 billion, or by 1.1 per cent. For travelers' expenditures the increase is from $419 to $435 billion, or 3.9 per cent, and for margin services, from $173 billion to $176 billion, or 1.7 per cent. Although almost one third of the countries in the expanded data set have made-up data, they are mostly small countries, and total trade is not greatly affected.

Table 15.E.5 indicates non-coverage of individual GTAP regions in the services trade data. For single-country regions, the indicator is either 0 or 1: a value of 0 indicates that the country is covered in the services trade data, 1 that it is not covered. For multi-country regions, the indicator may lie between 0 and 1, if some countries in the region are covered and some are not. In such cases, the indicator is equal to the share of non-covered countries in the region's total services trade (exports plus imports, summed over commodities; including non-margin services, travelers' expenditures, and margin services). For brevity, we omit fully covered regions.

In the table, a ratio of 1.00 indicates that the services trade data do not cover the region at all; this occurs for three single-country regions, Taiwan, Malawi, and Zimbabwe. The multi-country regions generally have ratios between 0 and 1, with the exception of "Rest of North America", which has a ratio of exactly 1, none of its member countries (Bermuda, Greenland, and Saint Pierre and Miquelon) being covered.

Table 15E.5 Non-coverage Ratios for GTAP Regions

GTAP Region	Ratio	GTAP Region	Ratio
Rest of Oceania	0.17	Rest of Europe	0.53
Taiwan	1.00	Rest of Former Soviet Union	0.07
Rest of East Asia	0.92	Rest of Middle East	0.17
Rest of South-East Asia	0.31	Rest of North Africa	0.26
Rest of South Asia	0.29	Malawi	1.00
Rest of North America	1.00	Zimbabwe	1.00
Rest of South America	0.06	Rest of SADC	0.09
Rest of Central America	0.49	Rest of Sub-Saharan Africa	0.13

We note that the table does not fully indicate the incidence of filled-in values in the final data set. In fact every country's trade is affected by the filling-in process, not just the omitted countries'. For example, the table omits Germany, since it has a ratio of exactly 0, being covered in the original data set. Nevertheless the filling-in procedure increases Germany's non-margin services exports by 2.1 per cent, from $53.9 to $55.0 billion, and its non-margin services imports by 1.5 per cent, from $74.7 to $75.8 billion. Although Germany is covered in the source data set, some of its trade partners are not; so we fill in trade values for 101 new (mostly small) partner countries.

The filling-in procedure offers several opportunities for improvement. Research undertaken after completing the trade modules suggests that merchandise trade would be a better scaling variable than GDP. Furthermore, we should be able to improve our estimates of trade between covered and omitted regions by using information about individual included regions instead of using the same proportionality constants for all regions. For example, as it appears from the source data that relative to GDP, Germany trades more intensively in services than does Japan, so it would be appropriate to use higher proportionality constants for Germany's trade than for Japan's. The current practice likely leads to underestimation of Germany's trade with non-reporters, and to overestimation of Japan's. Finally, it is not clear whether the filling-in procedure should increase the total trade of the included countries, or whether it should hold it constant, reallocating the trade away from their covered-country to their omitted-country partners. At the time of writing, we don't know enough about the construction of the source statistics to answer this.

Nevertheless, since the share of filled in data is small, improvements in the quality of the final data set are likely to arise less from improvements in the filling in methodology than from other sources. These include the use of bilateral services trade data and improvements in the quality of the unilateral services trade data.

15.E.4 Travelers' Expenditures

After expanding the preliminary services trade data sets to standard GTAP countries (section 15.E.3), for travelers' expenditures we have an extra step to perform. The services trade data gives us a bilateral trade matrix for travelers' expenditures treated as a single commodity. We have to divide this

up between the 57 standard GTAP commodities, so that travelers' expenditures on, for example, accomodation abroad are treated as exports of the GTAP commodity "recreational and other services" from the country in which they are traveling to their country of residence.

In GTAP 6 (as in GTAP 5), the commodity composition of travelers' expenditures is not based on statistics but on synthetic estimates. We take as our starting point the commodity composition of private consumption in the exporting country. (There is a circularity here, because we take our estimates of commodity composition from the GTAP Data Base; we get around this by using a preliminary version of the data base.) We then adjust this judgmentally, increasing the shares of transport services, "recreational and other services", and government services, decreasing the shares of food commodities, and setting the share of ownership of dwellings at zero.

