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Introducing an explicit Government institution in ICES model

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SUMMARY A challenging issue in global applied Computable General Equilibrium (CGE) models concerns the formalization of the government agent. Examples are the GTAP based models (as ICES), where there is not an explicit government but it is considered as part of a broader regional household. Here, a tax cut stimulates more public consumption in the economy as no public budget constraint is modelled. The aim of this paper is to present the methodology to explicitly introduce the public budget constraint and to make a clear link between tax receipts and public expenditures. Our work focuses both on the database and the model. We insert additional information to complete the GTAP database for the part related to the public finance. In the model we change the macro-economic closure between savings and investments and we link taxes and expenditures allowing the government to create debt.

Keywords: CGE models, public sector, Government budget.

JEL: C68, D58, H60

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SUMMARY

1. INTRODUCTION

Especially in multi-country Computable General Equilibrium models, the functioning of the public sector or, differently said, of the "government agent" is poorly represented. Typically, its action consists in collecting tax revenues and using them to buy goods and services, but without considering explicitly a government budget constraints and public debts or deficits.

This is for instance the case of one of the most widely used global CGE models: GTAP (Hertel (1997). The demand side in the model is represented by a utility-maximizing "regional household" that allocates its income among a private expenditure, a government expenditure and savings. These last are assumed to be only private. A budget constraint exists for the regional household, but not for the government expenditure. Accordingly, government expenditures could move in the opposite direction to income taxes; furthermore public debt and deficit are ignored.

According to Hertel (1997), this is one of the main limitation of the model, however allows for just one measure for regional utility and overcomes important problems such as a lack of available and consistent data on public budget and debt.

Aim of the present research is to introduce a more realistic public sector behavior in the Intertemporal Computable Equilibrium System (ICES) CGE model developed at CMCC. ICES uses the GTAP database version 8.1 (Narayanan et al, 2012), but it is much richer than GTAP for what concerns energy and climate change information and modelling (Eboli *et al*., 2010).

The paper is structured as follows. In section 2, we summarize the different modelling approaches to government budget and role inside the CGE literature. We present seven global recursive CGE models where the issue of the public actor is addressed, and the case of G-Cubed which is an intertemporal dynamic model. The models are presented according to how the public sector[1] is depicted starting from

[1] We use indistinctively the terms "public sector" and "government". However, from an accounting point of view they are different concepts. The public sector includes the public corporations as well, while the term "government" can be more narrow. Here, "public sector" and "government" stand for the "General

models without an explicit government (i.e. GTAP or MIRAGE models) to those offering a more detailed government description (i.e. MyGTAP model). Section 3 focuses on the regional household and its relation with the three accounts for final demand. Specifically, we describe the government agent in GTAP- based models introducing the main accounting rules. In addition we present a simplified Social Accounting Matrix (hereto SAM) to sum up these features and to give a simpler framework for our further considerations (in this case we provide an example with a SAM for Italy). In section 4, we define a more detailed treatment of government, the new accounting rules and, from a modeling point of view, the new macro-economic closures[2] of the government balance and the saving/investment account. In section 5, we deal with the empirical changes with respect to the original GTAP database. Here, we present both the countries for which we consider statistics in building the new database and a more technical subsection describing the GEMPACK routine applied to get the final modified GTAP database.

Government" as described in IMF (2001). Its definition is "*…all government units and all nonmarket NPIs that are controlled and mainly financed by government units.* […]*Only resident government units and NPIs are included in the general government sector, but it can be assumed that all government units and NPIs controlled by government are residents.* […]*The general government sector does not include public corporations or quasi-corporations*".

[2] A CGE model is nothing else than a system of equations which needs to have a same number of equations and unknowns to be solvable. A closure defines which is the causal chain between macro- aggregates and ensures the system is squared.

There are different closures affecting different institutions. Here, we focus on the closure rule in the government sector and the macro- economic closure in the saving- investment macro- balance. The former affects the causality between government revenue, expenditures and savings, while the latter assesses the causality between savings availability and savings demand for investments. A different closure have impacts on the final outcomes of the model since it affects the interdependence among variables.

2. MODELLING GOVERNMENT IN GLOBAL REAL CGE MODELS

The treatment of government is usually very simplified in global real[3] CGE models. The most important reason for this simplification is the difficulty to find data. Global CGE models have been mainly used for assessing trade policy liberalization or, more recently, the impact of climate change impacts and policy with a major attention on GDP and competitiveness effects, but little interest on the implication for public finance. This issue has been mostly addressed by single-country CGE models, (for instance the MAMS model (Lofgren and Diaz- Bonilla, 2010); the standard IFPRI model (Lofgren *et al*., 2002); the standard Pep- model (Decaluwe B. *et al*., 2013)) which are less demanding in data requirements and in the definition of intra-regional international transfers. Single country models, in fact, often present a detailed structure of the government account. They do not only consider taxes and goods and services consumption as most of global models, but also foreign grants, interest payments to non-residents and inter- regional transfers such as social benefits, interest payments to residents, social contributions. Moreover, they have an explicit public sector budget constraint and government deficit includes both the recurrent and the capital components. At the global level however such a detail is prevented by the difficulties in finding data with a sufficient coverage.

In this section we quickly examine the approaches followed by most global CGE models, to introduce the government institution. We mainly focus on the definition of the budget constraint, the relationships with the regional household, and the capital account.

[3] We define Global real CGE models, those models with a world country coverage (global) with a focus on the real side of the economy (real). This to distinguish them from real-financial CGE models where both the real, the financial and possibly also the monetary aspects are investigated. These last are typically single country models where problems on data collection are minimized.

2.1 GTAP MODEL

The GTAP model, as described in Hertel (2007), has no explicit government. Government expenditure is one of the component of regional final demand. There is not either any explicit public budget or realistic structure of that budget. In the basic form of the GTAP database, government savings are set to zero for all regions (i.e. the implicit government balance is zero).

The treatment of the government in GTAP will be described in details in section 3, since it is the starting point for our expansion of the public sector account .

The MIRAGE model (Bchir *et al*. 2002), in relation to the public institution is very similar to the GTAP model. A regional representative agent includes the government, which therefore both pays and earns taxes; no public budget constraint is explicitly introduced.

2.2 GLOBE MODEL

Respect to GTAP standard, the GLOBE model (McDonald *et al*, 2007) introduces an explicit government institution and a budget constraint. However, these are still partial as only tax revenue is a source of income for the government, and expenditure is limited to acquisition of goods and services. The model does not take into account transfers both between countries (i.e. foreign grants) and between the government and households (i.e. social transfers). More specifically, all factor incomes are distributed to the single private household after allowing for depreciation of physical capital and the payments of direct taxes on production factors (a proxy of income tax). The private household uses his income for three purposes: paying direct taxation, savings and consumption. The government receives income from taxation (commodities taxes, production taxes, and direct taxes) and uses it to pay for public consumption and savings. Therefore government savings are allowed together with private household savings, balance of trade in

goods and services, balance of trade in margin services, and depreciation of physical capital to fund one regional investment demand.

