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Addressing a 'self-trade' issue in GTAP*Agg*

Technical Paper

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Abstract

The successive versions of the GTAP databases are provided with GTAP*Agg*, a programme that computes values of the series of the database for any regional and sectoral aggregation. A 'self-trade' issue arises from the fact that GTAP*Agg* 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 economic flows internal to the region resulting from the aggregation process.

This paper details a method that aims at solving this shortcoming, and discusses the importance of doing so. A first section puts the research question into context and discusses its likely importance when using GTAP as a calibration dataset for computable general equilibrium modelling. A second section details the analytics of the method proposed to correct the aggregation process, in the broader framework of a programme extending GTAP*Agg* to the production of national account matrixes in the standard United Nations format. An appendix provides the code of the extended aggregation programme developed.

Keywords

Input-Output Tables, Trade Analysis, Computable General Equilibrium, Data Aggregation.

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I   Introduction

The GTAP*Agg* programme that aggregates regional data from the GTAP 7 database does so under the simplest assumptions regarding international trade, *i.e.* by summing up the export and import series of each aggregated region. This raises a crucial problem when using GTAP to calibrate CGE models—as is commonly done considering that the GTAP database offers a unique consistent picture of economic flows across sectors and regions at a global level. Basically, auto-imports and auto-exports, corresponding to imports and exports of an aggregated region to (from) itself are not brought to zero by GTAP*Agg*, and the shares of each detailed expenditure that are imported are not corrected.

The purpose of this paper is to present a detailed aggregation routine correcting this 'self-trade' problem. A first section puts the research question into context and discusses its likely importance when using GTAP as a calibration dataset for computable general equilibrium modelling. The contribution of the correction is illustrated on an example: a European Union IO table with and without 'self-trade' is given, with comments on implications that not correcting for 'self-trade' can generate.

A second section details the method proposed to correct the aggregation process, in the broader framework of a programme extending GTAP*Agg* to the production of national accounting matrixes in the standard United Nations format. The correction procedure is indeed embedded in the development of a Scilab[3] programme that automatically generates balanced input-output tables based on the GTAP7 database, for any aggregation of regions, sectors and factors. The comprehensive Scilab programme is provided in the appendix to make it accessible to the GTAP network.

II   The 'self-trade' issue in GTAP: what it is and what is at stake

As a global network of researchers and policymakers, the Global Trade Analysis Project (GTAP) 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.[4]

The GTAP network cooperates to produce the database that is probably the most used in general equilibrium modelling exercises.[5] GTAP has indeed the unique characteristic of providing a comprehensive and harmonized global database at a remarkable level of detail: in the 7th version, 57 sectors and 113 regions cover the entire global economic activity for the year 2004.[6] The GTAP website

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[3] Scilab is a freeware version of MatLab.

[4] www.gtap.org.

[5] https://www.gtap.agecon.purdue.edu/databases/default.asp.

[6] Previous versions provide data for the reference years 2001, 1997, 1995 and 1992.

provides regional and sector listings[7] and chapter 2, section 2.2.3 of the GTAP 7 Data Base Documentation details the sector definitions (Badri Narayanan *et al.*, 2008).

The success of the project is largely due to the voluntary contributions of hundreds of partner organizations and researchers across the world. Indeed, this global network groups more than 6700 researchers in more than 150 countries (Hertel and Walmsley, 2008).

As the quantitative analysis of global policy issues is increasingly widespread, and the general equilibrium modelling community growing, the use of such an exhaustive and comprehensive database is gaining ground. GTAP is not only a unique endeavour, it also has high scientific standards, its construction and maintenance being governed by the following principles: *Public Availability, Regular Updates*, *Broad Participation, Comparative Advantage*, *Documentation and Replicability* and *Quality Assurance* (*ibid*).

The database describes, among other things, bilateral trade flows, production, consumption and intermediate use of goods and services. Most data are given as dollar values (2004 USD) except for some energy data that are also available in quantities (million tons of oil equivalent, MTOE).

The successive versions of the databases are provided with GTAP*Agg*, a programme that computes values of the series of the database for any region, sector and factor aggregation. From a practical point of view, a modeller willing to use GTAP data for calibration purposes naturally turns to this user-friendly software: in a few seconds, the aggregated database is produced, with any required numbers of regions, sectors and factors[8] (smaller than or equal to respectively 113, 57 and 5). The folders that constitute this new database are automatically bundled into a ZIP archive. Most of the files that are produced with GTAP*Agg* are stored in a particular format, the Header Array or HAR format. Nevertheless, the data is easily sent to a spreadsheet by using the Copy button to send a report of the aggregation to the clipboard (Horridge, 2008).

Besides energy use data and time-series trade data, the two main files in the .ZIP archive are *basedata.har* and *baseview.har*. The detail of the series needed to build a comprehensive set of Input-Output (IO) tables is given in section III.2. Throughout the following paper, reference will be made to the different series by using prefixes: "bd." for the series *basedata.har* and "bv." for the series *baseview.har.*

The most important feature of the GTAP database, that which accounts for its particular relevance to CGE modelling, is that it is strictly balanced: at the regional level, where each of the 57 sectors are balanced in income and expenditure, for each of its 113 regions; and the international level, where bilateral trade flows data across all regions strictly compensate. Indeed, particular efforts have been made by the GTAP team to collect and scrutinise national or regional data to build 'local' IO tables that have been taken into account as important contribution to the GTAP database (Huff *et al.*, 2000); then the GTAP team has put much effort on reconciling bilateral trade data coming from many different sources to combine them in a consistent way into the database (Gehlhar, 1996).

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[7] Respectively https://www.gtap.agecon.purdue.edu/databases/regions.asp?Version=7.211 and https://www.gtap.agecon.purdue.edu/databases/v7/v7_sectors.asp.

[8] Endowment commodities.

However, the GTAP*Agg* programme that aggregates regional data from the database has one limitation: it aggregates the several series concerned with international trade like any other series, by simply summing them up. As a consequence, 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 region resulting from the aggregation process: auto-imports (auto-exports) corresponding to importations (exportations) of an aggregated region to (from) itself are not brought down to zero, and the imported shares of each detailed expenditure is not corrected. 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 GTAP*Agg* limited to the arrangement of the series it provides, produces (Table 1).

	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					

Table 1   A global IO table aggregated from GTAP*Agg* (in thousand billion 2004 USD)
In parenthesis: expenditures or taxes on imported goods

The aggregated world thus exhibits global exports and imports to itself that amount to 26% of its GDP (10.5 over 41.0, the sum of primary factor payments and taxes); indeed the detail of the uses of these imports is readily available (in parenthesis in table 1). Of course for the world aggregated as one region all goods are domestic ones, and any user confronted to such figures is bound to identify the self-trade issue. 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 quite opportunistically match—they indeed strictly describe the same set of economic flows.[9] Consequently the detail of the domestic or imported sources of expenditures and taxes can be ignored.

Now the self-trade issue and its settlement are much less obvious when any regional aggregation beyond the specific global case is considered. To illustrate this, the aggregation of the 27 member states of the European Union, based on the same undiscerning use of GTAP*Agg*, is provided and commented upon (Table 2). In this latter case a database user, particularly one not directly interested in trade issues, or not familiar enough with them to have a notion of the amounts at stake,[10] could easily overlook his mistake:

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[9] Note that by accounting for global exports and imports Table 1 is thus overestimating total global resources and total global expenditures by $10.5 trillion.

[10] The likelihood of the figures is all the harder to assess as goods are disaggregated.

the table is balanced and its numbers arguably look unsuspicious; the exports and imports broadly compensate one another, which does not raise any particular concern.

	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 Income	30.4					

Table 2   An EU27 IO table aggregated from GTAP*Agg* (in thousand billion 2004 USD)
In parenthesis: expenditures or taxes on imported goods

But the uncorrected exports reach $4.2 trillion, that is 32% of a $12.9 trillion GDP, and it is only by exploring bilateral trade data that one becomes aware that 2.6 of these trillions are in fact intra-European flows. By constructing an IO table without correcting for these flows one is indeed double counting them both on the resource and expenditure sides. Consider for example the export of some consumer good from France to Germany: it is counted both as household consumption of an imported good (part of a $1.3 trillion total, by the aggregation of the German household consumption data), and as an export (part of the $4.2 trillion total, by the aggregation of the French export data); similarly the income source of this good is counted both 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). Any trade policy analysis based on such an approximate data treatment is bound to be misleading in some of its results, all the more so as it is derived from a model resorting to a 'pooling'[11] rather than a bilateral description of international trade.

Table 3 below provides the corrected IO table produced by the method that will be extensively discussed in the following section. At $1.6 and $1.7 trillion respectively, export and import totals now exclusively sum up the trade flows to and from regions outside the EU. With GDP unchanged (for the simple reason that the sum of income sources, or of expenditures, is not affected by the correction) trade now amounts to a much lower 12% to 13% of income. The exposure of EU to international trade is reassessed quite lower than with the uncorrected data; incidentally, European trade appears more unbalanced than it did without correction of the self-trade issue. This cannot fail to have consequences on any policy analysis conducted on such a snapshot of the EU economy.

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[11] The exports of all regions form a pool, from which the regions import. Bilateral flows, including the problematic flows from each aggregate region to itself, are not identified anymore.

	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 Income	27.8					

Table 3   An EU27 IO table aggregated from GTAP*Agg*, with correction of the 'self-trade' flows (in thousand billion 2004 USD)
In parenthesis: expenditures or taxes on imported goods

III   A method to correct the 'self-trade' issue

This section details the method proposed to tackle the 'self-trade' issue, in the broader framework of a programme extending GTAP*Agg* to the production of IO tables in the System of National Accounts (SNA), the standard United Nations format (UN, 1993). A first subsection exposes a broad outline of the method developed. A second subsection details how to construct IO tables from the raw GTAP series, by precisely identifying which of the series or elements thereof are to be used, and how they should be organised. A third and final subsection provides the detailed description of the method used to correct the aggregation problem that has been identified.