We use the commodity composition of the exporting country, rather than of the importing country, for reasons of expediency. If the consumption pattern in the importing country is very different from that of the exporting country, and travelers' expenditures are a significant source of demand in the exporting country, then fitting the exporting country's I-O data to the trade data (chapter 19) can strongly affect the industry structure, causing some previously insignificant industries to become large. Since we have little confidence in the commodity composition of travelers' expenditures, we want to avoid major impacts on the industry structure; basing it on the exporting country's consumption composition helps in that.

Given the large share of travelers' expenditures in services trade, and the availability of statistics, at least for a few countries, on their commodity composition, exploiting those statistics is one of the highest priorities for further work in services trade in future GTAP releases.

15.E.5 Balancing the Margin Services Usage Data

Our task now is to generate a margin services usage data set, using three inconsistent data sets covering margin services usage–-the preliminary margin services trade estimates developed in section 15.E.2, the modal shares estimates (chapter 15.D), and the merchandise trade data (chapter 15.B).

As noted above (section 15.E.1), the margin usage array we seek to construct is indexed in four dimensions, by margin commodity, merchandise commodity, country of origin of the merchandise, and country of destination. Our margin services imports data set (sections 15.E.2, 15.E.3) covers two of these, the margin service and the country of destination. The merchandise trade data set (chapter 15B) also implicitly provides margins values, as the differences between the *fob* and the *cif* value of each trade flow; these values are indexed by merchandise commodity, country of origin of the merchandise, and country of destination.

Since we consider the merchandise trade data relatively reliable, we prefer to adjust the margin services trade estimates to match them, rather than the other way around. Using these two data

sets alone, we could extract margin services usage estimates from the merchandise trade data, and then split them across margin commodities by pro-rating according to the margin services imports estimates. This however would yield highly implausible estimates, in which for example air transport was as likely to be used for coal as for electronic equipment, and land transport was as likely to be used in trade between the United States and Japan as between France and Germany.

It is for this reason that we have constructed the the modal shares data set (chapter 15.D). This covers all four of the required dimensions: the margin service, the merchandise commodity, the country of origin of the merchandise, and the country of destination. What it lacks is money values; it provides only the shares of the various margin commodities in each flow.

We could now combine the modal shares and the merchandise-trade-based estimates to obtain the required margin services usage matrix quite simply. Recalling however that the modal shares data set is constructed largely through heroic assumptions and extrapolation (chapter 15.D), whereas the margin services imports data set is relatively well grounded in source statistics (section 15.E.2), we prefer to make maximum use of the latter.

Our plan of procedure is:

— adjust the margin services imports data to match the merchandise-trade-usage estimates;

— apply the modal shares estimates to the merchandise-trade-based estimates to obtain initial estimates for the full four-dimensional usage array; and

— balance those initial estimates against the merchandise-trade-based usage estimates and the adjusted margin services imports estimates simultaneously.

The merchandise-trade-based and the margin services import estimates have one dimension in common. Thus we compare margin usage by country between the two data sets; and of course we can compare global margin usage.

According to the margin services imports data set, global margin usage is $176 billion; according to the merchandise trade data set it is $245 billion, 39 per cent higher. So the two data sets do not agree on the order of magnitude of the global value.

As table 15.E.6 shows, the two data sets also differ in the distribution of margin services usage across countries. The table compares shares in global margin usage between the two data sets, for selected countries; the countries selected are those with relatively large revisions in relatively large shares. For some countries, the differences are drastic. Passing from the margin imports to the merchandise-trade-based estimates, Ukraine’s share in world margin services usage increases by a factor of almost 9; here it is possible that the services trade data reflect deficiencies in the statistics of an economy in transition. But even for large and mature economies we see quite substantial differences: for example, the United States’ share grows by a factor of 1.5, from 11.6 per cent to 17.2

per cent of world margin services usage; the share of the Netherlands declines by a factor of 2.1, from 4.7 per cent to 2.2 per cent.