The model defines the government income as the sum of tax revenues. Government consumption consists of the sum of commodity consumption. The equilibrium condition for the government is satisfied by savings which are calculated as a residual (difference between revenues and consumption) while the determinants of government income (i.e. taxes) and expenditures are fixed. There are, however, other possible closures, assuming either government expenditures or taxes to vary. A common alternative closure is fixing the government savings; this requires either consumption or tax revenue must be free to adjust.

The capital account closure guarantees that total investment equals total savings. To do this, either savings or investment must be fixed. In the default assumption, savings are exogenously determined and so a saving- driven system is determined. Investments are free to vary.

An important feature is the interdependence between the closure rules of different accounts and the global closure of the capital account[4].

[4] We have already described what is a closure and it is straightforward to demonstrate how the closure rule for the government (and for the rest of the world) affects the macro- economic balance. As previously stated, the closure rule for government defines which elements are endogenous and which are exogenous. One of these elements is government saving. Since total investment depends on the total amount of available savings, the choice on the reaction of the different saving supply is crucial.

2.3 LINKAGE, ENV-LINKAGE, AND ENVISAGE MODELS

Similarly to the GLOBE model, the LINKAGE model (van der Mensbrugghe, 2011) assumes distinct private household and government. They have different income sources, factors' remuneration the former, tax revenues the latter. Then the Government uses its income both for consumption of goods and services and for transfers to households (a new feature respect to GTAP and GLOBE models). The government has a budget constraint. The closure rule of the government account assumes that real government savings are fixed. Government expenditures are linked to changes in GDP so that some fiscal instruments, such as the income tax rate, are endogenous in order to achieve an exogenous government deficit. The standard fiscal closure rule is that the marginal income tax rate adjusts to maintain a given government fiscal position. Each region runs a current-account balance, which is fixed (in terms of the model numéraire). The global saving- investment relation equates gross investment to net saving (there are now three sources of savings- saving by households, net budget position (or in other words the deficit) of the government, and foreign capital inflows as the counterpart of the trade balance). This particular closure rule implies that investment is driven by saving.

The same treatment of the government is in the OECD ENV- Linkage model (Chateau *et al*., 2014).

Since the ENVISAGE model (van der Mensbrugghe, 2007) derives from the LINKAGE model, the two models show the same government closure. Here, in the default assumption government revenues are endogenous and its expenditures are fixed shares of GDP, thus total expenditures are endogenous. The government balance is fixed. To achieve this target, a uniform tax shift in the household direct tax should occur.

Investment is saving driven as well. Since government saving is fixed, foreign savings are fixed in the default closure, investment is mainly driven by household savings.

Respect to the models described above (i.e. the GTAP model and the GLOBE model), these models present an expanded government on the side of expenditures, where also transfers to households are considered. However the government deficit does not replicate the real values.

2.4 MYGTAP

MyGTAP develops the standard GTAP database (Minor and Walmsley, 2013a) and model (Minor and Walmsley, 2013b). From the database point of view, MyGTAP provides a more comprehensive representation of the public budget. While, in GTAP there are only tax revenues and government expenditures in commodities, MyGTAP counts for intra- regional and inter- regional transfers. Examples are the transfers between government and household, remittances, and foreign income inflows and outflows. From a model point of view, the first step is removing the regional household and replacing it with a separate government and private household. The government income accrues from tax revenue, intra-region transfers and net foreign transfer inflows. The income is now used to consume and save, according to a new institutional budget constraint. Private household earn income from factors (less depreciation), intra- regional transfers and international income sources, then he uses it for consumption and saving, according to a Cobb-Douglas function as in the GTAP standard. Foreign transfer flows are not bilateral, however inflows and outflows respect to a single country are provided.

There are at least two great important improvements of in this model respect to the previous ones. Firstly, as the models described above, MyGTAP introduces a government institution with its own budget constraint, distinguishing between the private household and the public agent. Secondly, MyGTAP improves the definition of the budget constraint introducing other elements, such as inter-regional transfers. Although Despite these new features, MyGTAP does not replicate the government deficit according to some international statistics. We get inspiration from MyGtap approach do develop our upgraded version of the ICES database and model.

2.5 G-CUBED

The G-CUBED model (McKibbin and Wilcoxen, 1998) is the only to introduce intertemporal optimization while the others show recursive dynamics. Government is an institution with its own budget; government revenues derive from tax revenues and by issuing government debt, while government outlays include consumption of goods and services (which is exogenous), interests paid on government debt, subsidies and transfers to households.

In the G-CUBED model an intertemporal public budget constraint is modelled. Government can run a budget deficit today but have to finance it by an appropriate budget surplus at some point in the future. Otherwise, the government would be unable to pay interest on the debt and agents would not be willing to hold it. The financing consists in a lump sum tax that government levies in each period equal to the value of interest payments on the outstanding debt. Thus, any increase in the debt will be matched by an equal present value increase in future budget surpluses. Other fiscal closure rules are possible, such as requiring the ratio of government debt to GDP to be unchanged in the long run.

3. THE REGIONAL HOUSEHOLD IN THE ICES MODEL

The Regional Household in the original ICES model has the same structure as in GTAP. It maximizes his utility deciding the allocation of income among private consumption, government consumption and savings. These three components are fixed shares of regional income (the utility is Cobb-Douglas). Then different demand functions are considered for private and public consumption. The private household expenditures derive from a CDE (Constant Difference Elasticity) demand system

which aggregates goods and services[5]. The government, instead, allocates its consumption according to a Cobb-Douglas function with constant budget shares.

There are at least two advantages for this approach:

1. Problems linked to data collection such as government expenditures and deficit can be avoided;
2. A unique measure for regional utility can be used which encompass both the private and the public consumption.

However, there are limitations and inconsistencies in this structure that cannot be neglected. First of all, the government is treated as a maximizing agent without its own budget constraint. Secondly, the public income uses are completely independent upon their sources. Thirdly, the possibility for the public sector to save is not considered at all.

Note also that the regional household income does not come only from production factors (net of depreciation), but also from total tax revenue. The final ICES/GTAP demand system may be summed up as in figure 1.

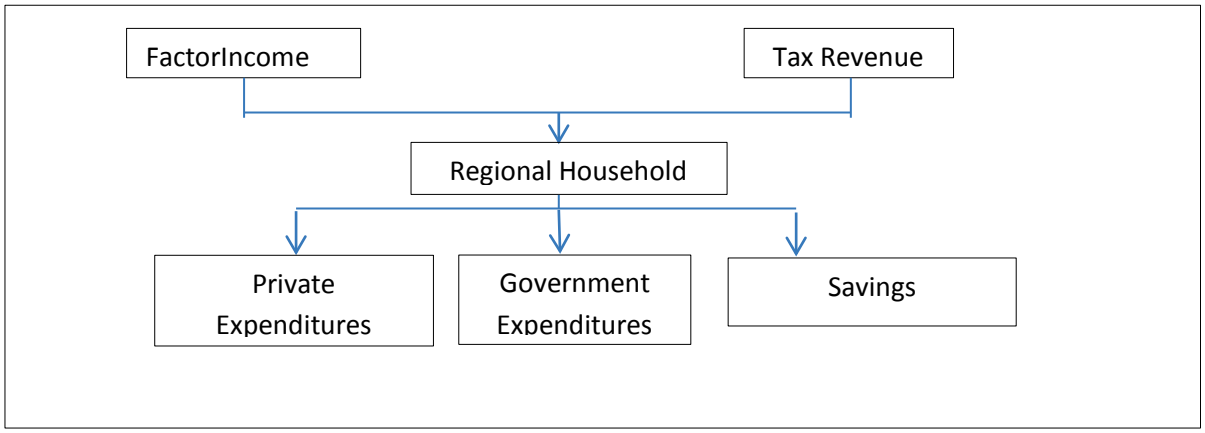

Figure 1: The structure of the demand side in the GTAP model.

