

Transformation of the 2001 Swiss SAM from ETH Zürich to GEMINI-E3 format

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Abstract

This paper describes the methodology used to transform the 2001 Swiss SAM devised at ETH Zürich and align it to the requirements of the GEMINI-E3 model which is based on the GTAP database.

Keywords SAM, Switzerland, 2001, GEMINI-E3, GTAP.

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1 Introduction

In order to use the new 2001 Swiss SAM devised at ETH Zürich (Nathani et al., 2006) in the latest version of GEMINI-E3 (Bernard and Vielle, forthcoming), which is based in the GTAP Version 6 database (Dimaranan, 2007), a number of transformation have to be undertaken. The differences between the two SAM are numerous but can be organized in four blocks that we will discuss separately: the sectoral disaggregation, the representation of the final consumptions, the representation of factors and taxation as well as the international trade. Finally, once all these part are harmonized, a final balancing will have to be performed to ensure the equilibrium between uses and resources.

1.1 Description of a SAM

A SAM Pyatt (1988) can be interpreted as a complete description of the entire market transactions of commodities and primary factors made by the agents within an economy. A SAM describes also the transfers of revenues between agents (for example, social benefits payed by the government to households). The SAM is founded on the principle of balance between expenses (in columns) and

Table 1: Sectors and commodities described by GEMINI-E3

01	Coal
02	Oil
03	Gas
04	Petroleum Products
05	Electricity
06	Agriculture
07	Forestry
08	Mineral Products
09	Chemical, rubber, Plastic
10	Metal and Metal products
11	Paper products publishing
12	Transport nec
13	Sea Transport
14	Air Transport
15	Consuming goods
16	Equipment goods
17	Services
18	Dwellings

the receipts (in lines) on the level of each account, but also on the level of the whole accounts. In this way a SAM is based on the Walras' law in which all markets are balanced. The building of a SAM required to compile different statistical data and to reconcile these alternative sources. The SAM is now widely used in economic modeling and in particular in Computable General Equilibrium model. The SAMs that we describe in this paper is those used by the GEMINI-E3 model Bernard and Vielle (forthcoming).

1.2 The Structure of the GEMINI-E3 SAM

GEMINI-E3 describes 18 sectors and commodities (or goods), they are described in the table 1.

The SAM used in the GEMINI-E3 model takes into account three agents (or institutions) : Households, Government and Foreign (or rest of the world). Note that firms in GEMINI-E3 are not considered as an agent, even if the production accounts are described for the 18 sectors, because we suppose that firms are owned by households who received the remuneration of capital and the rents of fix factor.

The figure 1 presents the general structure of a SAM used in GEMINI-E3. this SAM is constituted of six blocks :

- An intermediate consumption matrix, which gives for each sector the intermediate consumption in the 18 goods;
- A domestic final uses block, which describes the households consumption, the government consumption and the investment in the 18 goods;
- An external trade block, which gives the imports and exports;
- An indirect taxation block which describes the taxes collected on household consumption, on value added components (social security contribution on labor, tax on operating surplus), on external trade (imports duties and export subsidies), on intermediate consumption, etc.
- A transfer revenue matrix, which describes the transfer of revenue between agents (household, government and rest of the World);

- finally, a saving block which computes the saving of each agent which the sum is equal to the total investment.

The figures 2, 3, 4 complete the description and show how are computed savings respectively for households, government and rest of the world. Household receipts are the remuneration of the value added (wage, operating surplus and the remuneration of the fix factor), social benefits payed by the government. Household expenditure are the household consumption (including indirect taxes), the taxes on property and the net transfer to foreign (ROW). Concerning government account the receipts are mainly constituted by taxes, direct and indirect. Note that GEMINI-E3 describes with a great detail the indirect taxation (VAT, import duties, social contribution, tax on capital remuneration, etc). Government expenditures are the government consumption and the social benefits given to households. Concerning Rest of the World the account is simple, saving is computed by the difference between imports and export plus the net transfer coming from households.

