



CENTRE
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Chaire Modélisation prospective
au service du développement durable

Addressing a self-trade issue in *GTAPAgg*

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Outline

1. Introduction : GTAP and GTAPAgg
2. The «*self-trade*» phenomenon
3. A new aggregation procedure to correct the '*self-trade*' issue
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Global Trade Analysis Project GTAP

- **Global network** of researchers and policy makers
groups more than 6700 researchers in more than 150 countries
- Helps and allows many economists to conduct **quantitative analysis** of international policy issues, **since 1992.**
- The project is coordinated by the **Centre for Global Trade Analysis in Purdue University's Department of Agricultural Economics.**

GTAP database

- The **GTAP network** cooperates to **produce the database** that is probably **the most used** in general equilibrium modelling exercises
- A unique characteristic:
providing a comprehensive and harmonized **global database** at a remarkable level of detail:

in the 7th version: **57 sectors , 113 regions and 5 factors**
cover the entire global economic activity for the **year 2004**.
- The database describes (among other things):
 - bilateral trade flows, production, consumption and intermediate use of goods and services.

GTAP database and GTAPAgg

- The most important feature of the **GTAP database : Strictly balanced**
 - **Regional level**: each of the 57 sectors are balanced in income and expenditure for each of its 113 regions.
 - **International level: bilateral trade flows data across all regions strictly compensate**
- Particular efforts have been made by the GTAP team
 - Collecting and scrutinizing national and regional data to build ‘local’ IO tables
 - **Reconciling bilateral trade data** coming from many different sources
To combine them in a consistent way into the database
- **GTAPAgg**: A user-friendly software that computes values of the series of the database
 - **for any region, sector and factor aggregation**
 - a modeller willing to use GTAP data and for calibration purposes naturally turns to **GTAPAgg**

The « *self-trade* » phenomenon

The **GTAPAgg** programme has one limitation:

- it **aggregates** the several series concerned with **international trade** like any other series
by simply summing them up

→ The resulting series **include** a share of exports and imports happening between the aggregated regions,

*which should rather be treated as **trade flows internal to the aggregated region***

- ***self-imports (self-exports)*** corresponding to importations (exportations) of an aggregated region from (to) itself ***are not equal to zero***
- and the *imported shares of each detailed expenditure is not corrected.*

Illustration: The global IO table

This 'self-trade' issue is best illustrated
with a *straightforward example*:

→ *the global IO table, for*

- *one region (the world),*
- *one good,*
- *and one factor*

→ *that a use of GTAPAgg produces*

Illustration: The global IO table

... aggregated from GTAPAgg (in thousand billion 2004 USD)

In parenthesis: expenditures or taxes on imported goods

	Intermediate Consumption	Consumption of households	Public consumption	Investment	Exports	Total Expenditure
Intermediate consumption	39.4 (6.8)	25.2 (2.8)	7.1 (0.2)	8.7 (1.4)	10.5	90.9
1 ^{ary} factor payments	32.5					
Taxes	8.5 (0.7)					
Imports	10.5					
Total Resource	90.9					

The World exhibits global exports and imports to itself that amount to ...

**26% of the
global GDP**

Perfectly balanced.....

.....for the world aggregated as one region **all goods are domestic ones** But..

By accounting for global exports and imports

—————→ **overestimation** of total global resources and total global expenditures by

\$10.5 trillion (~ +12%).

A regional aggregation

An EU27 IO table aggregated from GTAPAgg (in thousand billion 2004 USD)
 In parenthesis: expenditures or taxes on imported goods

	Intermediate Consumption	Consumption of households	Public consumption	Investment	Exports	Total Expenditure
Intermediate consumption	13.3 (2.7)	7.7 (1.3)	2.7 (0.1)	2.6 (0.5)	4.2	30.4
1 ^{ary} factor payments	9.1					
Taxes	3.8 (0.4)					
Imports	4.2					
Total Resource	30.4					

***The table is balanced
 its numbers arguably look unsuspecting !***

2.6 of the 4.2 trillions of the exportations are in fact *intra-European flows*
 ~ 62% of the exportations

Overestimation of the economies' openness rates

A regional aggregation

An EU27 IO table aggregated from GTAPAgg (in thousand billion 2004 USD)