In summary, the behavior of the government is not consistent with a public budget constraint where government income (mainly from taxes) should be equal to expenditures plus public deficit, furthermore the role of transfers is completely

[5] The shares of consumption for each good are not fixed because CDE is not homothetic.

ignored although in official statistics they are a consistent percentage of total public expenditures.

Against this background, we thus introduce the fundamental and missing government accounting rules, while the production of goods and services will not change (see Hertel, 1997, for the GTAP model and Eboli *et al*., 2010, for ICES model). Differences mainly occur in income distribution between government and household, the definition of the budget constraint for the public sector and the closure of the capital account balance, since it depends on savings availability.

In equation (1) we represent first the original ICES specification for the income in region *r* (Y_r) broken down in macro-expenditure items. It states that total income is completely devoted to private consumption ($PEXP_r$), public consumption ($GEXP_r$) and regional savings ($SAVE_r$). Then, equation 2 shows the sources of regional income as the sum of factor income net of depreciation ($FACTINC_r$-$DEPR_r$) and total tax revenues ($TTAX_r$). Equations 1 and 2 must give the same result- total regional income is completely used for final purposes.

$$Y_r = PEXP_r + GEXP_r + SAVE_r \quad (1)$$
$$Y_r = (FACTINC_r - DEPR_r) + TTAX_r \quad (2)$$

Rearranging respect equations (1) and (2) and making savings explicit, we derive equation (3) where we link income sources and savings.

$$SAVE_r = (FACTINC_r - DEPR_r) + TTAX_r - PEXP_r - GEXP_r \quad (3)$$

Finally, the macro closure for regional savings- investment balance is equal to equation (4), where the regional savings ($SAVE_r$) plus the current account balance ($(X\text{-}M)_r$) equals the total investments net of depreciation ($NINV_r$).

$$SAVE_r + (X - M)_r = NINV_r \quad (4)$$

Given the GTAP assumption that the amount of regional income to government is equal to its consumption, we have zero savings for the government. Therefore,

regional savings are exclusively private. As a consequence, investment at regional level is mainly driven by private savings since the trade balance is fixed.

To better explain these relations, we derive a 2007 Social Accounting Matrix (SAM) based on GTAP database version 8 for Italy to quantitatively assess this issue. The SAM is presented in table 1 below.

Linking to the theoretical presentation above, equations 2 and 4 are presented in rows O and T where the supply of regional income and savings are summed up. Corresponding columns, 13 and 18, show the uses of income at the regional level (as equation 1) and the investment demand (the right- hand side of equation 4). Equation 3, instead, is the definition of the basic principle in SAM compilation: corresponding rows and columns total must be equal. In other words, it ensures that totals of row O and column 13 (both referring to the regional household) are equal.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
		Mcomm	Dcomm	Act	Fact	Mtax	Xtax	tssm	tssd	Tf	TRM	TRX	ROW	Reghhd	Phhd	prodtax	dirtax	govt	Inv	Totals
A	Mcomm			408.672											135.79			4.865	44.287	593.614
B	Dcomm			2004.756								9.779	545.747		994.113			420.019	412.805	4387.219
C	Act		4387.29																	4387.29
D	Fact			1529.617																1529.617
E	Mtax	3.633																		3.633
F	Xtax		-0.071																	-0.071
G	Tssm			8.207											21.802				0.947	30.972
H	Tssd			44.689											116.011					160.7
I	Tf			268.194																268.194
L	TRM	13.985																		13.985
M	TRX										13.985									13.985
N	ROW	575.996																		575.996
O	Reghhd				958.538	3.633	-0.071	30.972	160.7	268.194						123.155	316.289			1861.41
P	Phhd													1267.716						1267.716
Q	prodtax			123.155																123.155
R	dirtax				316.289															316.289
S	Govt													424.9						424.9
T	Inv				254.79							4.206	30.249	168.794						458.039
	Totals	593.614	4387.219	4387.290	1529.617	3.633	-0.071	30.972	160.7	268.194	13.985	13.985	575.996	1861.41	1267.716	123.155	316.289	424.9	458.039	

Table 1: A 2007 SAM for Italy (based on GTAP database version 8), billion 2007 USD

Legend: Mcomm= imported commodities; Dcomm= domestically produced commodities; Act= activities; Fact= factors of production; Mtax= import tax; Xtax= export tax; Tssm= sales tax on imported commodities; Tssd= sales tax on domestically produced commodities; Tf= factor tax; TRM= margins services on imports; TRX= margins services on exports; ROW= rest of the World account; Reghhd= regional household; Phhd= private household; prodtax= production tax; dirtax= direct tax; Govt= government account; Inv= investment account; Totals= rows and columns totals.

4 THE "NEW" GOVERNMENT IN THE ICES MODEL

In order to introduce the Government in the ICES model we follow three steps:

1. We split the regional household into two different agents or "institutions" in the CGE jargon (private household and government) with different behaviors and we verify whether this affects the internal consistency of the SAM (the fundamental relation to satisfy is that the sum of savings from these two components must be equal to the total savings in the standard model);
2. We model an accounting rule for the Government and a budget constraint making it financially independent from the regional household (namely we introduce an explicit relation between fiscal receipts and expenditure items, including transfers within- and between countries);
3. Having introduced a public saving (or dissaving) we change the macroeconomic closure.

4.1 AN EXPLICIT GOVERNMENT ACCOUNT

The first step is to split the regional household between the two new institutions. We assume that private household earns factor income net of depreciation (equation 5) and the government tax revenues government (equation 6). This essentially does not affect the theoretical structure of the private household (only numbers are affected). Equations 5 and 7 describe the situation for the private household. In the second step the Government, instead, changes its behavior because the public expenditure is now constrained by tax revenues (equation 6) and deficit (equation 8). This implies a new macroeconomic closure in the capital account where government saving is explicitly one of the saving sources (equations 9a and 9b). Below the new equations:

From the sources perspective:

$$YH_r = (FACTINC_r - DEPR_r) \quad (5)$$

$$YG_r = TTAX_r \quad (6)$$

Or, in other words, from the uses perspective:

$$YH_r = PEXP_r + PSAVE_r^* \quad (7)$$

$$YG_r = GEXP_r + GSAVE_r^* \quad (8)$$

$$(FACTINC_r - DEPR_r) - PEXP_r + TTAX_r - GEXP_r + (X - M)_r^* = NINV_r^* \quad (9a)$$

Equation (9a) may be rewritten as:

$$PSAVE_r^* + GSAVE_r^* + (X - M)_r^* = NINV_r^* \quad (9b)$$

Here, elements with a star denotes hereto the values in this first case when no new item is introduced and the total balance inside the model is not affected by any change.