Table 15.E.6 Shares in World Margin Services Usage, for Selected Countries

	From Margin Imports Data (%)	From Merch. Trade Data (%)	Revision Direction	Revision Factor
UAE	0.14	0.80	+	5.8
Czech Republic	0.19	0.81	+	4.3
Denmark	1.83	0.61	–	3.0
Greece	0.13	0.47	+	3.6
Hungary	0.17	0.62	–	3.6
Indonesia	1.63	0.84	–	2.0
India	2.54	0.86	–	2.9
Ireland	1.10	0.51	+	2.2
South Korea	1.41	3.02	+	2.1
Mexico	0.18	1.55	+	8.7
Netherlands	4.67	2.22	–	2.1
Poland	0.41	1.15	+	2.8
Thailand	2.92	1.01	–	2.9
Taiwan	0.90	1.97	+	2.2
Ukraine	0.05	0.45	+	8.9
United States	11.62	17.16	+	1.5

To estimate global margin usage by mode of transport, we calculate global shares from the margin services import data. According to that data set, “other transport” accounts for 26 per cent of total international margins, water transport for 61 per cent, and air transport for 13 per cent. Applying these shares to the merchandise-trade-based estimate of global margin usage, we get money values of $64 billion, $149 billion, and $31 billion respectively.

Our next step is to balance the margin services imports data against these global by-margin totals and the by-destination totals from the merchandise trade data. Following the RAS procedure, we apply by-margin and by-destination scaling factors against the margin imports data set. This yields our final estimates of margin services usage by destination and commodity together.

To construct the full four-dimensional margin usage array, we need to apportion these estimates across freight commodities and source regions. For example, we have an estimate that the United States uses $30.4 billion of water transport margin services; we need now to estimate how much of this is incurred in importing oil from Saudi Arabia, how much in importing electronic equipment from Japan, and so on. Alternatively, we can look at the problem as one of apportioning the merchandise-trade-based estimates across the margin commodities.

As noted above, we construct our initial estimates for the full four-dimensional array by applying the modal shares estimates (chapter 15.D) to the merchandise-trade-based margin value estimates. For example, for imports of electronic equipment into the United States from Japan, the merchandise trade data set shows total margins of $556 million, while the modal shares data set shows the share of "other transport" as 0.1 per cent, the share of water transport as 32.6 per cent, and the share of air transport as 66.8 per cent. Applying the shares to the total margin, we estimate money values of $3 million for "other transport", $181 million for water transport, and $371 million for air transport. Similarly, for imports of oil from Saudi Arabia, the transport margin data set shows a water transport share of 99.0 per cent, so we calculate water transport margins as $821 million out of a total margin cost of $830 million.

Proceeding in the same way for all sources and countries, we obtain the initial estimates for the full four-dimensional usage array. Summing these over merchandise commodity and origin, we obtain totals for margin usage by margin and destination that we can compare with the final data set for margin usage by margin commodity and destination described above. Thus for imports into the United States, we calculate totals of $7.9 billion for "other transport", $27.1 billion for water transport, and $7.1 billion for air transport. The corresponding estimates from the margin-by-destination data set are $4.8 billion for "other transport", $30.4 billion for water transport, and $6.7 billion for air transport. The two data sets show the same value for total margin usage by the United States, $42.0 billion, since both inherit it from the merchandise trade data set. Thus they differ only in modal composition.

Table 15.E.7 compares the estimates derived from the modal shares data set with the rebalanced margin imports data set. It shows only selected countries, more specifically, the countries with the largest margin imports and the largest differences in their composition.

The most striking feature of table 15.E.7 is how often the estimates derived from the modal shares data set appear preferable to those from the rebalanced margin imports data set. This is remarkable, given that the modal shares data set is heroically extrapolated from a one-country data set, while the margin-by-destination array has a relatively strong statistical backing. The cases reported in the table fall into three classes:

— In several island or near-island countries, the initial estimates show low shares for "other" transport (essentially land transport), but the margin imports data set shows much higher shares. This happens with Singapore, Australia, the Philippines, and several other countries. Here the modal-shares-based estimates are much more plausible. The problem here is that in the initial processing of the source data (section 15.E.2), we fill in missing services trade data for these countries using average shares, but these countries must have much less than average "other" transport shares. Taiwan presents a more extreme form of the problem: for it we have no data at all from the services data set, so the commodity composition of trade derives entirely from filling in.