III.1   Overview of a new aggregation procedure to correct the 'self-trade' issue

This subsection provides an overview of the method used to correct the 'self-trade' issue of the GTAP*Agg* programme before entering into the details given in subsection III.3. The description bellow relies on concepts of National Account Systems that are evoked in subsection III.2 (Input Output tables construction: the GTAP dataset needed)

The input-output table of any aggregated region is corrected in a 5-step process:

- The 'self trade' shares of the free-on-board (FOB) imports and the exports at world price (the two shares must indeed amount to the same: the exports of one region to itself must equal its imports from itself) are subtracted from their raw aggregate totals. This does not affect the balance of expenditures and resources for each good; however it affects that of the imported variant of each good: imports on the resource side become smaller than the consumption of imported goods on the expenditure side.

- On the resource side, the 'self trade' shares of the import and the export taxes are subtracted and reallocated to a new tax category—the status of these border taxes internal to the region resulting from the aggregation is indeed quite specific.

- Still on the resource side, a share (*cf. infra*) of the taxes on the imported good consumption is reallocated to the taxes on the domestic good consumption; this increases the unbalance between resource and expenditure for the imported goods.

- On the expenditure side, a share (*cf. infra*) of the intermediate and final consumptions of the imported variant of each good is reallocated to its domestic variant: this restores the resource-expenditure balance for the imported goods.

- 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). Since GTAP does not identify what part of the 'self-import' transportation is undertaken by businesses of the self-importing region, this part is set proportional to the participation of the region to these international transportation activities. This deserves an illustration: 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 thus 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.

For each region the shares to be reallocated under points 3 and 4 above are identical, defined as the aggregate share of the 'self-trade' part in the sum of imports FOB, the transportation costs of international exchanges, and import taxes.

III.2 Input Output tables construction: the GTAP dataset needed

Before detailing the GTAP series that allow building balanced IO tables, let us quickly recall a few notions and concepts concerning the National Accounts.[12] The National Accounts—and the IO tables (or Social Accounting Matrixes) that synthesize them—are based on a balance between expenditures and resources. This equilibrium has to be verified for all the goods[13] considered, summing up:

- On the expenditure side, the intermediate consumptions (57 productions in GTAP, including the production of good in question), the final consumptions (1 representative Household, 1 government and 1 investing sector) and exports (nominal exports and transportation services specifically linked to international trade).

- On the resources side, the factor consumptions (5 factors), the taxes and the imports (nominal imports and their international transport costs).

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[12] Linked to the GTAP database in terms of the number of goods and factors.

[13] When it comes to any modelling with a connection to 'quantity' problems such as energy balances or environmental pollutions, a disaggregation by goods rather than by production sectors is more relevant. Incidentally this requires some caution in the transposition of modelling results to industrial branches, because of joint production issues.

The GTAP series that allow reconstituting this equilibrium, *i.e.* the GTAP dataset needed to build balanced IO tables, is the following:[14]

Intermediate Consumptions: valued at market price (tax-free valuation):

Intermediates - Firms' Imports at Market Prices (bd13 – VIFM - without taking the CGDS[15]) ;

Intermediates - Firms' Domestic Purchases at Market Prices (bd14— VDFM without taking the CGDS) ;

Final Consumptions (Households, Governments, and CGDS): valued at Agents prices (including all taxes):

Intermediates - Household Imports at Agents' Prices (bd26 - VIPA) ;

Intermediates - Household Domestic Purchases at Agents' Prices (bd27 - VDPA) ;

Intermediates - Government Imports at Agents' Prices (bd28 - VIGA) ;

Intermediates - Government Domestic Purchases at Agents' Prices (bd29 - VDGA) ;

Intermediates - Firms' Imports at Agents' Prices (bd15 – VIFA – taking CGDS) ;

Intermediates - Firms' Domestic Purchases at Agents' Prices (bd16 - VDFA taking CGDS).

Exports: sum of exports at world price and exports of transportation services specifically linked to international trade:

Decomposition of exports at world prices[16] (bv11 – BI01: In the selection bar for regions, the exporting region is the left one. In order to obtain the export total of the selected region, the modeller must select Sum REG in the right selection bar for regions);

Trade - Exports for International Transportation, Market Prices (bd23 - VST).

Factors Consumptions: valued at market price (this valuation takes into account capital depreciation—fixed capital consumption—, but GTAP does not indicate how to disaggregate this data between the different productions):

Endowments - Firms' Purchases at Market Prices (bd18 - VFM)

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[14] Each series is mentioned as a part of the file BaseData (bd) or BaseView (bv) followed by its line number in the file, as well as the GTAP Header code, *e.g.* bd13 – VIFM for the series number 13 of the file BaseData.har whose the Header code is VIFM: Intermediates - Firms' Imports at Market Prices. The number and file (bd or bv) are related to the version 7 of the GTAP database. For the previous versions only the names of the series remain the same.

[15] This refers to the consumption of the different goods that are immobilized in CGDS.

[16] Note that the 'self-trade' issue is observable in this series: the exports from one region to its self are not equal to zero.

Imports: imports at world price or CIF, valued without taxes:

Decomposition of imports at market prices (bv12 – BI02).

Taxes:

Production taxes :

outtax in the series Value of output at market prices (bv20 – CM04) ;

Factor consumption taxes :

comtax in *Cost structure of firms* (bv22— SF01 detailing one factor consumption) ;

Intermediate consumption taxes:

comtax in *Cost structure of firms* (bv22— SF01 detailing one intermediate consumption)[17];

Households consumptions taxes:

comtax in *Cost structure of consumption* (bv23 – SF02). As for the intermediate consumptions, the tax detail by origin (domestic or imported good consumption) is available.

Governments consumption taxes:

comtax in *Cost structure of government* (bv24 – SF03). Again, the tax detail by origin (domestic or imported good consumption) is available.

Import taxes :

mtax in Disposition of imported goods (bv19 – CM03).

Export taxes:

xtax in Decomposition of exports at world prices (bv11 – BI01) .

The series *GDP from the expenditure side* (bv5 – AG01) and/or *GDP from the sources side* (bv6 – AG02) allow checking if the IO tables built from the series above provide correct GDP.

III.3 Detailed description of the 'self-trade' correction method and the IO table construction

Although the primary objective of this section is to give the details of the self-trade correction method, we start by describing the programme that automates the construction of IO tables from the GTAP database at any regional and sectoral aggregation level. Indeed, the 'self-trade' correction is embedded in a larger programme that finally leads to the construction of balanced IO tables delivered under a csv or xls format.

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[17] The tax detail by origin (*i.e.* domestic or imported good consumption) is available. The CGDS taxes have to be considered for each good concerned (the *comtax* column on the CGDS has to be transformed in a row of taxation on each good in its consumption for the CGDS).

The method is exposed in two main parts: a first part details the data extracted from GTAP to be used in the programme; the second part describes how the programme operates.

III.3.1   GTAP data importation

The "one-to-one" aggregations of the GTAP*Agg* programme (without any regional, sectoral and factor aggregation) produce the raw data that are used by the IO table building programme.

These data are stored as matrices in 16 .sce files:

Conso_Interm_Imp.sce holds the 57x58 matrices of the intermediate consumptions of imported goods. These matrices are extracted from the series bd13-VIFM, *Intermediates - Firms' Imports at Market Prices*. GTAP gives 113 matrices of size 57x58 (57 is the sector number; the 58th column gives CGDS at market prices) that are stored in the scilab list ***C.*** The 113 intermediate consumptions matrices strictly speaking (CGDS excluded, thus of size 57x57) are stored in a second scilab list: ***CI_imp.*** In this list of 113 elements, each element ***k*** (a matrix 57x57) details the intermediate consumptions of imported goods for each sector of the region ***k***.

Conso_Interm_Dom.sce holds the 57x58 matrices of the intermediate consumptions of domestic goods. These matrices are extracted from the series bd14-VDFM *Intermediates -Firms' Domestic Purchases at Market Prices*. Similarly to Conso_Interm_Imp.sce, the data are stored in the scilab list ***CC***, then without the CGDS in the list ***CI_dom***, thus obtaining 113 matrices of the intermediate consumptions of domestic goods.

Conso_Menages.sce[18] holds two matrices of size 57x113: ***C_25*** for the household consumptions of domestic goods and ***C_26*** for the household consumptions of imported goods. These matrices are respectively extracted from the series bd26-VIPA *Intermediates - Household Imports at Agents' Prices* and bd27-VDPA *Intermediates - Household Domestic Purchases at Agent' Prices*.

Conso_AP.sce[19] holds two matrices of size 57x113: ***C_28*** for the government consumptions of domestic goods and ***C_27*** for the government consumptions of imported goods. These matrices are respectively extracted from the series bd28 - VIGA *Intermediates - Government Imports at Agents'* Prices and bd29 – VDGA Intermediates - *Government Domestic Purchases at Agent' Prices.*

Conso_FBCF.sce[20] holds two matrices of size 57x113: ***C_14*** for the CGDS consumptions of imported goods and ***C_15*** for the CGDS consumptions of domestic goods. These matrices are respectively extracted from the series bd15-VIFA Intermediates - *Firms' Imports at Agents' Prices* and bd16- VDFA *Intermediates - Firms' Domestic Purchases at Agents' Prices.*

Export_Import.sce holds the exports and imports matrices: ***XX,*** of size 57x113, contains the exports at world price, extracted from the series bv11 – BI01 *Decomposition of exports at world prices*. ***x_Trans,*** of size 3 goods x 113 regions, contains exports of transportation services specifically linked to international

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[18] *Ménages* is French for households. A further/international version of the paper will translate all variable names.

[19] AP refers to *Administrations Publiques*, the French for Public Administrations. This is Government consumption.