We can appreciate the new structure by comparing table 1 with table 2 (below) where we have a different composition of saving supply (while the total is equal). In Table 2, the SAM for Italy is modified to introduce explicitly these two institutions. We delete row O and column 13 (referring to the regional household) from the SAM in Table 1 and redistribute cells to rows O', R' and columns 13', 16' (the household and the government accounts, respectively) in the new SAM. Moreover, we split cell T-13 into two cells (S-13 and S-16), such that the sum of the new cells equals the old one.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16'	17	
		Mcomm	Dcomm	Act	Fact	Mtax	Xtax	tssm	tssd	tf	TRM	TRX	ROW	Phhd	prodtax	dirtax	govt	Inv	totals
A	Mcomm			408.672										135.79			4.865	44.287	593.614
B	Dcomm			2004.756								9.779	545.747	994.113			420.019	412.805	4387.219
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H	tssd			44.689										116.011					160.7
I	tf			268.194															268.194
L	TRM	13.985																	13.985
M	TRX										13.985								13.985
N	ROW	575.996																	575.996
O'	Phhd				958.538														958.538
P	prodtax			123.155															123.155
Q	dirtax				316.289														316.289
R'	govt					3.633	-0.071	30.972	160.7	268.194					123.155	316.289			902.872
S	Inv				254.79							4.206	30.249	-309.178			477.972		458.039
	totals	593.614	4387.219	4387.290	1529.617	3.633	-0.071	30.972	160.7	268.194	13.985	13.985	575.996	958.538	123.155	316.289	902.872	458.039	

Table 2: A 2007 SAM for Italy with explicit Government (based on GTAP database version 8), billion 2007 USD

Legend: Mcomm= imported commodities; Dcomm= domestically produced commodities; Act= activities; Fact= factors of production; Mtax= import tax; Xtax= export tax; Tssm= sales tax on imported commodities; Tssd= sales tax on domestically produced commodities; Tf= factor tax; TRM= margins services on imports; TRX= margins services on exports; ROW= rest of the World account; Phhd= private household; prodtax= production tax; dirtax= direct tax; Govt= government account; Inv= investment account; Totals= rows and columns totals.

4.2 INTRODUCING INTRA- REGIONAL TRANSFERS

Consistent with the theory and empirical evidence, government holds the total tax revenue, and uses it to buy goods and services ($GEXP_r$) and to save ($GSAVE_r$) according to equations 5 and 7. However, if we look to numbers we easily detect a quite unrealistic feature- according to the SAM, the government saves nearly half of its total tax revenue (52%). This feature is in contrast with available international statistics (e.g. country reports by IMF). Moreover, the opposite happens for the private household who spends more than his income (a negative private saving in cell S-13 in table 1).

According to these findings, a reader may think that the problem of fiscal sustainability of increasing expenditures does not exist: the government is using less than its disposable income and it could increase its expenditures. However, the GTAP database does not account for other expenditure items which are mainly monetary transactions between institutions (namely transfers between government and household). In this step we focus on intra-regional transfers, such as social transfers and benefits from the government to the private household.

The final demand system shown in figure 1 has been changed in the one explained in figure 2 below.

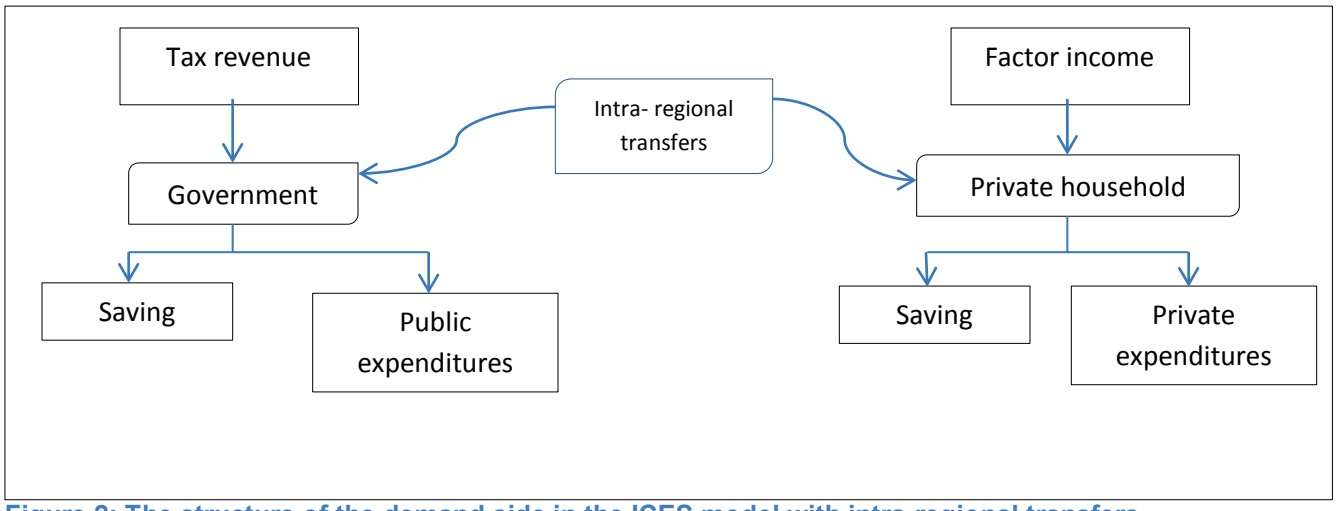

Figure 2: The structure of the demand side in the ICES model with intra-regional transfers

To introduce these new data we need additional information from sources outside the GTAP database. To account for intra- regional transfers, in the worked example on the Italian SAM, we use data from the IMF country reports for various years (from 2008 to 2011) where the items of the government budget6 for the year 2007 are recorded as percentage of GDP. Finally, we apply the percentage to the GTAP Italian GDP in the same year.

To build the new SAM reported in table 3, we have to introduce a new cell (O- 16 in the new SAM), such that transfers are accounted as an expenditure by the government (reading column 16) and as an income source for private households (reading row O).

Formally, this means that the block equation (5-9) must be rearranged to consider the new transfers (GTRNr). Now, there are more sources of income for the private household (equation 10) and a new item as government expenditures (equation 13) while revenues are unchanged (equation 12). Within the region, this means that both private savings and government savings are changed (equations 11 and 13, respectively), namely private saving increases while government savings decreases.

$$YH_r = (INCFACT_r - DEPR_r) + GTRN_r \quad (10)$$

$$PSAVE_r = YH_r - PEXP_r \quad (11)$$

$$YG_r = TTAX_r \quad (12)$$

$$GSAVE_r = YG_r - (GEXP_r + GTRN_r) \quad (13)$$

The macroeconomic closure becomes after substituting equations 10-13 into equation 9b:

$$(FACTINC_r - DEPR_r + GTRN_r - PEXP_r) + (TTAX_r - GEXP_r - GTRN_r) + (X - M)_r = NINV_r \quad (14a)$$

[6] These statistics are written according to the Government Financial Statistic manual of the IMF (IMF, 2001). It defines exactly which sources or expenditures enter the budget and under which category. It is an international standard to follow in public finance statistics which helps comparisons among different countries. Technically, it is known as “Statement of Government Operations” and we consider the part “transactions affecting net worth”.