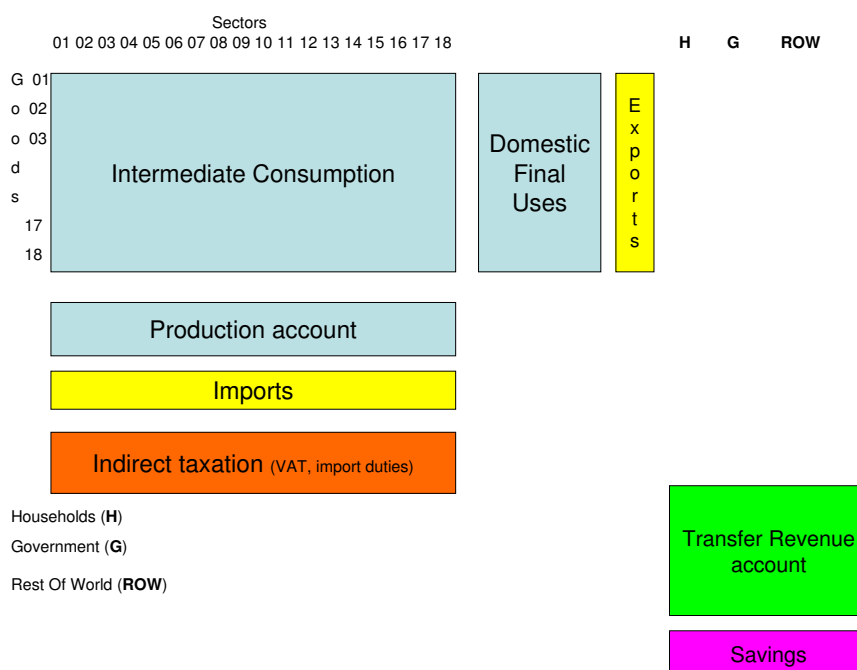


Figure 1: Social Accounting Matrix

For a better understanding of what is a SAM and on how they are used in economic models, see Pyatt (1988).

2 Harmonization of the intermediate consumption

The new 2001 Swiss SAM devised by ETH Zürich is disaggregated in 47 sectors and commodities whereas GEMINI only uses 18. It would not be a problem to aggregate the 47 ETH sectors into

