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1 Introduction

This paper has two aims. First of all it describes a contribution of the bilateral services trade data set for the next version of the GTAP database, using the Gehlhar (1996) method. Secondly, this paper discusses briefly some alternative methods to make a choice between two available mirror data for the same bilateral flow. This is interesting for the GTAP community, because these data could be used for all the bilateral trade data in the GTAP data base.

Good statistical measurement of services trade becomes more and more important now trade in services gets the attention of policymakers. In 1995 many countries decided to liberalise services trade according to the General Agreement for Trade in Services (GATS). Also in the Doha round the WTO members aim to open their markets in services further. Moreover, the European Commission launched new policy proposals for the intra-EU service market (EC, 2004). To analyse the welfare impact of these (and other) policy proposals, it is necessary to depart from good bilateral data on services trade. With the new interest in services trade, efforts increase to raise the quality of services data on production and on trade. The OECD has cooperated with Eurostat, to create a comprehensive database on bilateral trade in services. This database is based on the concepts and framework of trade in services set out by the IMF in their balance of payments statistics.

In February 2006 a special OECD database called "*OECD Statistics of International Trade in Services: Detailed Tables by Partner Country (including unpublished data)"* became available which includes the year 2003. Interestingly, compared to an earlier version of the OECD database, other commercial services sector is here split into communication, construction, insurance, financial services, computer and information services, royalties and licences, and other business services. This improves the concordance to the GTAP sectors considerably. The OECD gave permission to use these data (although we have to refer to unpublished data which

is not ideal from the perspective of transparency and reproducibility). We provide a consistent trade dataset for 27 individual OECD countries, EU15 and 2 Non-OECD countries and deliver available data for all partner countries for the year 2003.

In section 2 we present an overview of the available Bilateral Services Trade data for the GTAP-7 database. As outlined in our CPB memorandum (Van Leeuwen and Lejour, 2006) we use the method of Gehlhar (1996) to check the reliability of the reporting country if there are two reporting observations available for the same bilateral flow. This is described in section 3. In section 4 we present the other decisions: if we only have one observation for a certain flow, we use this observation, and in case there is no flow at all, we have to construct a value based on total imports and exports. The database for 2003 contains many gaps, which means that many estimates are necessary to present a full matrix of bilateral services trade flows. These estimates are partly based on data for 2002. In section 5 we present 12 matrices of consistent bilateral flows of services sectors in 2003. In section 6 we discuss alternative methods to model the discrepancies, in particular the bias model of Tsigas, Hertel and Binkley (1992) and the variance model which is generally used to compile macro-economic statistics. Finally, we compare the results of the three methods for a small sample of 12 bilateral flows.

2 Coverage of the OECD data

In order to provide some more insight in the availability of the data we show 12 figures of the available sectors for the period 1999-2003 of bilateral trade in services between the 30 reporters. In these graphs we distinguish four types of observations for the same flow:

1. If we have both observations of the same flow (from exporter and importer) we consider this as "export + import"
2. If we only have an export observation by a reporter we refer to this as "export + missing"
3. If there is only an import observation by a reporter, we call this "missing + import"
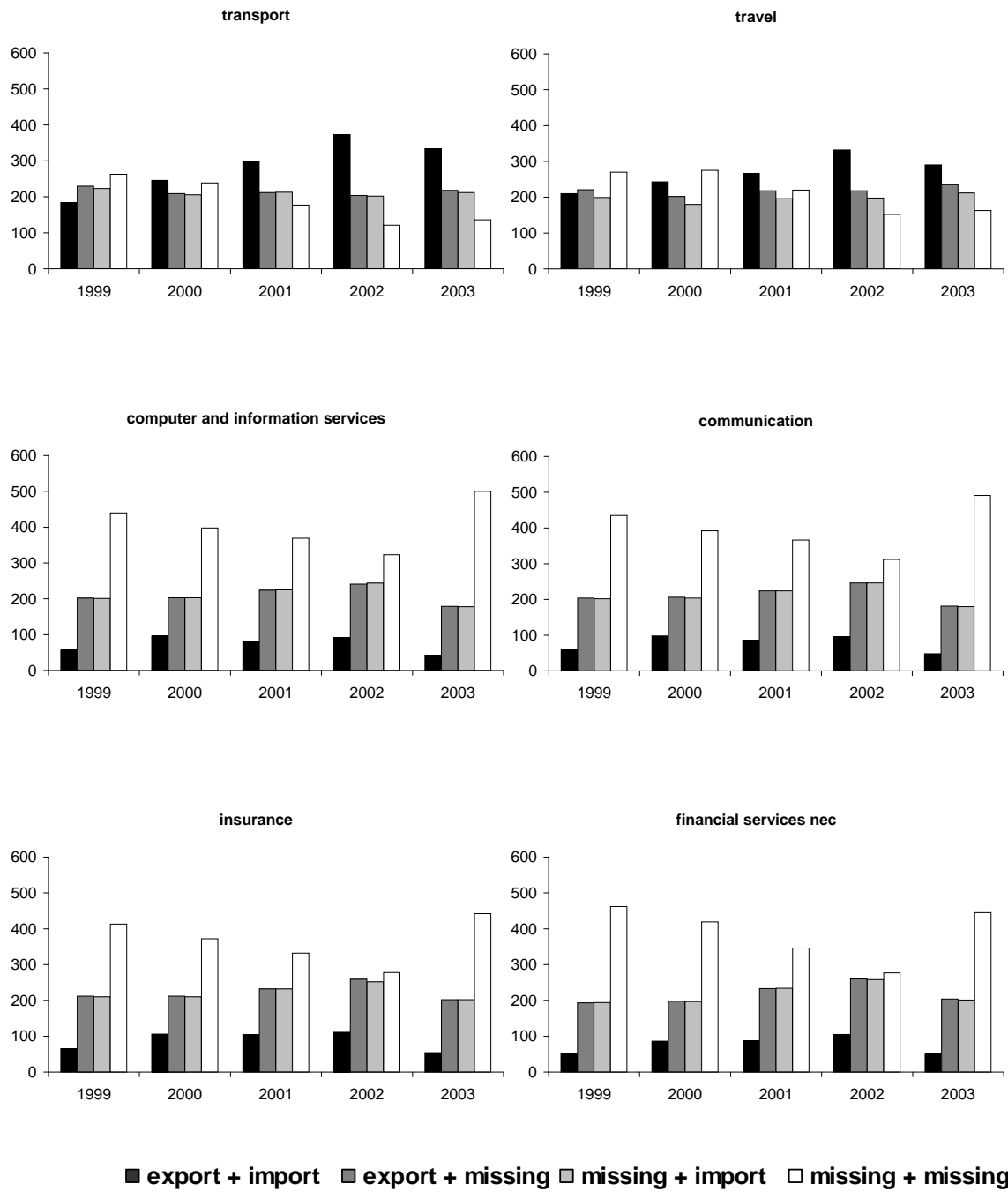4. If both observations are found as missing we count these observations as "missing + missing"

The total number of observations for each year is 900, because we have counted the observations of the 30 reporters and the same partners. Note that 29 observations are "missing + missing" by definition. These are the internal trade flows within a OECD country.[1]

From figure 2.1 we can see that more observations are available in the more aggregated sectors (travel, transport and other commercial services) than in the sub sectors within other commercial services. This is not surprising because the OECD published only data for the categories total services, transport services, other commercial services, travel and other government services in recent years. Many countries do not register or classify bilateral services trade flows at a more disaggregated level. For many of these sectors, we only have for about hundred flows two observations. That is about 10% of the total number of flows. Contrasting, for the sector transport we have two reporting countries for about 40% of the flows in 2002.

Moreover we conclude that over the years the number of "export + import" observations is increasing over the period 1999-2002. For the final year (2003) there are fewer observations available, but this is probably a timing issue. This is more specifically the case for the sub sectors within other commercial services.

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[1] Note that EU15 is a special reporter. It is used as a reporter in this paper to estimate missing observations for other countries in section 5. The observations of this region however are not mentioned in the results of section 3 and 4 since the region is an aggregate of the 15 individual EU countries.

Figure 2.1   **Comparison of observations per year and sector**

transport

travel

computer and information services

communication

insurance

financial services nec

■ export + import   ■ export + missing   ▨ missing + import   □ missing + missing

Figure 2.1   Comparison of observations per year and sector (continued)