Or in other words, giving the identities in equations (7) and (8) above:

$$PSAVE_r^* + GSAVE_r^* + (X - M)_r^* = NINV_r^* \quad (14b)$$

Thus, intra- regional transfers do not affect the saving- investment relation both regionally and at the global level, as equations 14a and 14b show.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
		Mcomm	Dcomm	Act	Fact	Mtax	Xtax	tssm	tssd	tf	TRM	TRD	ROW	Phhd	prodtax	dirtax	govt	Inv	totals
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E	Mtax	3.633																	3.633
F	Xtax		-0.071																-0.071
G	tssm			8.207										21.802			0.016	0.947	30.972
H	tssd			44.689										116.011					160.7
I	tf			268.194															268.194
L	TRM	13.985																	13.985
M	TRD										13.985								13.985
N	ROW	575.996																	575.996
O	Phhd				958.538												295.458		1253.996
P	prodtax			123.155															123.155
Q	dirtax				316.289														316.289
R	govt					3.633	-0.071	30.972	160.7	268.194				89.8	123.155	316.289			902.872
S	Inv				254.79							4.206	30.249	-13.72			182.514		458.039
	totals	593.614	4387.219	4387.29	1529.617	3.633	-0.071	30.972	160.7	268.194	13.985	13.985	575.996	1253.996	123.155	316.289	902.872	458.039	

Table 3: A 2007 SAM for Italy with explicit Government and intra-regional transfers (SAM based on the GTAP database 8), billion 2007 USD

Legend: Mcomm= imported commodities; Dcomm= domestically produced commodities; Act= activities; Fact= factors of production; Mtax= import tax; Xtax= export tax; Tssm= sales tax on imported commodities; Tssd= sales tax on domestically produced commodities; Tf= factor tax; TRM= margins services on imports; TRX= margins services on exports; ROW= rest of the World account; Phhd= private household; prodtax= production tax; dirtax= direct tax; Govt= government account; Inv= investment account; Totals= rows and columns totals.

4.3 INTRODUCING INTER- REGIONAL TRANSFERS

According to Minor and Walmsley (2013a) and international statistics (IMF country reports), government recurrent[7] revenue and expenditures are not composed of only intra- regional elements but there are inter- regional transfers as well.

They are mainly inflows and outflows of foreign aid ($AIDI_r$, $AIDO_r$) and interest payments on debt[8]. We assume that grants are only aid and transfers for international cooperation, although they comprehend for instance tax payments from foreigners. Interest payments are divided between interests paid to residents ($INTD_r$) and interest paid to nonresidents ($INTFO_r$). Although these data are easily available for Developing Countries they are not always available for Developed Countries. Subsection 5.1 below deals with our simplifying assumptions on interest payments when these official statistics are not available. Each region may present a positive or negative balance for inter- regional transfers, however at the global level they must sum zero.

Since we want to replicate the real 2007 values of the current account deficit[9] (or surplus) for each regional government, and since the GTAP data do not fit exactly with the international statistics (both in tax revenue and government expenditures) we use the other revenue and the other expenditures accounts ($OTHINC_r$ and $OTHEXP_r$, respectively) to balance the total budget constraint. They are considered as intra-regional transfers. A more detailed discussion on these items is in subsection 5.1.

[7] The term "recurrent" defines only a part of government expenditures. According to IMF and its previous version of the Manual (1986) its definition is "*all payments other than for capital assets, including on goods and services, (wages and salaries, employer contributions), interest payments, subsidies and transfers*".

[8] This outlay is usually not counted for in global real CGE models with the only exception of the G- CUBED model.

[9] Also known as net operating balance. "*It is a summary measure of the ongoing sustainability of government operations. It is comparable to the national accounting concept of saving plus net capital transfers receivable*" (IMF, 2001).

Figure 3 graphically depicts the final demand system where both intra- and inter-regional transfers are taken into account in the ICES model.

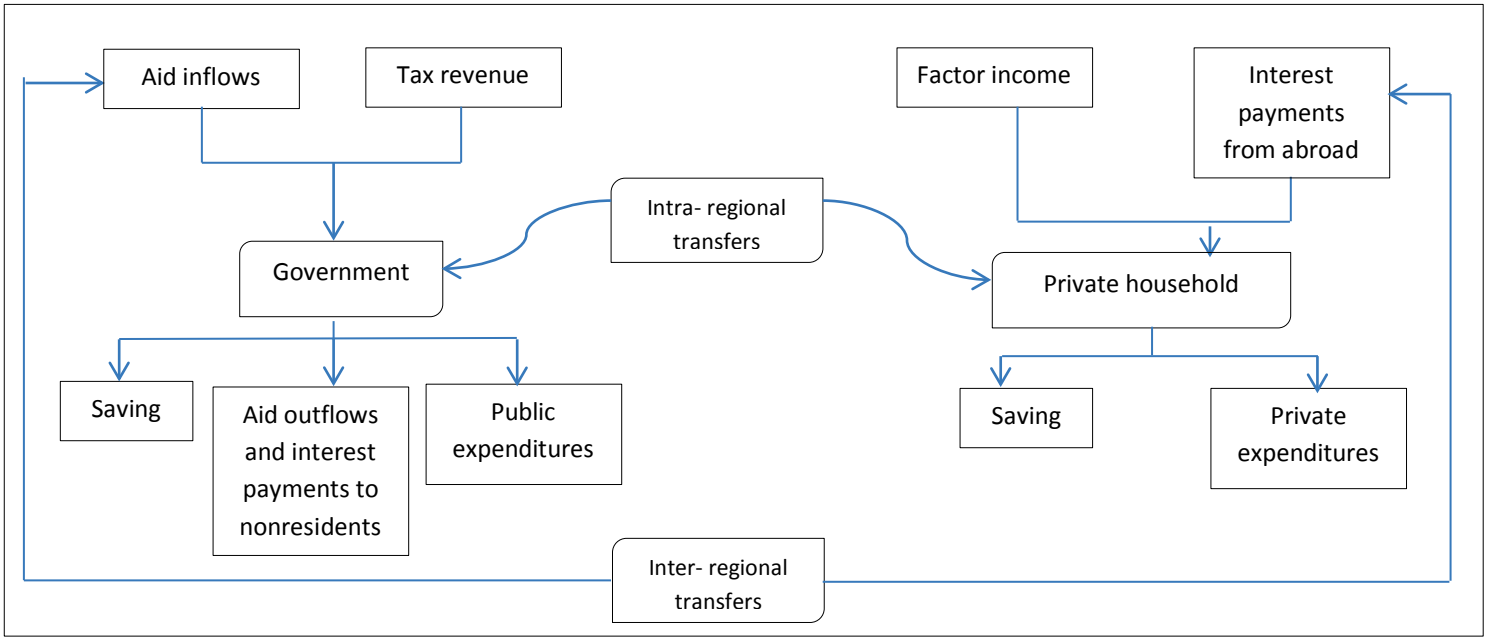

Figure 3: The structure of the demand side in the ICES model with both intra- and inter- regional transfers

To account for the transfers we described above, it is not necessary to create new rows and columns in the SAM but simply fill in some cells (table 4). In cells O-16 and N-16 there should be respectively interests payments paid to residents and to non-residents. In fact, they are in the column of the government, since they are expenditure items for this institution, but on the row of domestic private household and ROW since they are income sources. In cell O-12 there are interest payments inflows from abroad: foreign countries paid interests since residents borrow a fraction of their saving to foreign governments.