Table 15.E.7 Comparison of Margin Usage Estimates Derived from (1) Modal Shares and (2) Margin Import Data Sets (US$ million)

		"Other"	Water	Air
Australia	(1)	57	1850	720
	(2)	892	1340	395
China	(1)	1066	6589	2267
	(2)	1982	7011	929
Germany	(1)	5217	7612	2847
	(2)	9608	5525	543
Spain	(1)	750	3629	959
	(2)	1788	3365	185
United Kingdom	(1)	968	6772	2432
	(2)	2650	6082	1439
Italy	(1)	1171	5510	1510
	(2)	3084	4476	630
South Korea	(1)	148	5683	1553
	(2)	2493	3787	1104
Mexico	(1)	1754	1428	618
	(2)	218	599	2983
Malaysia	(1)	355	1574	798
	(2)	13	2709	5
Netherlands	(1)	987	3537	907
	(2)	1794	3478	159
Philippines	(1)	32	1155	449
	(2)	557	833	247
Romania	(1)	95	587	185
	(2)	642	177	47
Saudi Arabia	(1)	182	1364	420
	(2)	18	1940	8
Singapore	(1)	66	2428	1404
	(2)	1325	1986	587
Taiwan	(1)	96	3530	1194
	(2)	1301	2969	550
United States	(1)	7892	27057	7060
	(2)	4832	30434	6744

— On the other hand, there are several countries where the modal-shares-based estimates show a reasonably normal modal composition, but the margin imports data set shows a composition strangely specialized toward a single mode. Cases include Mexico, Malaysia, and Saudi Arabia. These cases appear to reflect errors in reporting services trade data to the IMF. For example, Mexico reports no imports of land or water freight transport, but only of air freight transport; Malaysia reports imports both land and water transport, but

none of air transport. It seems likely that Mexico does import some land and water transportation services, and Malaysia some air transportation services, but that these have either gone unreported or have been reported under other headings.

— There are also cases where both estimates appear broadly plausible, although quite different. For example, in Germany and Italy the margin imports data set shows higher shares for air transport and lower for land transport; further investigation would be required to determine which set of shares is more accurate.

At this point it seems that we can simply declare the "initial" four-dimensional usage array to be also the final array, and discard the margin-imports-based margin-by-destination array. At the time at which the work was planned however, the comparisons summarized in table 15.E.7 had not been made, and the procedure was developed in the belief that the margin-imports-based data were more reliable (we were more concerned about the heroic extrapolation of the modal shares data, than by the filling in of the services trade data). Accordingly, we prepared the final four-dimensional usage array by adjusting the initial estimates to match the margin-imports-based data.

Specifically, for each destination country, we have a three-dimensional margin usage array, indexed by merchandise commodity, merchandise origin, and margin (mode). We balance this simultaneously against totals for usage by merchandise commodity and origin from the merchandise-trade-based estimates, and values for usage by margin from the margin-by-destination data set. Following the RAS procedure, we apply by-commodity-and-origin and by-margin scaling factors to the initial estimates, to obtain the final margin usage array.

Looking to the future, we expect that the quality of the source data will improve as the statistical collections for services mature. It is also clear that we need to reconsider the policy of preferring the margin imports data to the modal shares data; at a minimum, we should prefer the modal shares data for countries where the margin imports data have been filled in using average shares.

15.E.6 Balancing the Margin Services Supply Data

We now face the problem that the margin usage data are inconsistent with the margin supply data. For each margin commodity, total margin usage (summed over freight commodity, freight source country, and freight destination country) should be equal to total margin supply (summed over margin supply country), but this is not the case. We resolve this inconsistency by rescaling the margin supply data to agree with the margin usage data. Table 15.E.8 shows the initial and final margin supply values and the scaling factors.

The scaling factors are all close to the average scaling factor of 1.391, the ratio of the global margin services value from the merchandise trade data set to the value from the margin services trade data set.

Table 15.E.8 Margin Supply (US$ billion)

Margins Commodity	Initial Value	Final Value	Scaling Factor
"Other" transport	46	64	1.390
Water transport	107	149	1.392
Air transport	23	31	1.392

15.E.7 Final Overview

To summarize the work described in this chapter, we prepare four services trade data sets, covering:

- non-margin services trade, with an aggregate value of $811 billion,
- travelers' expenditures, with an aggregate value of $435 billion,
- margin services usage, with an aggregate value of $245 billion, and
- margin services supply, also with an aggregate value of $245 billion.

The final estimates generally respect the source data and pass sanity tests, though the modal composition of margins usage appears suspect for several countries. Major areas for future work include exploiting available statistics on the bilateral structure of services trade, and acquiring and exploiting statistics on the commodity composition of travelers' expenditures. There are also several opportunities for improvement in the procedures used to exploit the current data sources.

References

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