[20] FBCF is the French equivalent of CGDS.

trade extracted from the series bd23-VST *Trade - Exports for International Transportation, Market Prices*. The three goods in question are the three types of transport that are distinguished in the GTAP database. To obtain a matrix **XX_Trans** of size 57x113, **x_Trans** is concatenated with two zero matrices, **x1_Trans** and **x2_Trans**. **MM_fob**, of size 57x113, contains the imports at world price without transports costs (free-on-board). It is extracted from the series bv13-BI03 *Decomposition of CIF values*, data *fob*. **MM_Trans,** of size 57x113, contains the transport costs of the imports above. It is also extracted from the series bv13-BI03 *Decomposition of CIF values*, but taking the *trans* data. The sum the two last matrices is the data *impcost* from the series bv12-BI02 *Decomposition of imports at market prices.* The data could simply be taken to this series, but the transport costs detail (*impcost = trans + fob)* is necessary for the 'self-imports' and 'self-exports' correction.

Exports.sce holds a 57 elements scilab list **Export**. Each element is a matrix 113x113 extracted from the series bv11-BI01 *Decomposition of exports at world prices* .Each matrix details the exports (taxes included) of one of the 57 goods, from any of the 113 regions (the exporting region is the column data) to any other (the export destination is the row data). These matrices are stored to allow correcting the trade balances aggregations as done by GTAP*Agg*.

Imports_Fob.sce holds a 57 elements scilab list **Import_fob**. Each element is a matrix 113x113 extracted from the series bv13-BI03 *Decomposition of CIF value* .Each matrix details the free-on-board imports of one of the 57 goods, by any one of the 113 regions (the importing region is the data in column) from any other one (the origin of the importation is the row data). Like the previous ones, these matrices are stored to allow correcting the aggregation of the trade balances.

Imports_Transp.sce holds 57 matrices that will be used to correct the transportation costs of the imports. Similarly to the previous file, these matrices are stored in the scilab list **Import_Tran** and they are extracted from the series bv13-BI03, taking the *trans* data (instead of *fob* in the previous file).

Conso_Fact.sce holds 113 matrices of size 5x58 (factors x production, the 58th production corresponds to the CGDS). These matrices detail the factor consumptions by region and production; they are extracted from the series bd18-VFM *Endowments - Firm's Purchases at Market Prices*. The data are stored in the scilab list **F,** then in the list **CFact** (excluding the CGDS). Each element **k** (*i.e.* each matrix) represents the factor consumptions of region k in each of the 57 production.

Taxes1.sce holds the matrices of the taxes on production, household and government consumption. The production tax matrix **T_13**, of size 57x113, is extracted from the series bv20-CM04 *Value of output at Market Prices*, taking the data *outtax*. The consumption taxes are extracted from the series bv23-SF02 *Cost structure of consumption* and bv24-SF03*Cost structure of government*, taking the data *comtax*. A distinction is done between the taxes on domestic goods consumptions (57x113 matrices: **T_16_Dom** for households and **T_17_Dom** for governments) and those on imported goods consumptions (57x113 matrices: **T_16_Imp** for households and **T_17_Imp** for governments).

Taxes2_Dom.sce holds the matrices of the taxes on the intermediate consumptions and on the CGDS of domestic products. It also holds the matrices of the taxes on the factor consumptions. These data are extracted from the series bv22-SF01 *Cost structure of firms*. GTAP provides 113 matrices of size 62x58 that are stored in the scilab list **TT**. From this list are extracted:

- The 113 matrices 5x57 of factors consumptios taxes, list **T_ConsFact** *;*

- The 113 matrices 57x57 of the taxes on the intermediates consumptions of domestic goods, list **T_CI_dom** ;

- The 113 matrices 1x57 of the taxes on the CGDS of domectic products, list **T_FBCF_dom**.

Taxes2_Imp.sce holds the matrices of the taxes on the intermediate consumptions and on the CGDS of imported products. They are extracted from the same series bv22-SF01 *Cost structure of firms*. The 113 matrices 62x58 given by GTAP are stored in the scilab list **T**. From **T**, are extracted, in way similar to the extraction in the previous file, the scilab *lists* **T_CI_imp** and **T_FBCF_imp.**

Taxes3.sce holds two matrices, of size 57x113, of the export and import taxes. The first, **T_xtax**, is extracted from the series bv11-BI01 *Decomposition of exports at world prices,* taking the data *xtax.* The second, **T_mtax**, is extracted from the series bv12-BI02 *Decomposition of imports at market prices*, taking the data *mtax.*

xtax.sce holds 57 matrices of size 113x113, stored in the scilab list **xtax**. This file takes the data from **T_xtax** (*c.f* previous file) and details bilateral trade (one matrix *per* good allows to determine which tax is applied to the exports of this good, for each exporting region—row data—to any other destination—column data).

mtax.sce, like the file xtax.sce, completes the **T_mtax** data by presenting bilateral trade. Each one of the 57 matrices of **mtax** gives the tax applied on the importation of a good of any importing region (column data) from any origin (row data).

Like the files *Exports.sce*, *Imports_Fob.sce* and *Imports_Transp.sce*, the file *xtax.sce* and *mtax.sce* are used for the treatment of the self-imports and the self-exports as aggregation proceeds.

III.3.2 Details of the procedure

As mentioned before, the GTAP*Agg* program produces a ZIP folder that contains the main information needed. Among other things, this ZIP folder contains a text file under the format .agg. Scilab extracts from this file the following parameters:

- **P, N, K** represent respectively the new number of sectors, regions and factors, depending on the aggregation scheme decided upon by the user;

- **b** and **B** are text vectors that contain respectively the names of the disaggregated sectors (of size 57) and the name of the aggregated sectors (of size P);

- **r** and **R** are text vectors that contain respectively the names of the disaggregated regions (of size 113) and the name of the aggregated regions (of size N);

- **f** and **Fact** are text vectors that contain respectively the names of the disaggregated factors (of size 5) and the name of the aggregated factors (of size K);

Aggregated matrices calculation

From these parameters, two matrices are defined: **Masc1** and **Masc2**. They indicate the membership of a disaggregated region (resp. a sector) to a new aggregated one, and they are constituted of 0 and 1. Their mathematic product with the various data matrices provides a new group of aggregated data according to

the aggregation level desired by the database user. Therefore, all the data of size 113 (resp. 57) become of size *N* (resp. *P*), defining two aggregated groups of matrices.

The first group is constituted of matrices that are stored in a list of *N* elements (one element *per* aggregated region):

- ***CI_imp_Agg, CI_dom_Agg, T_CI_imp_Agg*** and ***T_CI_dom_Agg***, of size PxP: contain the intermediate consumptions of imported and domestic goods, as well as the taxes on these consumptions.

- ***CFact_Agg*** and ***T_ConsFact_Agg***, of size *KxP*, contain the factors consumptions and the taxes on these consumptions.

- T_***FBCF_dom_Agg*** and ***T_FBCF_imp_Agg***, of size 1xP, contain the taxes on the CGDS of domestic and imported goods.

The second group is constituted of matrices of size PxN (only one matrix for all the aggregated regions):

- ***M_fob_Agg, M_Trans_Agg, X_Agg*** and ***X_Trans_Agg*** contain the *fob* imports, their transportation costs, the *fob* exports and the exports of transportation services specifically linked to international trade.

- ***C_25_Agg*** and ***C_26_Agg*** contain the household's consumptions of respectively imported and domestic goods.

- ***C_27_Agg*** and ***C_28_Agg*** contain the governments' consumptions of respectively imported and domestic goods.

- ***C_14_Agg*** and ***C_15_Agg*** contain the CGDS of respectively imported and domestic goods.

- ***T_13*** contains the production taxes.

- ***T_16_DomAgg*** and ***T_16_ImpAgg*** contain the taxes on the households' consumptions of domestic and imported goods.

- ***T_17_DomAgg*** and ***T_17_ImpAgg*** contain the taxes on the governments' consumptions of domestic and imported goods.

- ***T_mtaxAgg*** and ***T_xtaxAgg*** contain the exports and imports taxes.

Separation of the regions

Once regional and sectoral aggregations have been done on the raw data matrices, the columns of the new matrices of the second group above are separated to obtain, for each data (consumptions, taxes, *etc*.), one vector *per* aggregated region. In the rest of the text, the following abbreviations (notations) will be used in the names of the matrices:

C: consumption,

CI: intermediate consumptions,

T: taxes,

Hsld: Households,

G or **AP**: Governments,

X or **x**: exports,

M or **m**: imports,

Imp, **Dom**: imported goods, domestic goods,

Trans or **Tran**: transports,

corr: corrected,

i: aggregated region index, $1 < i < N$.

Based on this convention, the aggregated data vectors are stored in the following scilab lists:

C_Hsld_imp(i), C_Hsld_dom(i)

C_G_imp(i), C_G_dom(i)

C_FBCF_imp(i), C_FBCF_dom(i)

x(i), X_Trans(i)

m_fob(i), M_Trans(i)

Tmtax(i), Txtax(i)

Tprod(i)

THsld_Dom(i), THsld_Imp(i)

TG_Dom(i), TG_Imp(i)

Note that a simple concatenation of these lists allows the construction of an IO table. However, the 'self-trade' issue is still to be corrected.

Internal bilateral trade correction

The correction of the internal bilateral trade occurs after the aggregation process is done, through the subtraction of the 'self' shares from the totals of imports, exports, taxes and transport costs, then through the transfer of these shares to other posts of the IO table.

Obviously, this correction operation must respect the sectoral balances of the IO table on one hand, and on the other hand it also has to respect the general equilibrium between expenditures and resources in terms of importations (the sum of imported goods consumptions has to be equal to the imports including taxes).

Calculation of the 'self-trade' shares

We start with the sectoral aggregations (from 57 to *P* sectors) concerning the following lists:

Export, Import_fob, Import_Tran, mtax and xtax.