computer and information services

royalities and license fees

business services nec

recreational and other services

public admin. and defence, education, health

other commercial services

■ export + import   ■ export + missing   □ missing + import   □ missing + missing
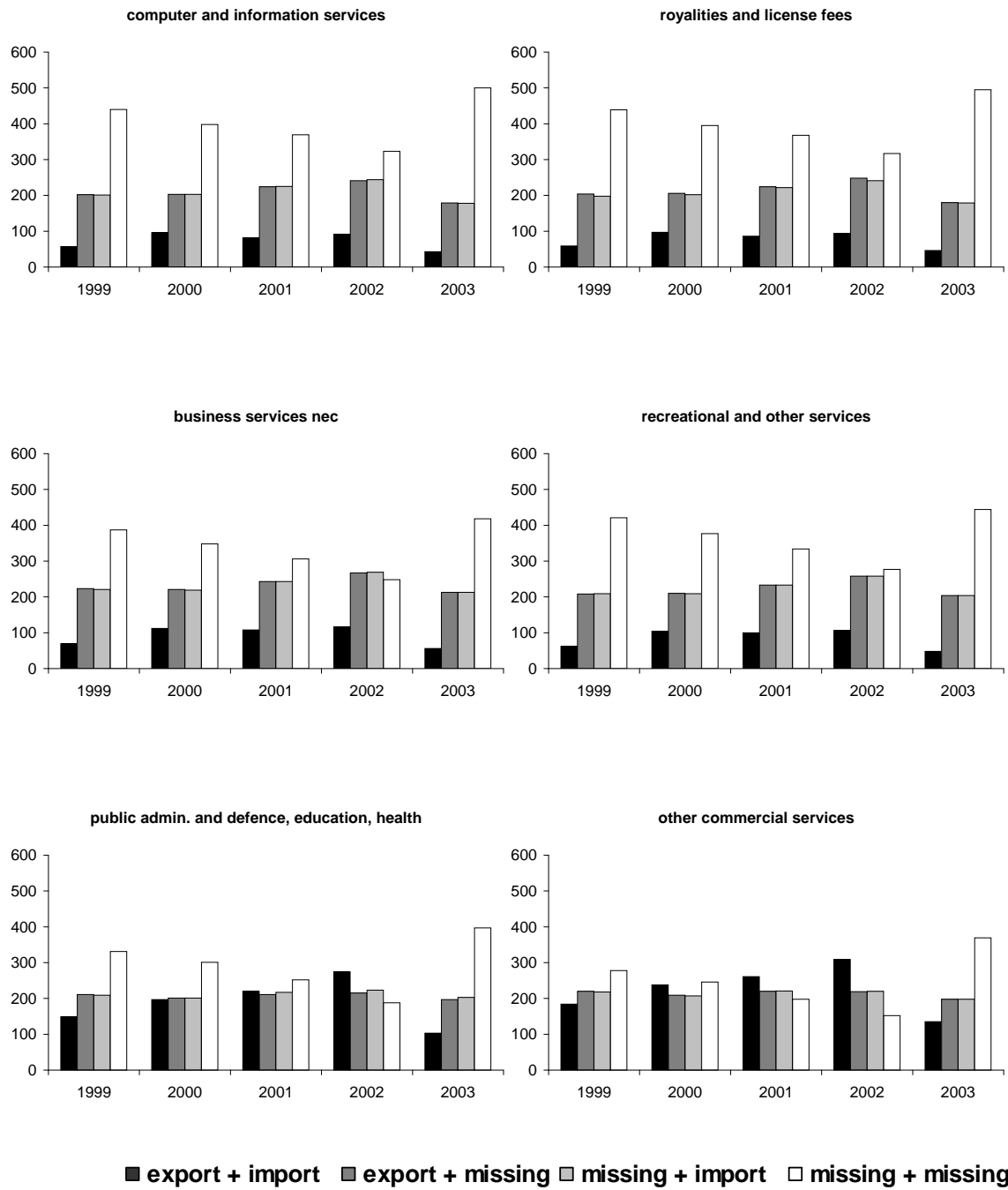
3 The Gehlhar method for establishing reliability

Indices for reliability (Gehlhar method)

Gehlhar (1996) has developed a method for reconciling bilateral merchandise trade data for the GTAP data base. He constructs reliability indices for each flow. According to this philosophy, transaction data are reliable if the values of the reporting countries deviate less than 20%. An arbitrary reporting exporter trades with dozens of countries in a particular good. Some of the transactions are reliable according to the definition above and some are not. By aggregating the values of the reliable transactions of the reporters and comparing the aggregate to total reported exports for that particular good Gehlhar constructs reliability indices of the exporters. This is done for every reporting exporting and importing country per good item. The higher the index, the larger the share of reliable transactions, and the more reliable the reporter is. If the index for the reporting exporter is higher than for the reporting importer, the reported trade flow from the exporter is considered to be the most reliable.

We use the same method to identify the most reliable reporters for all available services sectors. We also use the criterion of 20% as indication for a reliably reported flow. This threshold is arbitrary. In first instance, we experimented with a lower number because some biases in reporting that occur in merchandise trade are not (or less) relevant in services trade, such as the classification of trade and transportation costs. However in that case only a few flows were considered to be reliable. For practical reasons we adapted to the 20% criterion. We have done this for the years 1999-2003, aggregated the reliability indices for these five years, and calculated the indices to percentages.

The denominator of the Gehlhar index includes all $(28)^2$ bilateral trade flows of an exporter or importer. For many of these flows we do not have two observations. As a consequence the index "produces" lower numbers for sectors with a limited number of two observations per flow. So, if for only about 10% of the flows we have two reporting countries, the Gehlhar index will not exceed the value of this percentage assuming that there are not systematic differences in the values of the flows.