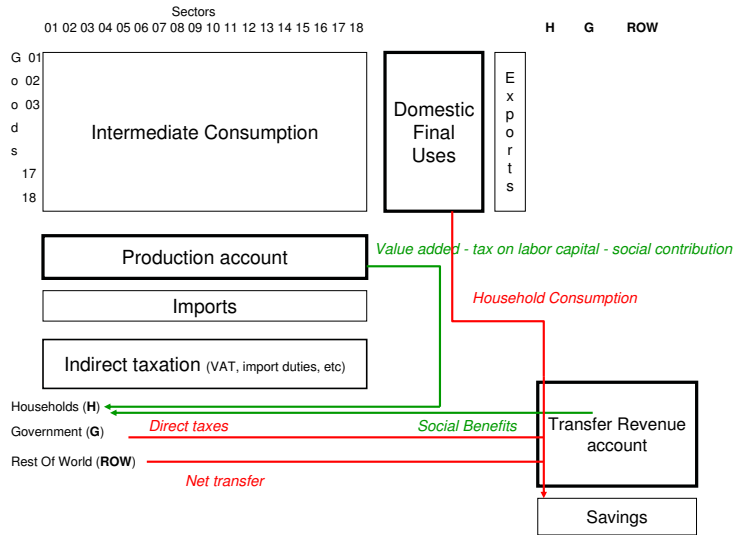


Figure 2: Household saving

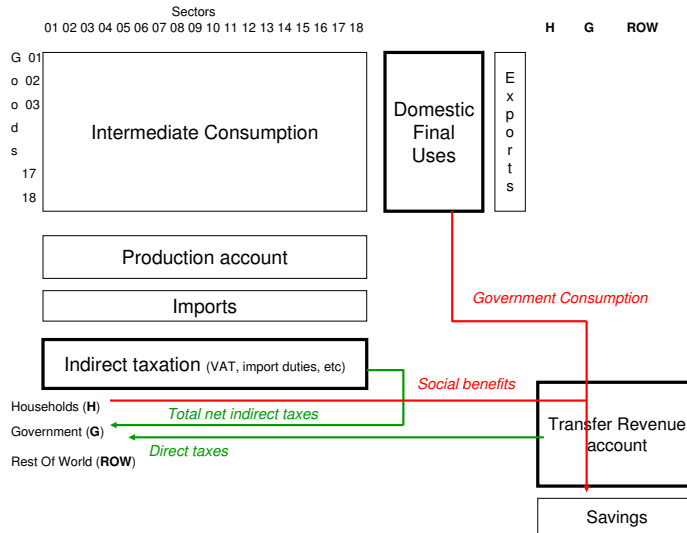


Figure 3: Government saving

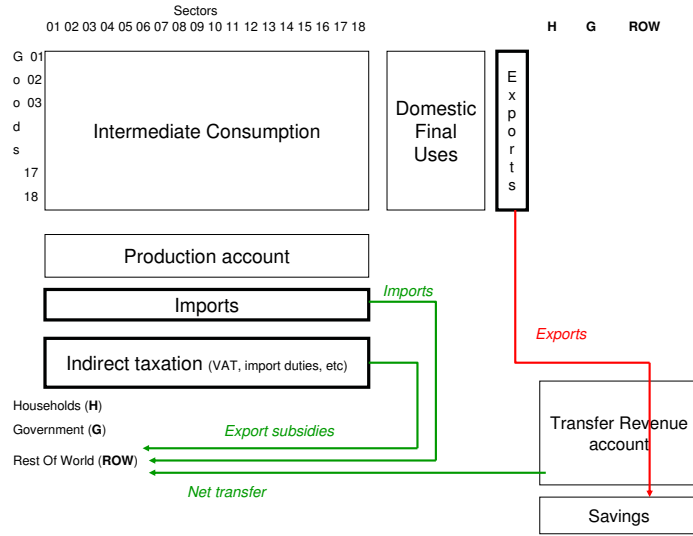


Figure 4: Rest Of the World saving

18 if the GEMINI sectors could be defined by aggregates of the ETH sectors. Unfortunately it is not the case.

GEMINI sectors are an aggregation of the 57 GTAP sectors, which have their proper classification (GSC2). The GSC classification is defined on the basis of 2 international classifications: CPC and ISIC Rev. 3. The GSC2 definition can be found in Annex A. The aggregation scheme for GEMINI can be found in Annex B.

The first step to harmonize the SAM is to aggregate all sectors where it is possible. This leads to 16 aggregated sector, of which 3 are still problematic: ISIC 10-14 (Mining and quarrying - includes also NOGA 10-13), 24 (Manufacture of chemicals and chemical products) and 40-41 (Electricity, gas, steam and hot water supply; Collection, purification and distribution of water). Those sectors already aggregated in the ETH SAM need to be disaggregated in order to be used in GEMINI. Table 2 shows how the aggregated sectors need to be disaggregate and integrated into GEMINI sectors.

ISIC Sectors	GEMINI Sectors
10-14	1,2,3,8
24	9,15
40-41	17,5,3

Table 2: Sectors requiring disaggregation

When we look carefully at the ISIC sector 24, we realize that it should be totally added to the existing GEMINI sector 9 (Chemical, rubber, Plastic) with the exception of ISIC 243 (manufacture of man-made fibre) which should go into sector 15 (Consuming goods). Considering that ISIC 243 is negligible, we add the complete sector 24 into GEMINI sector 9.

The same does not apply to ISIC sectors 10-14 and 40-41. In order to disaggregate them, we use the GTAP 6 disaggregated data. On one hand, the sum of GTAP sectors 43, 44 and 45 is equivalent to the ISIC sector 40-41 of the ETH SAM. On the other hand, GTAP sector 15, 16, 17 and 18 once aggregated is equal to the ISIC aggregate 10-14. Therefore, on the basis of the GTAP data aggregated GEMINI except for the sectors we just mentions, we are able to calculate disaggregation ratios that will allow us to disaggregate the ETH sectors. After this step the number of sectors has increased to 20.

The final step is to re-aggregate the 20 into 18 sectors. Table 4, which is a extract of the table presented in Annex B, shows how to re-aggregate the sectors. The sectors having an ID in bold are those we have disaggregated in the previous step.