We thus obtain **P** matrices of size 113x113 that detail bilateral trade, taxes and transport costs.

Then, for each aggregated region **i**, we build the **P**-*"self"-vectors*:

Auto_X(i),

Auto_M_fob(i),

Auto_M_Trans(i),

Auto_xtax(i),

Auto_mtax(i).

These vectors contain respectively the exports, FOB imports, transport costs of these imports, export taxes and import taxes of all the regions aggregated in region **i** between themselves. For example, considering two regions A and B aggregated into a region C: **Auto_X(C)** is the sum of exports from A to A, from A to B, from B to B and from B to A.

This operation produce, for each aggregated region, the amounts that are to be transferred from *foreign trade* to *domestic trade*.

However, an important question remains concerning the allocation of the transport costs of the trade that becomes domestic. Indeed, even if GTAP indicates the participation of each country in the international commodities transports, and gives the transport costs supported by each international trade flow, it does not assign each of these transport costs to any particular region. In other words, we do not know what share of the transport costs of the 'self-imports' **Auto_M_Trans(i)** of an aggregated region **i** is really carried out by this region. We settle this uncertainty by assuming that this share is proportional to the participation of the region **i** into international transportation activities. The result of this rule is stored in the vector **Part_AutoM_Trans(i)**.

Recalculation of exportations and FOB importations

For each aggregated region **i**, we remove the 'self' share from exports and imports to obtain two new **P**-*vectors*:

x_corr(i) = x(i) – Auto_X(i)

m_fob_corr(i) = m_fob(i) – Auto_M_fob(i)

The 'self' share value removed from the expenditure side is the same as the one removed from the resource side (**Auto_X(i) = Auto_M_fob(i)** by definition of the source series). This identity guarantees the preservation of the balance between expenditures and resources for each good.

However, this operation affects the balance of the imported variant of each good: imports on the resource side become smaller than the consumption of imported goods on the expenditure side. We correct this imbalance by transferring a share of the consumption of imported goods to the consumption of domestic goods, for each expenditure.

To do this transfer, and without any additional data, we define the following **P**-vector:

$$p\_bascul(i) = \frac{Auto\_M\_fob(i) + Part\_AutoM\_Trans(i) + Auto\_mtax(i)}{m\_fob(i) + M\_Trans(i) + Tmtax(i)}$$

This percentage transfer from the imported goods consumptions towards domestic goods consumptions restores the expenditure/resource balance in terms of imported and domestic goods and allows the definition of the following new corrected matrices:

C_Hsld_imp_corr(i), C_Hsld_dom_corr(i)

C_G_imp_corr(i), C_G_dom_corr(i)

C_FBCF_imp_corr(i), C_FBCF_dom_corr(i)

CI_imp_Agg_corr(i), CI_dom_Agg_corr(i)

Recalculation of trade exchange taxes

In the same way as the exports and FOB imports cases, we build:

Tmtax_corr(i) = Tmtax(i) – Auto_mtax(i),

Txtax_corr(i) = Txtax(i) – Auto_xtax(i).

Obviously, this calculation leads to unbalance the IO tables built from the corrected matrices: the amounts subtracted to international trade taxes have to be reallocated to other resources in order to guarantee the equilibrium. In theory, these reallocations should be done in favour of the different consumption taxes (the consumptions having benefitted from correction transfers: from imported good to domestic good consumptions). However, we come up against an insurmountable problem concerning the intermediate consumptions: the subtracted share of the taxes on the imports of good j should, to follow the transfers between the imported and domestic intermediate consumptions of good j, be transferred to the intermediate consumptions of good j; but the taxes on the intermediate consumptions are a resource (in the IO table) of the production of good j and also a resource of the production of all the goods where j enters; doing so would mean a substitution between a resource specific to the production of good j and a group of resources spread on the P productions, which would imply disequilibrium.

To avoid this problem, we create a new entry in the IO table: *__Auto_TMX(i)__* corresponds to the amount levied on the goods that have crossed an internal border (among countries of the same aggregated region *i*) between their production and their consumption.

Auto_TMX(i) = Auto_mtax(i) + Auto_xtax(i).

The choice is then left to the IO table user concerning the final treatment of this particular levy.

Imports transportation costs processing

The correction of the transport costs linked to the importations of an aggregated region *i* is simply obtained through the following *P*-vector:

M_Trans_corr(i) = M_trans(i) – Part_AutoM_Trans(i)

This operation, as the previous one, unbalances the IO table built with the corrected data. In order to rebalance them, we transfer the transport costs (subtracted proportionally to the participation in international transport) to the intermediate consumption of transport goods (goods number 48, 49 and 50 in the raw GTAP database).

To determine which one of their 3 consumptions benefits from the transfer,[21] we make the transfers proportionally to their participation in the total of the international transport activities of the considered region, and correct the *X_Trans(i)* vector accordingly.This deserves an illustration: : 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 thus subtract this amount *m* from *M_trans(i)* ; 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* (*X_Trans_Agg(i)*); we finally correct the expenditures by subtracting the same amounts from exports of these three transportation goods, thus creating the new matrix *X_Trans_corr(i)*.

Construction of an IO table from the output matrices:

For each region *i*, the balanced and corrected IO table is constructed from the matrices and the vectors obtained *via* the calculations described above and after a last series of manipulations such as matrices concatenations and grouping, and the addition of some intermediate sums (to allow a better visualisation of the tables).

On the expenditure side, we finally obtain:

- The intermediate consumptions of each good, by origin (domestic or imported): *CI_Tot_emplois(i)*, horizontal concatenation of the matrices *CI_imp_Tot(i)* and *CI_dom_Tot(i)*.

- The final consumptions (households, governments and CGDS): *C_Hsld_Tot(i), C_G_Tot(i), C_FBCF_Tot(i)*;

- The corrected exports: *X_Tot(i)* (concatenation of *x_corr(i)* and de *X_Trans_corr(i)*, as well as the corresponding totals).

On the resource side:

- Again, the intermediate consumptions of each good, by origin (domestic or imported), but with vertical concatenation: *CI_Tot_ress(i)*, vertical concatenation of the matrices *CI_imp_Tot(i)* and *CI_dom_Tot(i)*.

- Factor consumptions·*C_Fact_Tot(i)*.

- The tax detail: production taxes *T_Prod(i)*; factor taxes *T_C_Fact(i);* intermediate consumption taxes by origin *TCI_dom(i)* and *TCI_imp(i)* (concatenated into *TCI(i)*, including the calculation of the totals for both origins); households, governments and CGDS consumption taxes *T_Hsld(i)*, *T_AP(i)* and *T_FBCF(i)*; imports and exports taxes *T_M(i)* and *T_X(i)*; levy on the internal trade within an

---

[21] Note that this last rule is obviously irrelevant if the sectoral aggregation retained does not distinguish between the 3 goods.

aggregated region *i* *T_Auto_MX(i)*. All these taxes are concatenated vertically in the matrix *Taxes(i)*, adding the total of the taxes per good *Tot_Taxes(i)*.

- Imports: concatenation of *m_fob_corr(i)*, *M_Trans_corr(i)* and their sum in the matrix *M(i)*.

The synthesis tables *Emplois(i)* and *Ressources(i)*[22] correspond to the concatenation of the previous matrices (depending on their belonging to one or the other axis) adding the vectors *Total_Emplois(i)* and *Total_Ressources(i)* that are the expenditure and resource sums for each aggregated sector. These two last vectors allow the calculation of the error vector *Erreur(i)*:

$$Erreur(i) = Total\_Ressources(i) - Total\_Emplois(i).$$

The programme ends by delivering a message:

- If the absolute value of the vector *Erreur(i)*, for each aggregated region *i* and for all the sectors, is smaller than 1, the programme displays: "All the IO tables are balanced".

- If not, the message indicates for which region, and which sector there is an unbalance.

This last case can appear in a few instances such as if the modeller has made a mistake when importing the raw GTAP data from the .har files to the scilab files,[23] or he has made modifications of the .agg file 'by hand'.

The following appendix details the code of the Scilab programme that executes the routines described above: consolidating input-output tables from the GTAP data, including the treatment of the 'self trade' issue, to deliver them automatically in spreadsheet format (csv, xls).

IV   Appendix

IV.1   Comments

Scilab is a freeware version of Matlab: the comprehensive Scilab programme gives free access to the correction of the 'self-trade' phenomenon as described above. The programme is valid whatever the version of GTAP, provided the user changes the number of regions at the top of the code.

This programme has already been used for the calibration of two CGE models: *IMACLIM-S* (Ghersi et *al.*, 2009) and *IMACLIM-R* (Sassi et *al.*, 2010).

The Scilab code is given with French comments. A translated version of the code will be given in a further version of the paper.

The coming and final version of this article will include a last section before the Appendix, that will 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.

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[22] Emplois means Expenditures in French, and Ressources means Sources

[23] This operation has to be made only once.

The successive steps to run the programme are:

1. Download Scilab.exe
2. Create a folder : **GTAP_ScilabFolder**
3. Create the **.sce** files described in section III.3.1 through the importation of the different matrices from *basedata.harr* and *baseview.harr* files (with the "*one to one*" aggregation level) then put them in the folder **GTAP_ScilabFolder.**
4. Create the text aggregation file .agg and copy it in the folder **GTAP_ScilabFolder**
5. Make the following changes in the main programme GTAPagg_Scilab.sce:
   a. Currently, the variable **gtap_version** is equal to 7 (it refers to the version of GTAP), so if the modeller is using another version (5 or 6), he just has to change the value of this variable.
   b. Define the trajectory of the work directory, **workdir** = '………\ **GTAP_ScilabFolder';**

6. Create the subfolder **csv_ IOTables** in the folder **GTAP_ScilabFolder.** This subfolder is intended to hold the csv IO tables that will be created (One csv file per new aggregated region).
7. Copy the text of the section IV.2 bellow (the main programme) in any text editor to create the file **GTAPagg_Scilab.sce**
8. Run this main programme GTAPagg_Scilab.sce from the scilab widow:
   exec(GTAPagg_Scilab.sce)

After a few seconds, the csv files corresponding to the new aggregated regions' IO tables, for the chosen sectoral aggregated level and obviously including the self-trade correction are at disposal in the folder **csv_ IOTables**.