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[2] EU15 and internal trade within a country are excluded,

Table 3.1 **Reliability indices (in%) for reporting exporters in services, 1999-2003**

Reporting exporter	TTT	TRA	TRV	CMN	CNS	ISR	OFI	CIS	RLF	OBC	ROS	OSG	OCS
AUT	2.4	3.6	69.2	5	0.2	0	0.4	0	4.2	1.2	1.4	4.2	30.6
BEL	3.8	7	7.6	0.2	0	0	1.6	0	0	3.6	7.2	3.4	3.4
DNK	18.2	1.6	14.6	0	0	0	0	0	0	15.4	0	0	1.4
FIN	24.6	9	33	8.2	1.2	0	8.6	3	3.2	15.6	5.8	13	14
FRA	39	21.6	39.2	8.6	0.6	0	10.6	3	0.2	5.6	4	0	13.8
DEU	53	28	63	0	0	0	0	0	0	0	0	9.8	13.2
GBR	48	6.6	30.8	10.2	0.4	0.2	1.8	4.6	2.6	3.6	1.6	1.2	13.4
GRC	3	1.4	27.2	0	0	0	0	0	0.2	0.4	0	0	5.6
IRL	3.4	0	0	0	18.4	0.2	0	0	0	0	8.8	0	0
ITA	41.2	29.2	47.2	0.2	0	1	0.4	0.8	5.8	5.8	2.2	5.4	3
LUX	7	10.8	5.8	0	4	0	0	0	0	0	0	6	0
NLD	49.8	25.2	57.8	0.6	3.2	0	0.2	3.2	6.2	6.2	13	4.2	31.8
PRT	27.8	13.6	28.8	5.4	0.2	6.4	4	0.4	1.8	2	0.4	2.2	9.4
ESP	4.2	28.4	0	0	0.4	0	0	0	0	1	0	1.2	1
SWE	19.8	6.8	45.8	3.2	0.6	4.8	0.6	3.8	7.8	3.6	5.6	1.6	11
AUS	44.4	24.6	41.6	0	0	0	0	0	0	0	0	1.2	7.8
NZL	0	0	0	0	0	0	0	0	0	0	0	0	0
JPN	45	60.6	14.4	0.8	3.2	0	0	0.2	1	3.4	2.2	4	7.2
CAN	3.6	78.8	80.2	0	0	0	0	0	0	0	0	32.8	6.2
USA	53.8	39.4	35.2	0	0	0	0	0	0	0	0	16.2	19.8
MEX	0	0	77	0	0	0	0	0	0	0	0	0	0
KOR	40.4	12.6	5.8	0	0	0	0	0	0	0	0	1	0
HKG	0	0	0	0	0	0	0	0	0	0	0	0	0
NOR	15	8	14.6	12.8	13.8	2.4	4.8	8.4	3.4	15	1	7.2	26.2
HUN	3	15.6	1.6	0	0	2	0	0	0	0	0	1.6	12.4
SVK	25.6	26.2	17.6	0.8	1.2	24	0	0	3.8	4	0	2	11
CZE	41.8	13	35.4	0	0	14	0	0	1	1.4	0	4	16.4
TUR	0	0	27.6	0	0	0	0	0	0	0	0	0	0
RUS	0	0	0	0	0	0	0	0	0	0	0	0	0

For an explanation of the sectors and country codes we refer tot Appendix A

From tables 3.1 and 3.2 we conclude that most reliability indices are smaller than 20%. Using the maximum value of 100% as a benchmark at most a quarter of the values of the reported flows is considered to be reliable also for the sectors transport and travel. In particular in the sub sectors within other commercial services and in other government services the reliability is low. Only in a few cases the indices exceed the value of 40%. In transport services and travel the index sometimes exceeds the value of 50% indicating that at least more than half of the recorded trade values by these countries are reliable.

Table 3.2   Reliability indices (in %) for reporting importers in services, 1999-2003