Foreign grants to government are counted in cells R-12 and N-16. The former represents the aid inflows from foreign governments and the latter is the aid outflows.

Other expenditures and other income items are calculated in cells O-16 and R-13. As the reader can easily detect there are more items in the same cell. In the SAM below we insert the algebraic sum of the different items entering the same cell.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
		Mcomm	Dcomm	Act	Fact	Mtax	Xtax	tssm	tssd	tf	TRM	TRD	ROW	Phhd	prodtax	dirtax	govt	Inv	totals
A	Mcomm			408.672										135.79			4.865	44.287	593.614
B	Dcomm			2004.756								9.779	545.747	994.113			420.019	412.805	4387.219
C	Act		4387.29																4387.29
D	factors			1529.617															1529.617
E	Mtax	3.633																	3.633
F	Xtax		-0.071																-0.071
G	tssm			8.207										21.802			0.016	0.947	30.972
H	tssd			44.689										116.011					160.7
I	tf			268.194															268.194
L	TRM	13.985																	13.985
M	TRD										13.985								13.985
N	ROW	575.996															48.02		624.016
O	Phhd				958.538								7.326				395.672		1361.536
P	prodtax			123.155															123.155
Q	dirtax				316.289														316.289
R	govt					3.633	-0.071	30.972	160.7	268.194			11.127	89.847	123.155	316.289			1003.846
S	Inv				254.79							4.206	59.816	3.973			135.254		458.039
	totals	593.614	4387.219	4387.29	1529.617	3.633	-0.071	30.972	160.7	268.194	13.985	13.985	624.016	1361.536	123.155	316.289	1003.846	458.039	

Table 4: A 2007 SAM for Italy with explicit Government and intra- and inter- regional transfers (SAM based on the GTAP database 8), billion 2007 USD

Legend: Mcomm= imported commodities; Dcomm= domestically produced commodities; Act= activities; Fact= factors of production; Mtax= import tax; Xtax= export tax; Tssm= sales tax on imported commodities; Tssd= sales tax on domestically produced commodities; Tf= factor tax; TRM= margins services on imports; TRX= margins services on exports; ROW= rest of the World account; Phhd= private household; prodtax= production tax; dirtax= direct tax; Govt= government account; Inv= investment account; Totals= rows and columns totals.

Formally, the block equations includes a new equation for the current account balance, because of the presence of international transactions (equation 15a). According to the Balance of Payments Manual (IMF, 1993), the current account balance (CAB_r) is the sum of the trade balance, net investment income from abroad and net current transfers from abroad. Here, of these broad categories we have the trade balance ($(X\text{-}M)_r$), from GTAP database), net foreign interest payments inflows ($(INTFI_r\text{-}INTFO_r)$) (a part of the broader category of investment income) and net foreign official transfers ($(AIDI_r\text{-}AIDO_r)$) (a part of the broader category of current transfers). So, our current account balance becomes:

$$\boldsymbol{CAB_r = (X - M)_r + (INTFI_r - INTFO_r) + (AIDI_r - AIDO_r)} \quad (15a)$$

Rearranging and imposing a new definition of net foreign inflows $(INTFI_r - INTFO_r) + (AIDI_r - AIDO_r) = NFI_r$, 15a becomes:

$$CAB_r = (X - M)_r + NFI_r \quad (15b)$$

The income and saving equations for regional institutions gets :

$$YH_r = (INCFACT_r - DEPR_r) + GTRN_r + INTD_r + INTFI_r \quad (16)$$

$$PSAVE_r = YH_r - PEXP_r \quad (17)$$

$$YG_r = TTAX_r + (AIDI_r - AIDO_r) \quad (18)$$

$$GSAVE_r = YG_r - (GEXP_r + GTRN_r + INTFD_r + INTFO_r) \quad (19)$$

The macroeconomic closure becomes:

$$(FACTINC_r - DEPR_r + GTRN_r + INTD_r + INTFI_r - PEXP_r) + TTAX_r + (AIDI_r - AIDO_r) - (GEXP_r + GTRN_r + INTFD_r + INTFO_r) + (X - M)_r = NINV_r^* \quad (20a)$$

Rearranging it becomes:

$$(PSAVE_r^* + GSAVE_r^* + NFI_r) - NINV_r^* = (X - M)_r^* + NFI_r \quad (20b)$$

5 BUILDING AN EXTENDED DATABASE FOR THE ICES MODEL

The second part of our work concerns the data collection. This also is a huge task to achieve as taxes and public expenditures are reported only partially in GTAP. Even if the coverage of the tax instruments inside GTAP is incomplete and extremely simplified (Hertel, 1997), taxes on products (domestic or imported) and income tax are recorded and they can be considered a quite realistic representation of the tax revenue. Problem arises by analyzing the expenditure side. There is no reference to transfers to households or other expenditure items. Another important item is the interest payment, which is completely missing in the GTAP database. For this reason we recover this information from IMF (International Monetary Fund).

Table 5 depicts the composition of a standard government operation balance (IMF, 2001), and for each item we summarize then related data source.

	Data sources
Recurrent revenues	
- Tax revenue	GTAP database
direct tax	
indirect tax	
- Grants from abroad	IMF country reports or national Balance of Payments
- Other non-tax revenue	Balancing item
Recurrent expenditures	
- Wages	GTAP database
-Consumption of goods and services	GTAP database
- Transfers	Other sources
to domestic institutions	IMF country reports
to foreign institutions	IMF country reports or national Balance of Payments
- Interest payments	IMF country reports
to residents	IMF country reports or national Balance of Payments or debt statistics
to nonresidents	IMF country reports or national Balance of Payments or debt statistics
-Other expenditures	Balancing item
Current account deficit/ surplus	IMF country reports

Table 5: The structure of the Government statement and the data source

5.1 THE STARTING DATA TO BUILD THE DATASET

In order to update the GTAP database with the additional information needed, we mainly refer to the IMF information which is rich in details and shows a broad geographical coverage. IMF compiles country reports for various years (here, we consider years from 2008 to 2011). In these statistics we find the Government fiscal operations in percentage of GDP for the fiscal year 2007/2008 (or calendar year 2007). Few exceptions (such as Venezuela) are considered in a previous year since more recent data are not available. Then, we apply these percentages to the GTAP regional GDP to have consistent data in 2007 USD million, the base year in GTAP.

We consider the GTAP original regional aggregation to derive the data. We have data for all single countries while regional aggregates are an average of the most representative members.

While intra- regional transfers (i.e. transfers to households and social benefits) reflects the official percentage respect to GDP of the IMF Country reports, foreign aids and interest payments are not exactly the same of that source. In the three subsections below, we summarize the main differences and assumptions used to calibrate these transfers.

A. FOREIGN AID

From an accounting point of view, the global flow of foreign aid among countries must be equal to zero, since the total amount of outflows must match the total amount of inflows. At the regional level, however, there could be a deficit or surplus in this account.