IV.2   The Scilab main program of the revisited GTAP*Agg* procedure: GTAPagg_Scilab.sce

```
////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////

//    Ce programme repose sur les données du prgme GtapAgg ( Version 7,6 et 5)
                                                                                    //

// Partant de 57 Biens/113 (87 ou 66) Régions/5facteurs,

                                                                                    //

// ce prgm est destiné à fabriquer des TES équilibrés quelque soit l'agrégation de biens, de regions et de facteurs que l'utilisateur aura choisi///

//////////////////////////////////////////////////////////////////////////////////////

gtap_version = 7;

workdir = '...\GTAP_ScilabFolder';

chdir(workdir);

stacksize(150000000);

//Ce programme part de la lecture d'un fichier .agg issu de GTAP où sont définies les agrégations voulues


 Aggregations = input("Please enter the the name of the aggregations file: ","s");


//Lecture du fichier.agg
 Txt = read(Aggregations,-1,1,'(a)');


 Section = grep(Txt,'=');


 P = Section(3)-Section(2)-1; // le nouveau nombre de Biens

 N = Section(7)-Section(6)-1; // le nouveau nombre de Régions

 K = Section(11)-Section(10)-1; // le nouveau nombre de Facteurs
```

```
if        gtap_version == 5 then  numREG = 66;// 1997 ///// de la serie "Trade-Exports for International Transportation,MP" BaseDATA
elseif    gtap_version == 6 then  numREG = 87; //2001
elseif    gtap_version == 7 then  numREG = 113; //2004
end



Masc1 = zeros(numREG,N);
Masc2 = zeros(P,57);


//Matrices Textes des nouveaux Biens/Régions/Facteurs
 B = part(Txt(Section(2)+1:Section(3)-1),[1:13]);
 R = part(Txt(Section(6)+1:Section(7)-1),[1:13]);
 Fact = part(Txt(Section(10)+1:Section(11)-1),[1:13]);


//Matrices Textes des enciens  Biens/Régions/Facteurs
 b = part(Txt(Section(4)+1:Section(5)-1),[50:62]);
 r = part(Txt(Section(8)+1:Section(9)-1),[50:62]);
 f = part(Txt(Section(12)+1:Section(13)-1),[50:62]);


//Remplissage des "masques"
 for i=1:P
```

```
    for j=1:57
      if B(i)==b(j) then Masc2(i,j)=1;
          end
    end
  end
  for i=1:numREG
    for j=1:N
      if r(i)==R(j) then Masc1(i,j)=1;
          end
    end
  end
```

```
//Lecture des matriecs de données non agrégées:
  exec(workdir+'\Conso_Interm_Imp.sce');        //disp('exec Conso_Interm_Imp done');
  exec(workdir+'\Conso_Interm_Dom.sce');        //disp('exec Conso_Interm_Dom done');
  exec(workdir+'\Conso_Menages.sce');           //disp('exec Coonso_Ménages done');
  exec(workdir+'\Conso_AP.sce');                //disp('exec Conso_AP done');
  exec(workdir+'\Conso_FBCF.sce');              //disp('exec Conso_FBCF done');
  exec(workdir+'\Export_Import.sce');           //disp('exec Export_Import done');
  exec(workdir+'\Conso_Fact.sce');              //disp('exec Cons_Fact done');
  exec(workdir+'\Taxes1.sce');                  //disp('exec Taxes1 done');
```

```
exec(workdir+'\Taxes2_Dom.sce');           //disp('exec Taxes2_Dom done');
exec(workdir+'\Taxes2_Imp.sce');           //disp('exec Taxes2_Imp done');
exec(workdir+'\Taxes3.sce');               //disp('exec Taxes3 done');


exec(workdir+'\Exports.sce');              //Pour la correction de la part "Auto-Export" et "Auto-Import_fob"...cf les fichiers
exec(workdir+'\Imports_Fob.sce');
exec(workdir+'\Imports_Transp.sce');


exec(workdir+'\mtax.sce');                 //Pour la correction de la part "Auto-mtax" et "Auto-xtax"...cf les fichiers
exec(workdir+'\xtax.sce');


exec(workdir+'\Epargne.sce');              //disp('exec Epargne done');



//Calcul des matrices aggrégées:


//Conso Intermediaires(de produits domestiques et importés)+ Conso de Facteurs:
 Som_CI_imp = list();
 Som_CI_dom = list();
 CI_imp_Agg = list();    CI_imp_Agg_corr = list();
 CI_dom_Agg = list();    CI_dom_Agg_corr = list();
 Som_CFact  = list();
```

```
CFact_Agg  = list();
for j=1:N
    Som_CI_imp(j) = zeros(57,57);
    Som_CI_dom(j) = zeros(57,57);
    Som_CFact(j)  = zeros(5,57);
    for i=1:numREG
       if Masc1(i,j) == 1 then
         Som_CI_imp(j)= Som_CI_imp(j)+CI_imp(i) ;
             Som_CI_dom(j)= Som_CI_dom(j)+CI_dom(i) ;
          Som_CFact(j) = Som_CFact(j)+CFact(i);
        end
    end
    CI_imp_Agg(j)= Masc2*Som_CI_imp(j)*Masc2';    //voir plus loin CI_imp_Agg_corr
    CI_dom_Agg(j)= Masc2*Som_CI_dom(j)*Masc2';    //voir plus loin CI_dom_Agg_corr
    CFact_Agg(j) = Som_CFact(j)*Masc2';
 end


//Importations:
  M_fob_Agg = Masc2*MM_fob*Masc1;  //les Importations sans les couts de Transport!!!
  M_Trans_Agg = Masc2*MM_Trans*Masc1;
//Exportattions:
  X_Agg = Masc2*XX*Masc1; // au prix mondial!!!
```

```
  X_Trans_Agg = Masc2*XX_Trans*Masc1; //des services de transports Internationnaux


//Consommations Finales:

  C_25_Agg = Masc2*C_25*Masc1; //Conso Ménages de produits Imp

  C_26_Agg = Masc2*C_26*Masc1; //Conso Ménages de produits Dom

  C_27_Agg = Masc2*C_27*Masc1; //Conso AP produits Imp

  C_28_Agg = Masc2*C_28*Masc1; //Conso AP produits Dom

  C_14_Agg = Masc2*C_14*Masc1; //Conso FBCF produits Imp

  C_15_Agg = Masc2*C_15*Masc1; //Conso FBCF produits Dom


//TAXES:
  ///"Simples à traiter"
  T_13_Agg = Masc2*T_13*Masc1;                 // Outtax sur la Production

  T_16_DomAgg = Masc2*T_16_Dom*Masc1;  // Sur la conso des Ménages produits Dom

  T_16_ImpAgg = Masc2*T_16_Imp*Masc1;    // Sur la conso des Ménages produits Imp

  T_17_DomAgg = Masc2*T_17_Dom*Masc1;  // Sur la conso des AP produits Dom

  T_17_ImpAgg = Masc2*T_17_Imp*Masc1;    // Sur la conso des AP produits Imp

  T_mtaxAgg = Masc2*T_mtax*Masc1;                  // Sur les Importations

  T_xtaxAgg = Masc2*T_xtax*Masc1;              // Sur les Exportations


//Comtax sur: la Conso de Facteurs/la FBCF(dom et imp)/et les Conso Intermédiaires(dom et imp)
  Som_T_ConsFact=list();
```

```
T_ConsFact_Agg=list();

Som_T_FBCF_dom=list();

Som_T_FBCF_imp=list();

T_FBCF_dom_Agg=list();

T_FBCF_imp_Agg=list();

Som_T_CI_dom = list();

T_CI_dom_Agg = list();

Som_T_CI_imp = list();

T_CI_imp_Agg = list();

for j=1:N

    Som_T_ConsFact(j)=zeros(5,57);

    Som_T_FBCF_dom(j)=zeros(1,57);

    Som_T_FBCF_imp(j)=zeros(1,57);

    Som_T_CI_dom(j) = zeros(57,57);

    Som_T_CI_imp(j) = zeros(57,57);

    for i=1:numREG

        if Masc1(i,j) == 1 then

            Som_T_ConsFact(j) = Som_T_ConsFact(j)+T_ConsFact(i);

        Som_T_FBCF_dom(j) = Som_T_FBCF_dom(j)+T_FBCF_dom (i);

        Som_T_FBCF_imp(j) = Som_T_FBCF_imp(j)+T_FBCF_imp (i);

        Som_T_CI_dom(j)= Som_T_CI_dom(j)+T_CI_dom(i) ;

            Som_T_CI_imp(j)= Som_T_CI_imp(j)+T_CI_imp(i) ;
```

```
            end

        end

    T_ConsFact_Agg(j) = Som_T_ConsFact(j)*Masc2'; //N matrices(1par Région)

    T_FBCF_dom_Agg (j) = Som_T_FBCF_dom(j)*Masc2';

    T_FBCF_imp_Agg (j) = Som_T_FBCF_imp(j)*Masc2';

    T_CI_dom_Agg(j)= Masc2*Som_T_CI_dom(j)*Masc2';

    T_CI_imp_Agg(j)= Masc2*Som_T_CI_imp(j)*Masc2';

  end
```

// Pour la CORRECTION des erreurs de GTAP dues la présence d'"Auto_Imports" et "Auto_Exports":