In parenthesis: expenditures or taxes on imported goods

	Intermediate Consumption	Consumption of households	Public consumption	Investment	Exports	Total Expenditure
Intermediate consumption	13.3 (2.7)	7.7 (1.3)	2.7 (0.1)	2.6 (0.5)	4.2	30.4
1 ^{ary} factor payments	9.1	<div style="border: 1px solid black; padding: 5px;"> <p>Constructing an IO table <i>without correcting internal flows</i></p> <p>➡ Double counting them both on the resource and expenditure sides.</p> </div>				
Taxes	3.8 (0.4)					
Imports	4.2					
Total Resource	30.4					

The export of a good from France to Germany ➡ It is counted both:

- Expenditures
- As household consumption of imported good
(by the aggregation of the German household consumption data) (part of 1.3)
 - As an export
(by the aggregation of the French export data)

A new aggregation procedure to correct the '*self-trade*' issue

a programme extending GTAPAgg which :

- Produces **automatically IO tables** in the SNA format (the standard United Nations format); from the raw GTAP series; in csv format
 - **Corrects the 'self-trade' phenomenon**
 - Taking into account the **internal bilateral trade**, for any chosen aggregation level
 - Respecting the **accounting balance** for each production
 - Respecting the balance of expenditures and resources in terms of importations
- (the sum of the imported goods' consumptions = imports, for each good)**

Tackling the “self-trade” issue: A 5-steps process:

1

The “**self-trade**” shares of the *fob* imports and exports at world price **are subtracted** from their **raw aggregate totals**

The two shares amount to the same:

the exports of one region to itself equal its imports from itself.

For each good:

- The balance of expenditures and resources is not affected
- The balance of the imported variant is affected
Imports on the resource side **become smaller** than the **consumption of imported goods** on the expenditure side.

Tackling the “self-trade” issue: A 5-steps process:

2

On the resources side

The “self-trade” shares of the **imports and exports taxes** are

- Subtracted
- Reallocated to a new tax category
(assumed as border taxes internal to the aggregated region)

Tackling the “self-trade” issue: A 5-steps process:

3

Still on the resources side

A share of the taxes on the imported good consumption is reallocated to the taxes on the domestic good consumption



Increases the unbalance between resource and expenditure for the imported goods.

Tackling the “self-trade” issue: A 5-steps process:

4

On the expenditure side

A share of the **intermediate and final consumptions** of the imported variant of each good is reallocated to its domestic variant



Restores the resource-expenditure balance
for the imported goods

Tackling the “self-trade” issue: A 5-steps process:

For each region, the shares to be reallocated under **step 3 and 4** are identical :

$$reallocated_Share = \frac{Self_impFOB + partSelf_impTransp + Self_impTax}{impFOB + impTransp + impTax}$$

- = the aggregate share of the “self-trade” part in the sum of:
- imports FOB,
 - the transportation costs of international exchanges
 - import taxes

Tackling the “self-trade” issue: A 5-steps process:

5

On the expenditure side

A share of the exports of transportation services *specifically linked to international trade* is **reallocated** to the domestic intermediate consumption of transportation goods (goods 48, 49 and 50 of the database).

GTAP database does not identify what part of the “*self-import*” transportation is undertaken by business of the self-importing region



The **part reallocated** is set proportional to the participation of the region to these international activities

Illustration of the “*self-trade*” correction

An EU27 IO table aggregated from GTAPAgg

	Intermediate Consumption	Consumption of households	Public consumption	Investment	Exports	Total Expenditure
Intermediate consumption	13.3 (2.7)	7.7 (1.3)	2.7 (0.1)	2.6 (0.5)	4.2	30.4
1 ^{ary} factor payments	9.1					
Taxes	3.8 (0.4)					
Imports	4.2					
Total Resource	30.4					

**2 different pictures of the European economy...
With GDP unchanged**

The “corrected” IO table

	Intermediate Consumption	Consumption of households	Public consumption	Investment	Exports	Total Expenditure
Intermediate consumption	13.3 (1.1)	7.7 (0.5)	2.7 (0.0)	2.6 (0.2)	1.6	27.8
1 ^{ary} factor payments	9.1					
Taxes	3.8 (0.1)					
Imports	1.7					
Total Resource	27.8					

exclusively sum up the trade flows to and from regions outside the EU

Trade now amounts to much lower
~ 12% of income (in stead of 32%)