GEMINI		GTAP	
ID	Description	ID	Description
1	Coal	15	Coal
2	Oil	16	Oil
3	Gas	17	Gas
		44	Gas manufacture, distribution
5	Electricity	43	Electricity
8	Mineral Products	18	Minerals nec
		34	Mineral products nec
17	Services	45	Water
		46	Construction
		47	Trade
		51	Communication
		52	Financial services nec
		53	Insurance
		54	Business services nec
		55	Recreation and other services
		56	PubAdmin/Defence/Health/Educat

Table 4: Extract from GTAP aggregation for GEMINI

2.1 Problems encountered and solutions adopted

2.1.1 Energy sectors

After having performed the aggregations, we have calculated approximations of the energy prices dividing the intermediate consumption from key energy sectors by the energy uses of those very same intermediate consumption as reported by the OECD in the Swiss energy balances (International Energy Agency, 2002). Comparing those prices with those reported in the IEA Energy Prices and Taxes (International Energy Agency, Quarterly Statistics 2005), made it obvious that the intermediate consumptions of the energy sectors in the the new IO table could not be used in GEMINI-E3 which is specifically devised to analyze energy issues. Therefore, for the energy sectors, we have decided to keep the in most cases the GTAP data which are from far more inline with the energy balances of Switzerland. The gas and electricity sectors nevertheless required some extra works on order to be fully in line with the 2001 Energy balance and the Swiss Energy Statistics OFE (2001).

Gas The level of Gas uses reported by the GTAP as intermediate as well as in final consumption are not inline with the Swiss statistics as reported in OFE (2001). Therefore, on the basis of the volume data available in the GTAP and with the prices published by the IEA (International Energy Agency, Quartely Statitics 2005), we have calculated the uses of the gas sector. The import data being also far from the actual import values, we have balanced the sector using the imports and the import margins, which leads to imports slightly superior to the actual values in the statistics.

Moreover, in view of the fact that no gas is extracted in Switzerland, we have set to zero the intermediate consumptions and value added, as well as all related taxes.

Electricity Similarly, the level of electricity uses reported by the GTAP as intermediate as well as in final consumption, when divided by the volume data, reveal apparent prices much higher than the 0.11 CHF/kWh reported in International Energy Agency (Quartely Statitics 2005). Therefore, on the basis of the volume data available in the GTAP and the IEA prices, we have recalculated the values of the uses of the electric sector. The import and export data being also half of the values reported in the Swiss statistics (OFE, 2001), we have recalculated the those values using Export prices derived from OFE (2001) and adjusting the imports so that the sector is balanced. The apparent prices for electricity imports ends at approximately 0.05 CHF/kWh.

Coal and Oil In view of the fact that no Coal or Oil is extracted in Switzerland, we have set to zero the intermediate consumptions and value added, as well as all related taxes.

2.1.2 Sea Transport

The sea transport is certainly not one of the most important sectors in Switzerland and therefore small difference in values between the GTAP and the ETH SAMs end up in important relative differences when the two sources are combined. Indeed, the use of the trade data from GTAP unbalances the sector; Uses exceeding Resources by more than 60%. In order to solve this problem, we have multiplied by 3 the levels of intermediate consumption in the sector, which significantly reduces the difference between uses and resources and results in a relative balanced sea transport sector without changing too much all other sectors in view of the fact that the sea transport values remain small compared to the value of other sectors.

3 Harmonization of final uses

The final consumption in the ETH SAM is disaggregated according to the categories listed in table 5. In GEMINI, such detailed disaggregation is not required and therefore the consumption is aggregated into only 4 groups: Investment, Household Consumption, Government consumption and Exports.

In view of the fact that GEMINI-E3 has not been designed to deal with changes in inventories and that including D_INV could not be added to the investments without getting negative investment values, the changes in inventories have been estimated as null.

The same aggregation procedure as described in the previous chapter is used for the sectors. The GTAP variable used for the calculation of the disaggregation ratios are VDPA, VIPA, VDPM and VIPM for the household consumption, VDFA VIFA VDFM VIFM for investments and VDPA VIPA VDPM VIPM for the government consumption.