reporting importer	TTT	TRA	TRV	CMN	CNS	ISR	OFI	CIS	RLF	OBC	ROS	OSG	OCS
AUT	8.6	12.4	16.4	2.2	0.2	0.2	0	0.2	1.6	2.8	1	1.8	4
BEL	19.6	16.4	2.8	0.2	5.6	0	0.4	0	3.6	1	0	0	23.6
DNK	12.4	5.2	16.4	0	0	0	0	0	0	5.4	0	0	0.2
FIN	9.2	5	19	6.2	0	3.2	6.2	0	1.6	13	1.2	1.8	8.4
FRA	56.8	27.2	28	9.4	6.2	0	0	2.8	10.8	4.4	0	1.8	32.8
DEU	39.6	23.4	58.6	0	0	0	0	0	0	0	0	22	26.4
GBR	24.4	12.2	28	5.6	0	0.4	2.6	2	1.6	2.8	6.2	23.2	4
GRC	1.6	2.2	8	0.6	0	0	0	0	0	2.8	0	0.4	9.8
IRL	1.8	0	3.4	0	10	0	0	0	0	0	9.4	20	0
ITA	14.6	19	44.8	0.2	0	1	0	0	1.6	2.6	0	0.4	23.2
LUX	2.6	4	0.8	0	6	0	0	0	0	0	0	4	0.2
NLD	52.8	10.6	42.8	7.8	1.8	0	2	8.2	5.8	7.4	7.6	11.4	66.8
PRT	46.8	6.4	23.8	7.2	0.6	0.2	9.2	0.2	3.2	7.6	0	0	25.6
ESP	2.6	38.6	36.6	0	0	0	0	0	0	0	0	0	0
SWE	25	13.2	33.4	8.2	6.2	15.2	4.6	9.8	1.2	10.4	0	2.4	28.8
AUS	21.2	29.2	36.6	0	0	0	0	0	0	0	0	1.8	5.2
NZL	0	0	0	0	0	0	0	0	0	0	0	0	0
JPN	65.6	44.4	34	1.2	1.4	0.2	9.8	0.6	0.6	6.2	2	17.8	3.4
CAN	69.8	63.4	64.8	0	0	0	0	0	0	0	0	15	40.4
USA	55.6	42.8	49.6	0	0	0	0	0	0	0	0	0.4	5.6
MEX	0	0	79.8	0	0	0	0	0	0	0	0	0	0
KOR	5.6	26.4	8.6	0	0	0	0	0	0	2.8	0	0	0
HKG	0	0	0	0	0	0	0	0	0	0	0	0	0
NOR	21.2	10.4	31.2	2	5	3.6	0.6	9.6	1	13.4	8.8	1.4	29
HUN	10	24	1.6	0	2.2	0	0	0	0	0.4	2.2	2.6	15
SVK	17	14.8	0.2	2.8	1	0	2.2	0.4	0	0.6	0	6.4	10.8
CZE	31.4	17	13.6	0	0	4	0.6	0	1.8	0	0	1.2	24.8
TUR	0	0	0	0	0	0	0	0	0	0	0	0	0
RUS	0	0	0	0	0	0	0	0	0	0	0	0	0

For an explanation of the sectors and country codes we refer tot Appendix A

Figure 3.1 presents the reliability indices in % for each sector: the average over all countries as reporter of exports and imports. Even for the bigger sectors the reliability is quite low. If all observations would be available and reliable the column should reach the value of 100%. In practice this is not achievable, but the low numbers for the sub sectors in other commercial services are worrisome. To a large extent the low average indices point to the relatively low number of available observations. The figures in section 2 suggest that availability will increase over time, but the current situation is a long way from a 50% score of bilateral trade flows with two reporting observations.

Figure 3.1   Reliability indices (in %), average over all countries, 1999-2003
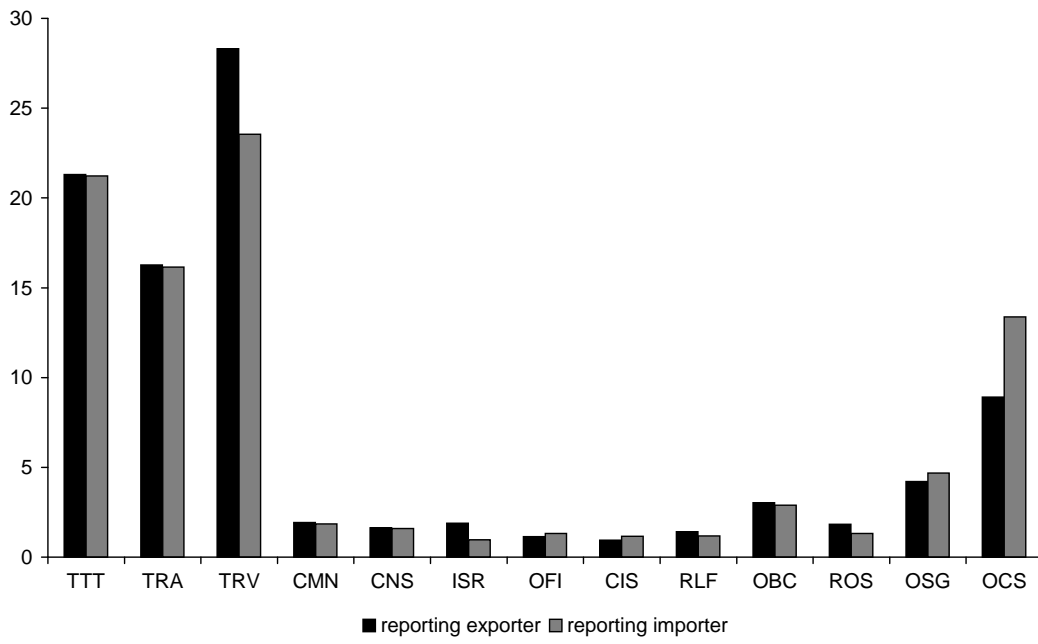
4   Choices and estimates

The previous sections showed that the choice in case of two observations is based on the method of Gehlhar (1996). If there is only one flow, this flow is considered to be the correct flow. In all other cases we have estimated the empty cells for the 30 by 30 matrix of bilateral services trade flows between OECD countries. The characteristics of the estimates are:

- The procedure to create one matrix out of the two matrices for which we have two or one observations per flow is carried out for both 2002 as 2003.
- This results in a matrix for all sectors of 30 reporters (27 OECD countries, EU15, Hong Kong and Russia) and the same 30 countries as partners.
- To calculate the remaining empty cells we have used three aggregate partners: total OECD, Non OECD and Total World
- For the matrices of all sectors in 2003 missing cells are estimated in the following order:

o For EU15 countries the export shares in the flow of EU15 of 2002 is used to calculate the flow for that sector in 2003

o For all reporters the export shares in the flow of total OECD of 2002 is used to calculate the flow for that sector in 2003

o For all reporters the export shares in the flow of total World of 2002 is used to calculate the flow for that sector in 2003

o For remaining cells of reporting countries and sectors within other commercial services, we first estimate the flows of that country to total world, using the share of that sector and total other commercial services of the flow of EU15 to total world in 2003. This total world is then used to calculate the required flow using the share of total commercial services of this country and that of the total world.

o For any remaining cells we use the shares of total sectors of either total OECD, or even total world

o For remaining empty flows from non EU countries to several partners similar equations are used, but with import shares in EU15.

o For the final empty cells between non EU15 countries we use the export shares of Japan, since that country is the only country with an almost full range of observations. The only flow we have to set to zero is the one from and to Turkey of this country.

5   Results

We have constructed a spreadsheet containing a consistent set of 12 matrices of bilateral services trade flows for GTAP and other GTAP related sectors according to the concordance in the table A2.

The 12 consistent tables can be used to create the flows for the required 9 GTAP services sectors. Therefore the following assumptions have to be made:

- Royalties and license fees is not a GTAP sector and can be ignored, except for foreign income transfers.

- OBS is the summation CIS and OBC

- OCS is the sum of CMN, CNS, ISR, OFI, CIS, RLF, OBC and ROS. Note that the table OCS in the spreadsheet is not necessarily equal to the sum of the above mentioned sectors. We have included it as an individual available sector in the original OECD database.

- We have ignored the data of "9842: Other commercial services transportation, excluding insurance services. (New Zealand)" and "205291: Transportation and government services (Canada)"

- In the tables we have included the values of 30 reporters to the 30 partners. All the values are expressed in **bln** US dollars.

In order to provide GTAP with the essential data to further include flows from and to other countries / regions, we have created 26 CSV files, which represent 13 sectors of both credits and debits of the 30 reporters to all the partners. There are 264 potential partners. Most of them are individual countries, but they also include regional aggregation of some partners. Most of the flows are not available, but some regional numbers can be found and may be useful to finalize a consistent matrix of bilateral services trade between all the GTAP countries / regions. The files only contain data for 2003 and are expressed in **mln** US dollars.

Because the OECD has not made these data publicly available we can not publish them either. Only results of the 30 by 30 matrices of bilateral services trade flows are available.

6   Alternative methods

On the GTAP board meeting of last year it has been decided to use the Gehlhar method to make a choice between two mirror data for bilateral service trade flows. This method is elegant for its simplicity, but also ad hoc. The criterion of 20% is debatable and crude: observations are reliable or not, there is no middle way. Also there is no optimal combination of the information of the two mirror values, only one value is used.

Econometric methods are more elegant and precise. In Ten Cate (2007) a review is given of various econometric models and estimation techniques for discrepancies in bilateral data, as follows. We present the results of the modelling for a small illustrative set of data, with four countries.

Table 6.1	Reported trade in services, OCS (2002, billion USD)					
reporting	reporting	reported	reported			$|\Delta|$ / import
exporter	importer	export	import	Δ	$|\Delta|$	(GTAP)
FRA	DEU	1.3	4.8	-3.5	3.5	73
FRA	ITA	1.8	3.7	-1.9	1.9	51
FRA	GBR	3.8	3.3	0.5	0.5	15
DEU	FRA	4.7	3.6	1.1	1.1	31
DEU	ITA	1.8	3.6	-1.8	1.8	50
DEU	GBR	6.6	3.9	2.7	2.7	69
ITA	FRA	3.3	1.5	1.8	1.8	120
ITA	DEU	3.4	1.4	2.0	2.0	143
ITA	GBR	3.6	1.2	2.4	2.4	200
GBR	FRA	5.7	4.8	0.9	0.9	19
GBR	DEU	7.5	9.1	-1.6	1.6	18
GBR	ITA	2.9	7	-4.1	4.1	59
Total		46.4	47.9	-1.5	24.3	

Source: OECD (2006)

In the first place, we have the model for biased reporting errors: reporting is systematically too low, or systematically too high. For each country we have a typical expected percentage of over-reporting or under-reporting, separately for export reporting and import reporting.