Data are collected according to different statistics:

- from the IMF country report, in the government operation statement, we derive grants as a source of current revenue for a vast majority of countries;

- then, we analyze the national Balance of Payments (BoP)[10] current transfers account, to have a percentage of outflows of grants. This value is sometimes expressed as a percentage of GDP, but if it is not so, we derive the percentage assuming the GDP of the IMF World Economic Outlook Database (IMF, 2014).

Total inflows and outflows are not equal[11], thus we take the mean value of global outflows and assign to each country the real percentage respect to the total.

This allows us to have the same international country ranking (a net exporter remains as such) but the absolute values and the percentages on GDP are not equal to official statistics.

B. INTEREST PAYMENTS

As already stated, it was not always possible to match exactly the interests paid to residents and nonresidents to the ones reported by official statistics .

From IMF Country reports we derive the total interest payments as a percentage of GDP. In many cases, especially Developing Countries, we have the distinction between payments to residents and nonresidents, however when this information is not available we assume a reasonable proxy. We suppose that the distinction between domestic and foreign debt is a good approximation of interest payments. It is reasonable assuming that if a region has a higher fraction of domestic debt respect to total debt, then it will pay a higher amount of interests to residents instead of

[10] The Balance of Payments (BoP) is a "*statistical statement that systematically summarizes, for a specific time period, the economic transactions of an economy with the rest of the world. Transactions, for the most part between residents and nonresidents, consist of those involving goods, services, and income; those involving financial claims on, and liabilities to, the rest of the world; and those (such as gifts) classified as transfers*" (IMF, 1993). It is compiled by the Central Banks of each country.

[11] It probably depends on the different definition of official current transfers (otherwise called current transfers to Government). Some statistics show that they count not only transfers for cooperation and grants but also tax payments by foreigners and other items; others, instead, are not so detailed so the final estimate could be biased.

nonresidents. In few cases, however, we have not this information and we apply a mean value of the neighboring countries.

As in the case of foreign aid, total global amount of payments to nonresident must be equal to total global amount of payments to residents from abroad. However, this information is not clear. It is part of the non- tax revenue in the government operations statement and part of the investments income account in the national Balance of Payments. To allocate the global amount among countries we assume to follow the credit item in the investment account.

We follow this procedure:

- we derive the credits in investment income (excluding income from factors account) form the BoP;
- then we compute the percentage of country investment over total world credits.
-finally, we apply this percentage on the world total outflows of interest payments.

We know that this procedure is a bit rough but since we have not enough data on the bilateral flows of interest payments, we assume that they are paid proportionally to the total credits from investment income.

C. BALANCING ITEMS

As previously cited, in the final dataset we introduce two balancing items, called OTHINC (other income) and OTHEXP (other expenditures) which have not any real counterpart in the official statistics but they are useful to replicate exactly the recurrent account deficit/surplus of IMF official statistics. The introduction of these balancing items is necessary because of the biased starting data inside the GTAP database.

Respect to our worked example for Italy, the table below shows the different items of the government budget. In the second column we record the GTAP data (as

percentage on GDP) in the third column the official estimates according to IMF (percentage of GDP). Then the fourth column highlights the difference in common item.

	GTAP (%on GDP)	IMF (%on GDP)	Differences between GTAP data and IMF
Recurrent revenues			
- Tax revenue	36.8%	29.8%	+7.0%
direct tax	14.9%	15.1%	-0.2%
indirect tax	21.9%	14.7%	+7.2%
- Grants from abroad		0.7%	
- Social contribution		13.3%	
- Other non-tax revenue		3.5%	
Recurrent expenditures			
- Wages		10.6%	
-Consumption of goods and services	20.1%	7.9%	+12.2%
- Transfers		18.3%	
to domestic institutions (social transfers)		17.1%	
to foreign institutions		1.2%	
- Interest payments		5%	
to residents			
to nonresidents			
-Other expenditures		3.7%	

Table 6: A comparison of government operation statement in GTAP and official estimates from IMF for Italy (2007)

Since we do not want to change the productive structure of the GTAP database, we have two biased values for both tax revenue and government consumption. The item "wages", according to IMF statistics, is partially captured in the labor factor payments of the productive sector public services[12]. However, tax revenues are higher than official estimates so to balance the total we have to increase the "other expenditures" item.

[12] The government has a double role in the economic structure- it is both an institution and a productive sector. However the two aspects are captured in different part of the SAM, since productive decisions are taken as the representative sector (maximizing profits under the technology constraint) while the institution acts as a consumer with a demand and a budget constraint.

5.2 DEVELOPMENT OF THE ROUTINE FOR DATABASE EXTENSION

To use these additional data, we need to create an extended version of the GTAP database in *.har* format to be usable in GEMPACK. To create this, we consider the MyGTAP routine (Minor and Walmsley, 2013a). Our routine comprises two different tablos and two additional tablos to present the database in a SAM format and create useful statistics. We consider four folders where inputs, intermediate output and final output are stored.

a. In folder "*input*" we have the necessary data to build the database. There are the *sets.har*, *default.prm, baseview.har* and *basedata.har* (all of them are the standard GTAP database files produced by the GTAPAgg program). There is a new file called *extradata.har* where we directly insert the elements of the government budget we derive from external sources.
b. In folder "*intermediate*" we have the two fundamental tablos which allow to obtain the final dataset, and the other satellite tablos.
c. In folder "*work*" the intermediate outputs of tablo *1_income* era stored. This file (called *database0.har*) becomes the input for tablo *2_split*.
d. In folder "*output*" we have the final modified *database.har.*

In the first step, tablo *1_income.tab* works at the regional level without distinguishing private household and government but it reads the extradata file, extracts the data and introduces them in the definition of regional income, after having eventually balanced the items in and out the region. Moreover, the other items are read and rewritten in the new output (i.e. the level of debt stock at the base year).

```
!Definition of regional Income!
Coefficient (all, r, REG) INCOME(r) # income, net of depreciation, by Household #;
Formula (all, r, REG)
   INCOME(r) = sum{i, ENDW_COMM, EVOA(i, r)} - VDEP(r)
         + NETAXES(r)
         + AIDIN(r) - AIDOUT(r)                                          (A)
         + INTFIN(r) -INTFOUT(r) ;

!Private Expenditure!
Coefficient (all, r, REG) PRIVEXP(r) # Private expenditure by Household #;
Formula (all, r, REG)                                                    (B)
  PRIVEXP(r) = sum(t, TRAD_COMM, VIPA(t, r) + VDPA(t, r)) ;

!Public Expenditure!
Coefficient (all ,r, REG) GOVEXP(r) # Government expenditure in region r #;
Formula (all, r, REG)                                                    (C)
      GOVEXP(r) = sum{i, TRAD_COMM, VGA(i, r)};

!NEW savings calculated based on NEW income!
Coefficient (all, r, REG) SAVE(r) # income, net of depreciation, by Household #;   (D)
Formula   (all, r, REG)
   SAVE(r) = INCOME(r) - PRIVEXP(r) - GOVEXP(r) ;
```

Above, we present the four fundamental blocks of tablo 1_Income.tab. Block (A) sum up the income sources at the regional level- factor remuneration, taxes, inter- and intra-regional transfers. Block (B) and (C) present the private and public expenditure. Finally, block (D) computes the new level of savings when consumption (both private and public) is subtracted from regional income. This code simply states what we previously presented as equations 16- 19.