Column ID	Description
C01	Food and non-alcoholic beverages (COICOP 1)
C02	Alcoholic beverages, tobacco and narcotics (COIOCP 2)
C03	Clothing and footwear (COIOCP 3)
C04	Housing, water, electricity, gas and other fuels (COIOCP 4)
C05	Furnishings, household equipment and routine household maintenance (COIOCP 5)
C06	Health (COIOCP 6)
C07	Transport (COIOCP 7)
C08	Communication (COIOCP 8)
C09	Recreation and culture (COIOCP 9)
C10	Education (COIOCP 10)
C11	Restaurants and hotels (COIOCP 11)
C12	Miscellaneous goods and services (COIOCP 12)
C_NPISH	Consumption of non-profit institutions serving households
C_GOV	Consumption of government
C_SOCSEC	Consumption of social security system
INV_EQ	Gross fixed capital formation in machinery and equipment
INV_BLD	Gross fixed capital formation in dwellings and buildings
D_INV	Changes in inventories
N_ACQ	Net acquisition of valuables
EXP	Exports

Table 5: ETH Disaggregation of the final uses

The major problem to harmonize the various uses is due to the fact that GEMINI requires the various uses at agent prices, i.e. including all taxes, whereas the final uses in the ETH SAM are taxes free. Three taxes are reported separately for every use category: VAT, NETTAX (other good taxes and subsidies on products) and TAR (import taxes). These tax lines refer to the following ESA codes: D.211 for VAT, D.212 for TAR and D.214 + D.31 for NETTAX. The supply matrix devised by ETH also provides the total taxes by commodity and therefore allows to calculate the part of taxes linked to the final uses of each commodity.

In order to encompass the taxes in the consumption, we have added to the consumption type of each commodity a part of the tax on the commodity proportional to the ratio of the part of the consumption type over the total final uses without considering the Exports.

4 Harmonization of factors and taxes

The ETH SIOT provides little details on payments of factors. The information on labor has been explicitly provided whereas the operating surplus as been aggregated with the other indirect taxes and subsidies on production. We have extracted the information regarding the indirect taxes from the GTAP database in the data set OSEP (Protection - Ordinary Output Subsidies) and subtracted it from PTX_OS. Then, on the basis of ratios calculated using the data from the GTAP database in the VFM data set, we have disaggregated the operating surplus (OS) in capital and land remuneration.

Regarding the social security, the total wages have been divided in two parts, one representing the net wages and one representing the social contributions (employer only), which in Switzerland represent 15.68% of the gross wages.

The aggregations of sectors have been done following the method used in the previous sectors.

Regarding taxes, one of the major difficulty has been to extract and properly represent excise

taxes. This is particularly important in GEMINI-E3 because of the taxes on petroleum products as well as on gas. Once we had identified the volume of excise taxes on petroleum products, we have used the GTAP volume data on the purchase of energy to split the total excise taxes amount between all sectors and households. It is important to note that in view of the nature and scope of the studies carried out with GEMINI-E3, we did not work on other excise taxes such as those on beer or alcohol, which are been summed up to the VAT.

As we have already seen, the taxes on final uses are available in the ETH SAM under different headings: VAT (D.211), TAR (D.212) and NETTAX (D.214 + D.31). As explained above, we have used TAR in order to calculate figures for the Excise taxes as well as the import duties. We then have summed VAT and NETTAX in order to obtain the amounts of indirect taxes payed through investments, households consumption and government consumption. These taxes have also been added to the various categories of final consumption and detailed information on the calculation can be found in chapter explaining the harmonization of final uses.

Since the ETH SAM did not provide any information on Labor, Fix Factors or Capital taxes, the corresponding lines in the final SAM remain empty.

Regarding the taxes on intermediate consumption, NETTAX and VAT on intermediate consumption have been added and placed under the Indirect Tax heading together with the Ordinary Output Subsidies from the GTAP which have been deducted from the PTX_OS. Excise taxes paid by sectors have been placed under the heading "Taxes on intermediate consumption". It is important to mention that, in view of the fact that we have only dealt with the excise taxes regarding petroleum products and gas, the part of the final SAM representing the taxes on intermediate consumption remains empty except for the line concerning those two sectors.

5 The international trade

In view of the fact that the Swiss SAM will be used in connection with SAMs of all the other regions, it was a requirement to keep the Swiss international trade modified as slightly as possible, in order to avoid having to re-balance the international trade.