///On commence par agréger les secteurs uniquement, on garde toutes les régions désagrégées afin de pouvoir soustraire la part d'auto-exp ou Auto-Imp de n'importe quelle agrégation de zones.....(jmexplihquerai mieux + tard)


```
 Export_Sect_Agg = list();

 Import_fob_Sect_Agg = list();

 Import_Trans_Sect_Agg = list();


 mtax_Sect_Agg = list();

 xtax_Sect_Agg = list();


 for i=1:P                        //j'avais 57 matrices, now j'en ai P
```

```
        Export_Sect_Agg(i)=[];

        Import_fob_Sect_Agg(i)=[];

        Import_Trans_Sect_Agg(i)=[];

        mtax_Sect_Agg(i)=[];

        xtax_Sect_Agg(i)=[];

        for j=1:57

            if Masc2(i,j) == 1 then

                Export_Sect_Agg(i) = Export_Sect_Agg(i) + Export(j);

                Import_fob_Sect_Agg(i) = Import_fob_Sect_Agg(i) + Import_fob(j);

                Import_Trans_Sect_Agg(i) = Import_Trans_Sect_Agg(i) + Import_Tran(j);

                    mtax_Sect_Agg(i) =  mtax_Sect_Agg(i) + mtax(j);

                    xtax_Sect_Agg(i) =  xtax_Sect_Agg(i) + xtax(j);

                end

        end

 end




//Construction des TES:


 //Declaration des Vriables "list":


C_Hsld_imp = list(); C_Hsld_dom = list(); C_Hsld =list(); C_Hsld_Tot = list();
```

```
C_Hsld_imp_corr = list(); C_Hsld_dom_corr = list();


C_G_imp = list();    C_G_dom = list();    C_G = list();   C_G_Tot = list();

C_G_imp_corr = list();    C_G_dom_corr = list();


C_FBCF_imp = list(); C_FBCF_dom = list(); C_FBCF = list();C_FBCF_Tot = list();

C_FBCF_imp_corr = list(); C_FBCF_dom_corr = list();


x = list();     Auto_X = list();  x_corr = list();

X_Trans = list(); X_Trans_corr = list();

X = list();     X_Tot = list();


CI_imp_Tot = list(); CI_dom_Tot = list();

CI_emplois = list(); ci_tot_emp = list(); CI_Tot_emplois = list();

CI_ressources = list(); ci_tot_ress = list();  CI_Tot_ressources = list();


C_Fact_Tot = list();


m_fob = list(); m_fob_corr = list(); Auto_M_fob = list();

M_Trans = list();  M_Trans_corr = list();  Auto_M_Trans = list();

M = list();M_Tot = list();
```

```
p_bascul = list();


T_Prod = list();

T_C_Fact = list();

TCI_dom = list(); TCI_imp = list(); TCI = list();

T_FBCF = list();

T_Hsld_dom = list(); T_Hsld_imp = list();T_Hsld = list();

T_AP_dom = list(); T_AP_imp = list();T_AP = list();

T_M = list();

T_X = list();



THsld_Imp_corr = list();

TG_Imp_corr = list();

T_FBCF_imp_Agg_corr = list();


THsld_Dom_corr = list();

TG_Dom_corr = list();

T_FBCF_dom_Agg_corr = list();


T_CI_imp_Agg_corr = list();

T_CI_dom_Agg_corr = list();
```

```
Tprod = list();

THsld_Dom = list();

THsld_Imp = list();

TG_Dom = list();

TG_Imp = list();


Tmtax = list(); Auto_mtax = list(); Tmtax_corr = list();

Txtax = list(); Auto_xtax = list(); Txtax_corr = list();

Auto_TMX = list(); T_Auto_MX = list();


Taxes = list(); Tot_Taxes = list();


Emplois = list(); Total_Emplois = list() ;

Ressources = list(); Total_Ressources = list();

Erreur = list();


xtr_Agg = list();

xtrans1 = list();

xtrans2 = list();

xtrans3 = list();

xtr48 = list();
```

```
xtr49 = list();

xtr50 = list();

part_AutoM_Trans = list();


CI_dom_Agg_corr_Trans = list();


bascul_XTransp = list();


for k=1:numREG

    xtr(k) = x_Trans(1,k) + x_Trans(2,k) + x_Trans(3,k);

end



for j=1:N

    ///Séparation des Régions pour chaque "série"

    //Coté Emplois:

    C_Hsld_imp(j) = C_25_Agg(:,j);  //Ce sont des vecteurs colonne ( P éléments)

    C_Hsld_dom(j) = C_26_Agg(:,j);

    C_G_imp(j)    = C_27_Agg(:,j);

    C_G_dom(j)    = C_28_Agg(:,j);

    C_FBCF_imp(j) = C_14_Agg(:,j);

    C_FBCF_dom(j) = C_15_Agg(:,j);
```

```
x(j)          = X_Agg(:,j);
X_Trans(j)    = X_Trans_Agg(:,j);
```

//Coté Ressources:

```
m_fob(j) = M_fob_Agg(:,j);     //Ce sont tjrs des vect colonnes (P éléments)que l'on transposera + tard
M_Trans(j) = M_Trans_Agg(:,j);
```

```
Tmtax(j) = T_mtaxAgg(:,j);
Txtax(j) = T_xtaxAgg(:,j);
```

```
Tprod(j) = T_13_Agg(:,j);
THsld_Dom(j) = T_16_DomAgg(:,j);
THsld_Imp(j) = T_16_ImpAgg(:,j);
TG_Dom(j) = T_17_DomAgg(:,j);
TG_Imp(j) = T_17_ImpAgg(:,j);
```

/// Suite des CORRECTIONS

//// Corection des Exportations: Soustraction pour chaque région de la part "Auto-Exportation"

//// Corection des Importations: Soustraction pour chaque région de la part "Auto-Importation"