The output of this tablo is an intermediate database, stored in the "*work*" folder. Then this file become and the input of the following tablo, called *2_split.tab.* At this step, the income is defined for each agent (private household and government) and the agent's saving as the difference between income (net of intra- agent transfers) and expenditures. Moreover, we derive some other useful statistics, such as the average private saving rate, or the government savings on GDP. The final *database.har* is available in folder "*output*".


```
!Household Income!
Coefficient (all, r, REG) INCOME_HHLD(r) # income for Household #;
Formula (all, r, REG)
   INCOME_HHLD(r) = sum{i, ENDW_COMM, EVOA(i, r)} - VDEP(r) +                    (E)
         TRANS_GOV(r) + INTFIN(r) + INTD(r)
         + OTHEXP(r) - OTHINC(r);

!Government Income!
Coefficient  (all, r, REG) INCOME_GOV(r) # income for Government #;
Formula (all, r, REG)
   INCOME_GOV(r) = NETAXES(r)+ AIDI(r) - AIDO(r) -                               (F)
         TRANS_GOV(r) - INTFOUT(r) - INTD(r)
         +OTHINC(r)-OTHEXP(r);

!Private Expenditure!
Coefficient (all, i, TRAD_COMM) (all, r, REG) PRIVEXP(i, r) # Private expenditure #;
Formula (all, i, TRAD_COMM) (all, r, REG)                                      (G)
   PRIVEXP(i, r) = VIPA(i, r) + VDPA(i, r);
   PRIVEXP_HHLD(r) = sum{t, TRAD_COMM, PRIVEXP(t, r)} ;

!Public Expenditure!
Coefficient (all ,r, REG) GOVEXP(r) # Government expenditure in region r #;
Formula (all, r, REG)                                                          (H)
   GOVEXP(r) = sum{i, TRAD_COMM, VGA(i, r)};

!NEW HHLD savings calculated based on NEW INCOME_HHLD!
Coefficient (all, r ,REG) SAV_HHLD(r) # Household savings #;
Formula (all, r, RG )                                                          (I)
   SAV_HHLD(r) = INCOME_HHLD(r) - PRIVEXP_HHLD(r) ;

!NEW GOVT Savings calculated based on new INCOME_GOV!
Coefficient (all, r, REG) SAV_GOV(r) # Government savings #;
Formula (all, r, REG)                                                          (L)
   SAV_GOV(r) = INCOME_GOV(r) - GOVEXP(r) ;

Coefficient (all, r, REG) SAVA(r) #Savings total from HHLD  savings and GOVT saving;
Formula (all, r, REG)
   SAVA(r) = SAV_GOV(r) + SAV_HHLD(r);                                         (M)
```

The core blocks of tablo *2_Split.tab* are presented above. Block (E) and (F) split the previous block (A) of *tablo 1_Income.tab*, while blocks (G) and (H) are the expenditures. Then, blocks (I) and (L) derive institution saving as sources minus expenditures. Note that transfers are considered in the income block, although they are not a source but an expenditure (i.e. see AIDO with sign minus). Finally, block (M) calculates the total country saving level adding the two components.

The satellite tablos (*3_sam* and *4_view*) produce two files which are quite common in GTAP database. The first one is *sam.har* file which shows data in a SAM format for each region. The second one is *baseview.har* file where the new relation between current account and capital account is shown and tested and there are other statistics on imbalances.

```
Coefficient (all, r, REG)(all, k, CAPACCT) CAPITALACCT(r, k) # S - I -NFI = X - M #;
Formula (all, r, REG)
   CAPITALACCT(r,"psave") = SAV_HHLD(r);
Formula (all, r, REG)
   CAPITALACCT(r,"gsave") = SAV_GOV(r);                                    (N)
Formula (all, r, REG)
   CAPITALACCT(r,"inv") = - NETINV(r);
Formula  (all, r, REG)
   CAPITALACCT(r,"nfi") = -NETFLOW(r);

Coefficient (all, r, REG)(all, k, CURACCT)(all ,i, TRAD_COMM) CURRENTACCT(r, k, i) # X - M = S - I - NFI #;
Formula (all, r, REG)(all, m, MARG_COMM)
   CURRENTACCT(r, "export", m) = sum{s, REG, VXWD(m, r, s)} + VIST(m, r);  (O)
Formula (all, r, REG)(all, i, NMRG_COMM)
   CURRENTACCT(r, "export", i) = sum{s, REG, VXWD(i, r, s)}
Formula  (all, r, REG)(all, i, TRAD_COMM)
   CURRENTACCT(r,"imp",i) = - sum{s, REG, VIWS(i, s, r)};
```

Blocks (N) and (O) are the most significant part in the *4_view.tab*. It is a fundamental check for the internal coherence of the database. In fact, the first block shows the components of the capital account, or in other words the difference between investments and regional domestic saving sources (the sum of the household saving and the government savings). Then, foreign savings are divided into trade balance (or current account) and net foreign inflows. For sake of simplicity we put on the right- side of the identity the trade balance and the inflows in the left side. So, the user can easily check if the saving- investment balance condition holds. In the final *baseview.har* the last column of the CAPITALACCT coefficient must be equal to the last column of the CURRENTACCT coefficient both regionally and globally.

Table 4 depicts the routine with a focus on input requirements, produced output, and tasks in each tablo.

	tablo file	Output	Effect
set.har *default.prm* *baseview.har* *basedata.har* *extradata.har*	*1_Income.tab*	*Basedata0.har*	> Consider the new items inside the regional income.
Basedata0.tab	*2_Slpit.tab*	*Basedata.har*	> Insert the new items inside the database; > Split the income between the private agent and the government; > Derive as a residual the private and public savings.
basedata.har *set.har* *default.prm*	*3_sam.tab*	*sam.har*	*> Tabular representation of the variables in the format of SAM.*
Basedata.har	*4_view.tab*	*view.har*	*> Check for internal consistency of the modified database;* *> Measuring of imbalances;* *> Check of the saving- investment macro- balance;* *> Other useful statistics.*

Table 3: The routine to obtain the database in .har format

To follow this routine there are at least two advantages:

1. The four fundamental starting files are produced by GTAPAgg program, so that each user may customize his/her database according to his/her own regional/sector/and factor aggregation. The final basedata has the same aggregation.
2. Introducing the external sourced data in a separated file *.har* allows the researcher to modify it easily when he/she has more updated data.

6. CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

In this paper we present and apply a methodology to implement in the ICES model a more realistic government behavior in order to analyze fiscal sustainability of different fiscal instruments. The work entailed different steps. Starting from the standard GTAP database, we firstly split the regional household into private household and government; then we introduced both intra- and inter- regional transfers. Finally, we modify the specification of the closure rule and the budget constraint for the regional institution.

As previously indicated, this work regards the static version of ICES model. Then, it will be extended to its recursive-dynamic one. This tasks mainly concerns the definition of the accumulation of debt over time, and the linkage between debt stock and interest payments.

From the database perspective, an interesting further step could be the introduction of the capital account of the government operation statement to have a more precise picture of the government budget. This implies the possibility to split investment demand according to the demander. In other words, this means distinguishing a private investment demand and a public investment demand. Although we have IMF statistics on total private and public investments we have no data on a sector disaggregation of this item.

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