This model has been discussed, and estimated with least squares regression, by Tsigas et al. (1992). Unfortunately, they have not solved the fundamental problem of such models: all these systematic biases are only identified up to an arbitrary shift between the export reporters and the import reporters. We proceed from here by adding a new element to the model: the model is

symmetric in export reporting and import reporting; we do not consider a priori one of these flows more or less reliable than the other. This is expressed by stating that the total of the export reporting biases plus the total of the import reporting biases is zero. With this addition the model is identified.

When using the estimated biases, including their sign, the optimal combination of two mirror values is not always closest to the most accurate reporter. See Ten Cate (2007) for details.

The result of this model for the illustrative data is given in table 6.2

Table 6.2	Estimate of the bias model			
	export		import	
	+Δ	estimated bias	-Δ	estimated bias
	billion USD	%	billion USD	%
FRA	−4.9	−56	−3.8	−22
DEU	2.0	−4	3.1	22
ITA	6.2	75	7.8	52
GBR	−4.8	−12	−5.6	−54
Total	−1.5	+2	+1.5	−2

Not all columns add up tot the total, due to rounding

For instance, it shows that France as an export reporter has a downward bias of 56 %. As an import reporter France has a downward bias of 22 %. In total it appears that exports are over-reported and imports are under-reported by 2 %.

An altogether different model states that each country reports unbiased, or in other words correctly on average. Here the countries have a different spread (variance) of the reporting error. This is the statistical model of Stone et al. (1943), used by national statistical bureaus to compile macro-economic statistics. See Annex A of Wroe et al. (1999) for a literature review. With this model, the optimal combination of two mirror values is always closest to the most accurate reporter (i.e., the reporter with the smallest variance). A similar symmetry condition as above is applied here to identify the model. In Ten Cate (2007) two methods for the simultaneous estimation of the variances are presented: least squares and maximum likelihood. The latter is numerically more complicated and less robust, but statistically correct. Hence we have chosen the latter here. Please recall that this is only a small numerical example to illustrate how the various alternative methods work, and not a full scale application to base a choice on.

The results of this model for the illustrative data are:

Table 6.3   **Estimates of the variance model**

	export reporting				import reporting			
	total	|Δ|	rel |Δ|	√variance	total	|Δ|	rel |Δ|	√variance
	billion USD		%		billion USD		%	
FRA	6.9	5.9	86	0	9.9	3.8	38	0
DEU	13.1	5.6	43	40	15.3	7.1	46	83
ITA	10.3	6.2	60	101	14.3	7.8	55	71
GBR	16.1	6.6	41	17	8.4	5.6	67	14
Total	46.4	24.3			47.9	24.3		

Table 6.3 shows the square root of the estimated variances. For the export reporting, the results are quite different depending on the estimation method; for the import reporting, this is not the case.

Fortunately it is possible to judge empirically the two models (the bias model and the variance model). Ten Cate (2007) finds that his small illustrative dataset fits best to the bias model (independently of the estimation method of the variance model).

It might be useful to estimate and test these models on all sorts of bilateral trade data (goods and services), and then make a choice which method to apply in future releases of the GTAP data.

As an aside, we note that the Gehlhar method is implicitly based on the no-bias notion: the accuracies have no sign and the attention is only for the most accurate reporter of two mirror values. Also, the above mentioned symmetry rule is implied here: together the exporters are judged on the same discrepancies as the importers together.

7 Comparing results of Gehlhar with bias and variance model

It is interesting to compare the results of the models in section 6 with those of the Gehlhar method in section 3. For a complete overview we have calculated the reliability indices in percentages of the Gehlhar method for the sample of data in table 6.1

Table 7.1	Reliability indices (in %) for reporting exporters and importers in OCS, 2002	
	exporter	importer
FRA	55	48
DEU	0	59
ITA	0	0
GBR	82	39

Note that the variance model is also sign-free. From table 6.1 we can see that only three out of our 12 discrepancies are below the 20% relative discrepancy. From table 7.1 it can be seen that Italy has a zero GTAP reliability for export reporting and for import reporting. This agrees with the results in table 6.3, as does the good result for France and the United Kingdom. The result for Germany differs from Gehlhar. According to the results in table 7.1, Germany is an unreliable export reporter, and in table 6.3 it is an unreliable import reporter.

In table 7.2 we present the numbers from the original mirror data of table 6.1 followed by the of outcomes the Gehlhar method, bias and variance models respectively[3].