//// Idem pour mtax et xtax

```
//Construction des vecteurs "Auto"

//Je retiens les indices des zones qui constituent la région agrégée "j"

    index = [];

    n = 0;

    for i=1:numREG

        if Masc1(i,j) == 1 then

            n = n+1;

    index(n) = i ;

    end

    end

//Je construit les vecteurs des Auto-Exportations(Auto_X(j)) et des auto Taxes sur les exportations (Auto_xtax(j)) des zones internes de
la région agrégée "j" vers ces memes zones

    //Par exemple si "j"=A+B, alors Auto_X(j) = X(A-->A)+ X(A-->B)+ X(B-->B)+ X(B-->A) (idem pour la xtax)


    //Je construit de meme, le vecteur des Auto_Importations_fobet Trans ainsi que celui des Auto_xtax des zones internes de la région
agrégée "j" en provennance de ces memes zones

    //Par exemple si "j"=A+B, alors Auto_M_fob(j) = M(A-->A)+ M(A-->B)+ M(B-->B)+ M(B-->A)  (idem pour Transport et mtax)


    Auto_X(j)=zeros(P,1);

    Auto_xtax(j)=zeros(P,1);


    Auto_M_fob(j)=zeros(P,1);
```

```matlab
        Auto_M_Trans(j)=zeros(P,1);

        part_AutoM_Trans(j)=zeros(P,1);

Auto_mtax(j)=zeros(P,1);


        CI_imp_Agg_corr(j)=zeros(P,P);

        CI_dom_Agg_corr(j)=zeros(P,P);

        T_CI_imp_Agg_corr(j)=zeros(P,P);

        T_CI_dom_Agg_corr(j)=zeros(P,P);


        for k=1:P
            for s=1:size(index,'r')
            for t=1:size(index,'r')


                //Auto-X du bien agrégé "k" pour la zone agrégée "j"
                Auto_X(j)(k) =  Auto_X(j)(k) + Export_Sect_Agg(k)(index(s),index(t)); //X du bien agrégé "k" de la
                                                        //zone t vers s

                Auto_xtax(j)(k) = Auto_xtax(j)(k) + xtax_Sect_Agg(k)(index(s),index(t));


                //Auto-M du bien agrégé "k" pour la zone agrégée "j"
                Auto_M_fob(j)(k) =  Auto_M_fob(j)(k) + Import_fob_Sect_Agg(k)(index(s),index(t));

                Auto_M_Trans(j)(k) =  Auto_M_Trans(j)(k) + Import_Trans_Sect_Agg(k)(index(s),index(t));

                Auto_mtax(j)(k) = Auto_mtax(j)(k) + mtax_Sect_Agg(k)(index(s),index(t));
```

```
                    end

                end

            end


        ///Cas de M_Trans: On ne retire qu'une part de Auto_M_Trans:


if              gtap_version == 5 then  XTrans_Monde = 211372.74;// 1997 //// de la serie "Trade-Exports for International Transportation,MP"
BaseDATA

elseif  gtap_version == 6 then  XTrans_Monde = 234441.71; //2001

elseif  gtap_version == 7 then  XTrans_Monde = 362713.343750; //2004

end



    //xtr(j) = x_Trans(1,j) + x_Trans(2,j) + x_Trans(3,j) (j zone desagégée)

    xtr_Agg(j)=0;

    xtrans1(j)=0;

    xtrans2(j)=0;

    xtrans3(j)=0;



    for i=1:numREG
```

```
      // agrégation des régions pour les participations au transport international(biens de transp 48,49,50)
   if Masc1(i,j)== 1 then
      xtr_Agg(j) = xtr_Agg(j) + xtr(i);
      xtrans1(j) = xtrans1(j) + x_Trans(1,i);
      xtrans2(j) = xtrans2(j) + x_Trans(2,i);
      xtrans3(j) = xtrans3(j) + x_Trans(3,i);
   end
 end
   xtr48(j) = xtrans1(j)/ xtr_Agg(j);  // xtr48(j) = x_Trans(1,j)/xtr(j);
   xtr49(j) = xtrans2(j)/ xtr_Agg(j);  // xtr49(j) = x_Trans(2,j)/xtr(j);
   xtr50(j) = xtrans3(j)/ xtr_Agg(j);  // xtr50(j) = x_Trans(3,j)/xtr(j);


//Pour k=1:P   part_AutoM_Trans(j)(k)=( xtr(j)/XTrans_Monde )* Auto_M_Trans(j)(k);
   part_AutoM_Trans(j) = ( xtr_Agg(j)/XTrans_Monde )* Auto_M_Trans(j);




   //// Corection des Exportations: Soustraction pour chaque région de la part "Auto-Exportation"
      //J'effectue ma soustraction pour x
      x_corr(j) = x(j) - Auto_X(j);


   //// Correction des Importations: Soustraction pour chaque région de la part "Auto-Importation"
      //J'effectue mes soustractions pour m_fob (pour M_Trans voir plus loin)
```

```
    m_fob_corr(j) = m_fob(j) - Auto_M_fob(j);

  //pour M_Trans voir plus loin


  // Pour rééquilibrer les TES


  ////Calcul du "pourcentage de basculement"(Coté Emplois:de Cons_M vers Cons_D /Coté Ressources: de TCm vers TCD ):
 ////p_bascul% pour chaque bien i:


 p_bascul(j) = (Auto_M_fob(j) + part_AutoM_Trans(j) + Auto_mtax(j))./(m_fob(j) + M_Trans(j) + Tmtax(j));


//// Basculement de Conso de produits Importés vers Conso de produits Domestiques


  // Pour les Conso Finales:


    // Je retire p% des CFM
    C_Hsld_imp_corr(j)   = C_Hsld_imp(j) - (p_bascul(j).*C_Hsld_imp(j));
    C_G_imp_corr(j)              = C_G_imp(j) - (p_bascul(j).*C_G_imp(j));
    C_FBCF_imp_corr(j) = C_FBCF_imp(j) - (p_bascul(j).*C_FBCF_imp(j));


    // je rajoute p% des CFM aux CFD
    C_Hsld_dom_corr(j)   = C_Hsld_dom(j) + (p_bascul(j).*C_Hsld_imp(j));
    C_G_dom_corr(j)              = C_G_dom(j) + (p_bascul(j).*C_G_imp(j));
```

```
    C_FBCF_dom_corr(j)            = C_FBCF_dom(j) + (p_bascul(j).*C_FBCF_imp(j));


 // Pour les Conso Intermédiaires:


    // Je retire p% des CIM pour chaque bien et je le rajoute aux CID
    for i=1:P
       CI_imp_Agg_corr(j)(:,i) = CI_imp_Agg(j)(:,i) - ((p_bascul(j)).*(CI_imp_Agg(j)(:,i)));
       CI_dom_Agg_corr(j)(:,i) = CI_dom_Agg(j)(:,i) + ((p_bascul(j)).*(CI_imp_Agg(j)(:,i)));
    end


//// Basculement des Taxes sur la Conso de produits Importés vers les taxes sur la Conso de produits Domestiques


    // Pour les Taxes sur Conso Finales:


    // Je retire p% des TCM
    THsld_Imp_corr(j)            = THsld_Imp(j) - (p_bascul(j).*THsld_Imp(j));
    TG_Imp_corr(j)                 = TG_Imp(j) - (p_bascul(j).*TG_Imp(j));
    T_FBCF_imp_Agg_corr(j)     = T_FBCF_imp_Agg(j) - (p_bascul(j)'.*T_FBCF_imp_Agg(j));



    // je rajoute p% des TCFM aux TCFD
    THsld_Dom_corr(j)            = THsld_Dom(j) + (p_bascul(j).*THsld_Imp(j));
```

```
        TG_Dom_corr(j)                              = TG_Dom(j) + (p_bascul(j).*TG_Imp(j));
        T_FBCF_dom_Agg_corr(j)     = T_FBCF_dom_Agg(j) + (p_bascul(j)'.*T_FBCF_imp_Agg(j));


// Pour les Taxes sur les Conso Intermédiaires:


    // Je retire p% des TCIM pour chaque bien et je le rajoute aux TCID
    for i=1:P
      T_CI_imp_Agg_corr(j)(:,i) = T_CI_imp_Agg(j)(:,i) - (p_bascul(j).*T_CI_imp_Agg(j)(:,i));
      T_CI_dom_Agg_corr(j)(:,i) = T_CI_dom_Agg(j)(:,i) + (p_bascul(j).*T_CI_imp_Agg(j)(:,i));
    end



//// Corection des Taxes sur les M et X: Soustraction pour chaque région de la part "Auto" des xtax et mtax


    Tmtax_corr(j) =   Tmtax(j) - Auto_mtax(j);
  Txtax_corr(j) =   Txtax(j) - Auto_xtax(j);


//Pour réequilibrer les TES


    //On rajoute Une nouvelle taxe dans notre TES:
  Auto_TMX(j) = Auto_mtax(j)+Auto_xtax(j);
```

```
////Correction M_Trans ( retrait de la partie "auto-M_Tans" selon les explication du papier...!!!


//Correction M_Trans ( on lui enleve la part qui correspond a des Auto frais de Transports)
 M_Trans_corr(j) = M_Trans(j) -  part_AutoM_Trans(j);


// Réequilibrage du TES : (Basculement vers CI_dom et retrait  de Xtrans )


 //Basculement vers CI_dom


 CI_dom_Agg_corr_Trans(j) = CI_dom_Agg_corr(j);


 for i=1:P
    if Masc2(i,48) == 1 then
        for k=1:P
           CI_dom_Agg_corr_Trans(j)(i,k) =  CI_dom_Agg_corr_Trans(j)(i,k) + (xtr48(j)*part_AutoM_Trans(j)(k) );
        end
    end
    if Masc2(i,49) == 1 then
        for k=1:P
           CI_dom_Agg_corr_Trans(j)(i,k) =  CI_dom_Agg_corr_Trans(j)(i,k) + (xtr49(j)*part_AutoM_Trans(j)(k) );
```

```
        end

    end


    if Masc2(i,50) == 1 then

        for k=1:P

            CI_dom_Agg_corr_Trans(j)(i,k) =  CI_dom_Agg_corr_Trans(j)(i,k) + (xtr50(j)*part_AutoM_Trans(j)(k) );

        end

    end

 end


 // retrait  de la part "auto" correspondante dans Xtrans


  bascul_XTransp(j) = sum( (CI_dom_Agg_corr_Trans(j)- CI_dom_Agg_corr(j)),'c');


  X_Trans_corr(j) = X_Trans(j) -  bascul_XTransp(j);



////Coté Emplois:
///Concaténation des Matrices ( Produits Imp avec Produits Dom et X avec X-Transport)(matrices P*2)
      C_Hsld(j) = [ C_Hsld_imp_corr(j)   C_Hsld_dom_corr(j)];
C_G(j)    = [ C_G_imp_corr(j)     C_G_dom_corr(j) ];
      C_FBCF(j) = [ C_FBCF_imp_corr(j)   C_FBCF_dom_corr(j)];
```

X(j)   = [x_corr(j)   X_Trans_corr(j)];

///Les meme données concaténées avec les totaux "correspondants" (matrices (P+1)*3)

C_Hsld_Tot(j) = [C_Hsld(j) sum(C_Hsld(j),'c') ; sum(C_Hsld(j),'r') sum(C_Hsld(j))];

C_G_Tot(j)   = [C_G(j) sum(C_G(j),'c') ; sum(C_G(j),'r') sum(C_G(j))];

C_FBCF_Tot(j) = [C_FBCF(j) sum(C_FBCF(j),'c') ; sum(C_FBCF(j),'r') sum(C_FBCF(j))];

X_Tot(j)   = [X(j) sum(X(j),'c') ; sum(X(j),'r') sum(X(j))];

///De même pour les Consommations Intermédiaires (Totaux pour matrice Imp, Totaux pour matrice Dom, Concaténation des 2 matries (P+1)*(P+1) --->> 1 matrice (P+1)*(2P+2)--->>Puis concaténation avec le vect TotalCI(P+1)--->> 1 matrice (P+1)*(2P+3)

CI_imp_Tot(j)   =   [CI_imp_Agg_corr(j)   sum(CI_imp_Agg_corr(j),'c')   ;   sum(CI_imp_Agg_corr(j),'r')   sum(CI_imp_Agg_corr(j))];
//(P+1)*(P+1)

CI_dom_Tot(j)   =   [CI_dom_Agg_corr_Trans(j)   sum(CI_dom_Agg_corr_Trans(j),'c')   ;   sum(CI_dom_Agg_corr_Trans(j),'r') sum(CI_dom_Agg_corr_Trans(j))];

CI_emplois(j) = [CI_imp_Tot(j) CI_dom_Tot(j)]; //(P+1)*(2P+2)

ci_tot_emp(j) = CI_emplois(j)(:,P+1)+ CI_emplois(j)(:,2*P+2); //vect(P+1)

CI_Tot_emplois(j) = [CI_emplois(j) ci_tot_emp(j)]; // (P+1)*(2P+3)

////Coté Ressources: (on procède de la meme maniere,en prenant concatenation en ligne cette fois(au lieu de colonnes)

//Consommations Intermédiaires

CI_ressources(j) = [CI_imp_Tot(j) ; CI_dom_Tot(j)]; //(2P+2)*(P+1)

ci_tot_ress(j) = CI_ressources(j)(P+1,:) + CI_ressources(j)(2*P+2,:); // 1*(P+1)

CI_Tot_ressources(j) = [CI_ressources(j); ci_tot_ress(j)]; //(2P+3)*(P+1)

//De meme pour la matrice des consommations de Facteurs

C_Fact_Tot(j) = [CFact_Agg(j) sum(CFact_Agg(j),'c');

sum(CFact_Agg(j),'r') sum(CFact_Agg(j))]; //(K+1)*(P+1)

//Concaténation de M_fob avec M_Trans (en prennant en compte les corrections), puis avec leurs totaux

M(j) = [m_fob_corr(j)' ; M_Trans_corr(j)']; //2*P

M_Tot(j) = [M(j) sum(M(j),'c') ; sum(M(j),'r') sum(M(j))]; // 3*(P+1)