Therefore, the imports and exports, as well as import duties and margins and export subsidies, have been taken from the GTAP database and amended in the following cases. The export of Metal and Metal products are much higher in the ETH SAM than what we can find in the GTAP one. Therefore, we decided take the figure provided on the Swiss National Bank which is in between the 2 figures we had, which helps balancing this sector. The services sector also showed a major different between the uses and the resources when using the GTAP export figure. Having in mind that the GEMINI-E3 can handle minor inconsistencies in the International Trade balance and that Switzerland figures remain relatively small in comparison to the figures of world trade, we have taken the ETH figure for the Export of Services. Moreover, the GTAP data concerning Imports and Exports of electricity are less than half of those reported in national statistics and used in other applications such as the Swiss MARKAL. Therefore we have used the data from the Swiss national statistics (OFENenergie2001). Finally, the balancing of the SAM as explained in the next chapter also modified slightly most of the International Trade data.

6 Balancing the SAM

A SAM requires a perfect balancing of uses and resources for every sector. After having updated the figures of the ETH SAM, as described in the previous chapters, the SAM showed some

difference between uses and resources. Whereas most differences do not exceed 2%, some more important differences could be noted in the Forestry, Metal and Metal products or the Transport NEC sectors. In order to balance the SAM we have used an iterative procedure (RAS - see McDougall (1999)) which distributes the differences between uses and resources of every sector across the columns of the matrix as a first step and as a second steps recalculates the differences and distributes them across the lines of the matrix. In view of the importance of taxation in GEMINI-E3, we have ensured that the procedure would not affect tax rates. Repeating this operation 5 times reduced the differences to very small figures that we could include without prejudice in the Import line.

7 Conclusions

In order to conclude this technical paper is is important to highlight the transforming a SAM to the requirements of a specific model requires a number of shortcuts and approximations when the original data are not provided with a sufficient level of disaggregation. In the case of GEMINI-E3 we do require very detailed information regarding the energy sectors which is not available in the new ETH matrix. Therefore we had to come back to the data available in the GTAP database which are updated data of the first SAM as devised by Dr. Gabrielle Antille at the Applied Economics Laboratory at University of Geneva in the early 90's.

In view of the rationale of GEMINI-E3, we need very detailed data on energy and on energy sectors. Unfortunately, the level of disaggregation we would require is not available in actual statistics. A disaggregation of energy data would be of great help for all researchers using CGE models for studies on energy or climate related issues.

8 Acknowledgements

We would like to thank Dr. Karsten Nathani from ETH Zürich for providing us with the Swiss SAM for the year 2001 and for having performed some of the required disaggregation allowing to use the new matrix into GEMINI-E3 (see Annex C.1). Moreover, our thanks extend to Mr. Marcel Wickart, also from ETH Zürich, who has diligently answered the various questions we raised in the course of our work.

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A GTAP Sector Classification (GSC2)

A.1 GSC2 Sectors Defined by Reference to the CPC

Number	Code	Code	Description
1	pdr	113	Rice, not husked
		114	Husked rice
2	wht	111	Wheat and meslin
3	gro	112	Maize (corn)
		115	Barley
		116	Rye, oats
		119	Other cereals
4	v_f	12	Vegetables
		13	Fruit and nuts
5	osd	14	Oil seeds and oleaginous fruit
6	c_b	18	Plants used for sugar manufacturing
7	pfb	192	Raw vegetable materials used in textiles
8	ocr	15	Live plants; cut flowers and flower buds; flower seeds and fruit seeds; vegetable seeds
		16	Beverage and spice crops
		17	Unmanufactured tobacco
		191	Cereal straw and husks, unprepared, whether or not chopped, ground, pressed or in the form of pellets; swedes, mangolds, fodder roots, hay, lucerne (alfalfa), clover, sainfoin, forage kale, lupines, vetches and similar forage products, whether or not in the form of pellets
		193	Plants and parts of plants used primarily in perfumery, in pharmacy, or for insecticidal, fungicidal or similar purposes
		194 199	Sugar beet seed and seeds of forage plants Other raw vegetable materials
9	ctl	211	Bovine cattle, sheep and goats, horses, asses, mules, and hinnies, live
		299	Bovine semen
10	oap	212	Swine, poultry and other animals, live
		292	Eggs, in shell, fresh, preserved or cooked
		293	Natural honey
		294	Snails, live, fresh, chilled, frozen, dried, salted or in brine, except sea snails; frogs' legs, fresh, chilled or frozen
		295	Edible products of animal origin n.e.c.
		297	Hides, skins and furskins, raw
		298	Insect waxes and spermaceti, whether or not refined or coloured
11	rmk	291	Raw milk
12	wol	296	Raw animal materials used in textile
13	for	3	Forestry, logging and related service activities
19	cmt	21111	Meat of bovine animals, fresh or chilled
		21112	Meat of bovine animals, frozen
		21115	Meat of sheep, fresh or chilled
		21116	Meat of sheep, frozen
...