Table 7.2	Results of the various methods					
from country	to country	reported export	reported import	Gehlhar	bias	variance
FRA	DEU	1.3	4.8	4.8	3.0	1.3
FRA	ITA	1.8	3.7	1.8	2.6	1.8
FRA	GBR	3.8	3.3	3.8	6.1	3.8
DEU	FRA	4.7	3.6	3.6	4.7	3.6
DEU	ITA	1.8	3.6	2.7	2.0	2.1
DEU	GBR	6.6	3.9	3.9	6.8	4.1
ITA	FRA	3.3	1.5	1.5	1.7	1.5
ITA	DEU	3.4	1.4	1.4	1.3	2.0
ITA	GBR	3.6	1.2	1.2	1.9	1.2
GBR	FRA	5.7	4.8	5.7	6.2	4.8
GBR	DEU	7.5	9.1	7.5	7.9	7.6
GBR	ITA	2.9	7.0	2.9	3.7	3.0

[3] For calculations we refer to Ten Cate (2007)

As expected, the results for Gehlhar are either the reported export or the reported import observation[4].

The results for the bias model depend on estimated bias values in table 6.2 and are in most cases between the reported export and import. An exception is the result for the flow of France to United Kingdom. This is almost twice as high as that of the individual mirror values. According to this method both countries under-report their reported values by more than 50%, which means that this value will have to be more than doubled. The results for the flows from Germany and United Kingdom are close to the reported exports from these countries, since the value of the estimated bias is quite close to zero. For the latter country these results are in line with those of the Gehlhar method, since the reliability index is the highest in this sample. Finally for the flows from Italy we notice that the results are close to the reported imports since Italy over-reports the export by 75 %.

For the variance method we notice that the results for the flows for France to the other countries equal the value of the reported export of this country, since this country has a zero variance. For the flows from other countries to France we see the values of reported import into this country as the result. According to this method France is the perfect reporter. United Kingdom is also a good reporter and this is reflected in the results as well. For the remaining flows we see a value in between both mirror values, except for the flows from Italy, where the variance is so high that the results are close the reported imports.

The differences between the results of the three methods are striking but maybe not surprising. We should also remember that the results are based on a relatively small sample of 12 mirror observations. Most results for all methods will differ if we increase the number of observations of a exporting or importing country. Moreover we can also cumulate the indices over years, as we have done in section 3 for the Gehlhar method. If we would use the indices of table 3.1 and 3.2 on the mirror values of table 7.1, we would see different results for some of the mirror values.

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[4] For the flow between Germany and Italy both reported export and reported import don't meet the Gehlhar conditions. Therefore the average value is calculated.

8 Summary and conclusions

In this paper we have explained the construction of 12 matrices of bilateral flows of 27 OECD countries, Hong Kong and Russia for the year 2003. In case of two observations for one flow we have used the Gehlhar method

We have also discussed alternative methods to make a choice out of two mirror data for an identical flow. Comparisons of results of the Gehlhar method with the two models have been presented for an illustrative set of data and the y lead to striking differences.

This leads tot he suggestion to do a full scale comparison of these methods, not only on services trade data but also on those of goods.

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Appendix A: List of available countries[5] and sectors

Table A1: List of available countries as reporters

AUS	Australia
NZL	New Zealand
JPN	Japan
CAN	Canada
USA	United States
MEX	Mexico
KOR	Korea
E15	EU15
AUT	Austria
BEL	Belgium
DNK	Denmark
FIN	Finland
FRA	France
DEU	Germany
GBR	United Kingdom
GRC	Greece
IRL	Ireland
ITA	Italy
LUX	Luxembourg
NLD	Netherlands
PRT	Portugal
ESP	Spain
SWE	Sweden
NOR	Norway
CZE	Czech Republic
HUN	Hungary
SVK	Slovakia
TUR	Turkey
HKG	Hong Kong
RUS	Russia

[5] Note that three OECD countries do not report: Iceland, Switzerland and Poland, EU15 is mentioned as a separate reporter and Hong Kong and Russia are Non-OECD reporters

Table A.2: Concordance between OECD (TISPW special) and GTAP sectors

OECD names	GTAP and GTAP related names
200: 200: TOTAL SERVICES	
205: 205: TRANSPORTATION	TRA transport
236: 236: TRAVEL	TRV Travel
245: 245: COMMUNICATION SERVICES	CMN communication
249: 249: CONSTRUCTION SERVICES	CNS construction
253: 253: INSURANCE SERVICES	ISR insurance
260: 260: FINANCIAL SERVICES	OFI financial services nec
262: 262: COMPUTER AND INFORMATION SERVICES	CIS COMPUTER AND INFORMATION SERVICES (OBS)
266: 266: ROYALTIES AND LICENSE FEES	RLF ROYALTIES AND LICENSE FEES
268: 268: OTHER BUSINESS SERVICES	OBC business services nec (OBS)
287: 287: PERSONAL, CULTURAL AND RECREATIONAL SERVICES	ROS recreational and other services
291: 291: GOVERNMENT SERVICES, N.I.E.	OSG public admin. and defence, education, health
9842: 9842: Other commercial services transportation, excluding insurance services. (New Zealand)	
205291: 205291: Transportation and government services (Canada)	
984A: 984a: OTHER COMMERCIAL SERVICES	OCS OTHER COMMERCIAL SERVICES

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