// Les matrices des Taxes

T_Prod(j) = [Tprod(j) ; sum(Tprod(j))]'; //1*(P+1)

T_C_Fact(j) = [T_ConsFact_Agg(j) sum(T_ConsFact_Agg(j),'c');

sum(T_ConsFact_Agg(j),'r') sum(T_ConsFact_Agg(j))]; //(K+1)*(P+1);

TCI_dom(j) = [T_CI_dom_Agg_corr(j) sum(T_CI_dom_Agg_corr(j),'c');

sum(T_CI_dom_Agg_corr(j),'r') sum(T_CI_dom_Agg_corr(j))]; //(P+1)*(P+1)

TCI_imp(j) = [T_CI_imp_Agg_corr(j) sum(T_CI_imp_Agg_corr(j),'c');

sum(T_CI_imp_Agg_corr(j),'r') sum(T_CI_imp_Agg_corr(j))]; //(P+1)*(P+1)

TCI(j) = [TCI_dom(j);

TCI_imp(j);

TCI_dom(j)(P+1,:)+ TCI_imp(j)(P+1,:)];   //(2P+3)*(P+1)

T_FBCF(j) = [T_FBCF_dom_Agg_corr(j) sum(T_FBCF_dom_Agg_corr(j));

T_FBCF_imp_Agg_corr(j) sum(T_FBCF_imp_Agg_corr(j));

T_FBCF_dom_Agg_corr(j)+T_FBCF_imp_Agg_corr(j)   sum(T_FBCF_dom_Agg_corr(j)+T_FBCF_imp_Agg_corr(j))]; //3*(P+1)

T_Hsld_dom(j) = [THsld_Dom_corr(j)' sum(THsld_Dom_corr(j))]; //1*(P+1)

T_Hsld_imp(j) = [THsld_Imp_corr(j)' sum(THsld_Imp_corr(j))]; //1*(P+1)

T_Hsld(j) = [T_Hsld_dom(j) ;

T_Hsld_imp(j);

T_Hsld_dom(j)+T_Hsld_imp(j)]; //3*(P+1)

T_AP_dom(j) = [TG_Dom_corr(j)' sum(TG_Dom_corr(j))]; //1*(P+1)

T_AP_imp(j) = [TG_Imp_corr(j)' sum(TG_Imp_corr(j))]; //1*(P+1)

T_AP(j) = [T_AP_dom(j) ; T_AP_imp(j);

                T_AP_dom(j)+T_AP_imp(j)]; //3*(P+1)

T_M(j) = [Tmtax_corr(j)' sum(Tmtax_corr(j))]; //1*(P+1)

T_X(j) = [Txtax_corr(j)' sum(Txtax_corr(j))]; //1*(P+1)

T_Auto_MX(j) = [Auto_TMX(j)' sum(Auto_TMX(j))];

Tot_Taxes(j) = [T_Prod(j)+T_C_Fact(j)(K+1,:)+TCI(j)(2*P+3,:)+T_FBCF(j)(3,:)+T_Hsld(j)(3,:)+ T_AP(j)(3,:)+ T_M(j)+ T_X(j) + T_Auto_MX(j)]; //1*(P+1)

Taxes(j) = [T_Prod(j); T_C_Fact(j); TCI(j); T_FBCF(j); T_Hsld(j); T_AP(j); T_M(j); T_X(j); T_Auto_MX(j) ;   Tot_Taxes(j)]; //(17+K+(2*P))*(P+1)

///Concaténation des matrices coté Emplois:

//Calcul de la Somme des emplois:

Total_Emplois(j) = ci_tot_emp(j) + C_Hsld_Tot(j)(:,3) + C_G_Tot(j)(:,3) + C_FBCF_Tot(j)(:,3) + X_Tot(j)(:,3);

Emplois(j) = [CI_Tot_emplois(j) C_Hsld_Tot(j) C_G_Tot(j) C_FBCF_Tot(j) X_Tot(j) Total_Emplois(j)];

///Concaténation des matrices coté Ressources:

//Calcul de la Somme des Ressources:

Total_Ressources(j) = ci_tot_ress(j) + C_Fact_Tot(j)(K+1,:) + M_Tot(j)(3,:) + Tot_Taxes(j) ;

```scilab
   Ressources(j) = [  CI_Tot_ressources(j);  C_Fact_Tot(j);M_Tot(j); Taxes(j);Total_Ressources(j)];


  ///Calcul de l'erreur:
    Erreur(j) = Total_Ressources(j)'-Total_Emplois(j);


  ///Le plafond d'erreur toléré est placé à 1 (en absolu)
    a=%T;
    if abs(Erreur(j))<=1 then aaaaaa = 12; //ça sert a rien mais tampis
    else a=%F;
        disp('Attention! Le TES de la Région '''+string(j)+''' est déséquilibré')
    end
 end


 if a==%T then disp('Tous les TES sont équilibrés (avec une erreur(Ress-Empl) < 1)'); end



//Construction des TES******Transfert des Résultats vers des fichiers Excel://
// Ce programme permet de construire des TES sous format csv à partir des Matrices issues de GTAP Scilab.



chdir('workdir\csv_ IOTables');  //La ou se trouvent les fichiers Excel
```

```
Vide1=[]; for i=1:((2*P)+4), Vide1(i)=' '; end; Vide1=(Vide1)';//vect ligne

Vide2=[]; for i=1:(3*P+2*K+32), for j=1:(P+16), Vide2(i,j)=' ';end; end;


//Coté Emplois

  Titre1 = [' ',' ','B','Tot','B','Tot',' ',' ','1','1',' ',' ','1','1',' ',' ','FBCF','FBCF',' ',' ','1','1',' ',' '];

  Titre2 = [' ',' ','Imp',Vide1(1:P),'Dom',Vide1(1:P),'Tot  CI','Imp','Dom','Tot  Hsld','Imp','Dom','Tot  G','Imp','Dom','Tot  FBCF','X','Transport','Tot  X','Tot Emplois'];

  Titre3 = ['CI',Vide1,'C_Hsld',Vide1(1:2),'C_AP',Vide1(1:2),'FBCF',Vide1(1:2),'X',Vide1(1:3)];

  Titre_Emplois = [Titre3;Titre2;Titre1 ];


//Coté Ressources

 //Pour TES entier:

  Tr1     =     [B;'Tot';'Tot    CI';'Cons    Fact';Fact;'Tot    VA';'M_FOB';'Transport';'Tot';'T_Prod';'T_Fact';Fact;'Tot';'T_CI';B;'Tot';B;'Tot';'Tot TCI';'T_FBCF';'dom';'imp';'Tot';'T_CHsld';'dom';'imp';'Tot';'T_CAP';'dom';'imp';'Tot';'Mtax';'Xtax';'T_Auto_MX';'Tot Taxes';''];


//                         Tr2              =              ['dom';(Vide1(1:(P+1)))';'VA';(Vide1(1:(K+1)))';'M';'                   ';'                   ';'Taxes';(Vide1(1:(K+3)))';'dom';(Vide1(1:P))';'imp';(Vide1(1:P))';(Vide1(1:6))';(Vide1(1:6))';(Vide1(1:4))';' '; 'Tot Ressources'];


  Tr2        =         ['dom';(Vide1(1:(P+1)))';'VA';(Vide1(1:(K+1)))';'M';'                   ';'                   ';'Taxes';(Vide1(1:(K)))';'                   ';'                   ';'dom';(Vide1(1:P))';'imp';(Vide1(1:P))';(Vide1(1:6))';(Vide1(1:6))';(Vide1(1:4))';' '; 'Tot Ressources'];


 //Pour Tableau des Ressources seul:

  Ttr1 = [' ';'B';'Tot';Tr1];
```

```
Ttr2 = [ 'CI';'imp';(Vide1(1:P))';Tr2];
```

//Pour chaque région "j";on associe un Tableau "Emplois", un Tableau "Ressources" et le TES:

```
Tab_Empl=list();

Part= list();

Ress1=list(); Tab_Ress1=list();

Ress2=list(); Tab_Ress2=list();

Tab_Empl_err = list();

TES=list();


for j=1:N

   //Emplois:

   Tab_Empl(j) = [Titre_Emplois;(Vide1(1:(P+1)))',[B;'Tot'],string(Emplois(j))];



   //Ressources:

   Part(j)                                                              = [
Vide1(1:(P+1));string(C_Fact_Tot(j));string(M_Tot(j));string(T_Prod(j));Vide1(1:(P+1));string(T_C_Fact(j));Vide1(1:(P+1));string(TCI(j));Vide1
(1:(P+1));string(T_FBCF(j));Vide1(1:(P+1));string(T_Hsld(j));Vide1(1:(P+1));string([T_AP(j);   T_M(j);   T_X(j);T_Auto_MX(j);   Tot_Taxes(j)
]);string(Total_Ressources(j))];
```

```
//Pour TES entier:
Ress2(j) = [string(CI_dom_Tot(j)); string(ci_tot_ress(j))  ;Part(j)];
Tab_Ress2(j) = [[Tr2,Tr1,Ress2(j)];['Erreur = ','Ress-Empl',string(Erreur(j)')]];


[ ' ' ; 'Erreur = Ress-Empl' ; string(Erreur(j)) ];


Tab_Empl_err(j) = [ Tab_Empl(j),[ 'Erreur =';'Ress-Empl' ; ' ' ; string(Erreur(j)) ]];


//les TES:
 TES(j) = [  Tab_Empl_err(j) ;  [Tab_Ress2(j) , Vide2]  ];


form='';
for i=1:(size(TES(j),'c')- 1)
    form=form + '%s;' ;
end;
form=form+'%s\n';
v=mopen('TEScorr_'+string(R(j))+'.csv' ,'w');
mfprintf(v,form,TES(j));
mclose(v);
end
```

V   References

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