The exposure of EU to international trade is reassessed quite lower than with the uncorrected data

Concluding comments

- The programme correcting the «*self-trade*» issue is developed under **Scilab** (a freeware version of Matlab)
- The programme is **valid whatever the version of GTAP**
- This programme has already been used for the **calibration** of two **CGE models**:
 - *IMACLIM-S* (Ghersi et al., 2009)
 - *IMACLIM-R* (Sassi et al., 2010)
- **Next Step:**
Illustrate the importance of the «*self-trade*» correction by comparing the conclusions of some policy analysis conducted either on the uncorrected, or on the corrected EU IO table.

Thank you ...!!!

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Appendix

An easy correction: The global IO table

	Intermediate Consumption	Consumption of households	Public consumption	Investment	Exports	Total Expenditure
Intermediate consumption	39.4 (6.8)	25.2 (2.8)	7.1 (0.2)	8.7 (1.4)	10.5	90.9
1 ^{ary} factor payments	32.5				0	80.4
Taxes	8.5 (0.7)					
Imports	10.5	0				
Total Resource	90.9	80.4				

- The aggregate import and export data can then simply be dropped.
- This is without consequence on the balance of the table since the two values match
- They strictly describe the same set of economic flows.
- Consequently the detail of the domestic or imported sources of expenditures and taxes can be ignored.

A regional aggregation

An EU27 IO table aggregated from GTAPAgg (in thousand billion 2004 USD)
 In parenthesis: *expenditures or taxes on imported goods*

	Intermediate Consumption	Consumption of households	Public consumption	Investment	Exports	Total Expenditure
Intermediate consumption	13.3 (2.7)	7.7 (1.3)	2.7 (0.1)	2.6 (0.5)	4.2	30.4
1 ^{ary} factor payments	9.1	Constructing an IO table <i>without correcting internal flows</i> → Double counting them both on the resource and expenditure sides.				
Taxes	3.8 (0.4)					
Imports	4.2					
Total Resource	30.4					

The export of a good from France to Germany → The income source of this good is counted both:

- Resource**
- at the level of primary factors and taxes (by the aggregation of the French data)
 - and as an import (by the aggregation of the German data).

Tackling the “self-trade” issue: Explanation for the step 5

- A region i is performing an amount m of the transport costs of a good j ,
(costs that are related to ‘self trade’ importations of this good)
- We subtract this amount m from its total imports
(in cost-insurance-freight, CIF, terms)
 - We then transfer it to the three transport intermediate consumptions of the production of the good j
 - ➔ This transfer is done in proportion of their part in the total of the international transport operated by i
 - We finally correct the expenditures by subtracting the same amounts from exports of these three transportation goods.

Illustration of the correction

Inermediate consumption matrix UE (\$2004)

		Moteur GTAP d'origine			Moteur Réctifié		
		E	Q	Total	E	Q	Total
Imp	E	2.03E+05	5.92E+04	2.62E+05	1.55E+05	4.53E+04	2.00E+05
	Q	2.31E+04	2.39E+06	2.41E+06	8.46E+03	8.76E+05	8.84E+05
	Total	2.26E+05	2.45E+06	2.67E+06	1.64E+05	9.21E+05	1.08E+06
Dom	E	1.37E+05	3.43E+05	4.80E+05	1.85E+05	3.57E+05	5.42E+05
	Q	1.13E+05	1.00E+07	1.01E+07	1.28E+05	1.15E+07	1.17E+07
	Total	2.50E+05	1.03E+07	1.06E+07	3.13E+05	1.19E+07	1.22E+07
Total CI		4.76E+05	1.28E+07	1.33E+07	4.76E+05	1.28E+07	1.33E+07

Households consumption UE (\$2004)

	Moteur GTAP d'origine			Moteur Réctifié		
	Imp	Dom	Total	Imp	Dom	Total
E	7.29E+04	3.28E+05	4.01E+05	5.58E+04	3.45E+05	4.01E+05
Q	1.18E+06	6.10E+06	7.28E+06	4.33E+05	6.85E+06	7.28E+06
Total	1.25E+06	6.43E+06	7.68E+06	4.89E+05	7.20E+06	7.68E+06

X2,6

Les TES correspondants offrent une image très différente