Number	Code	Code	Description
		21117	Meat of goats, fresh, chilled or frozen
		21118	Meat of horses, asses, mules or hinnies, fresh, chilled or frozen
		21119	Edible offal of bovine animals, swine, sheep, goats, horses, asses, mules or hinnies, fresh, chilled or frozen
		2161	Fats of bovine animals, sheep, goats, pigs and poultry, raw or rendered; wool grease
20	omt	21113	Meat of swine, fresh or chilled
		21114	Meat of swine, frozen
		2112	Meat and edible offal, fresh, chilled or frozen, n.e.c.
		2113	Preserves and preparations of meat, meat offal or blood
		2114	Flours, meals and pellets of meat or meat offal, inedible; greaves
		2162	Animal oils and fats, crude and refined, except fats of bovine animals, sheep, goats, pigs and poultry
21	vol	2163	Soya-bean, ground-nut, olive, sunflower-seed, safflower, cotton-seed rape, colza and mustard oil, crude
		2164	Palm, coconut, palm kernel, babassu and linseed oil, crude
		2165	Soya-bean, ground-nut, olive, sunflower-seed, safflower, cotton-seed, rape, colza and mustard oil and their fractions, refined but not chemically modified; other oils obtained solely from olives and sesame oil, and their fractions, whether or not refined, but not chemically modified
		2166	Maize (corn) oil and its fractions, not chemically modified
		2167	Palm, coconut, palm kernel, babassu and linseed oil and their fractions, refined but not chemically modified; castor, tung and jojoba oil and fixed vegetable fats and oils (except maize oil) and their fractions n.e.c., whether or not refined, but not chemically modified
		2168	Margarine and similar preparations
		2169	Animal or vegetable fats and oils and their fractions, partly or wholly hydrogenated, inter-esterified, re-esterified or elaidinised, whether or not refined, but not further prepared
		217	Cotton linters
		218	Oil-cake and other solid residues resulting from the extraction of vegetable fats or oils; flours and meals of oil seeds or oleaginous fruits, except those of mustard; vegetable waxes, except triglycerides; degreas; residues resulting from the treatment of fatty substances or animal or vegetable waxes
22	mil	22	Dairy products
23	pcr	2316	Rice, semi- or wholly milled
24	sgr	235	Sugar
25	ofd	212	Prepared and preserved fish
		213	Prepared and preserved vegetables
		214	Fruit juices and vegetable juices
		215	Prepared and preserved fruit and nuts
		2311	Wheat or meslin flour
		2312	Cereal flours other than of wheat or meslin
		2313	Groats, meal and pellets of wheat
		2314	Cereal groats, meal and pellets n.e.c.
		2315	Other cereal grain products (including corn flakes)
		2317	Other vegetable flours and meals
		2318	Mixes and doughs for the preparation of bakers' wares
		232	Starches and starch products; sugars and sugar syrups n.e.c.
		233	Preparations used in animal feeding
		234	Bakery products
		236	Cocoa, chocolate and sugar confectionery
		237	Macaroni, noodles, couscous and similar farinaceous products
		239	Food products n.e.c.
26	b_t	24	Beverages
		25	Tobacco products

A.2 GSC2 Sectors Defined by Reference to the ISIC, Rev.3

Number	Code	Code	Description
14	fsh	15	Hunting, trapping and game propagation including related service activities
		05	Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing
15	col	101	Mining and agglomeration of hard coal
		102	Mining and agglomeration of lignite
		103	Mining and agglomeration of peat
16	oil	111	Extraction of crude petroleum and natural gas (part)
		112	Service activities incidental to oil and gas extraction excluding surveying (part)
17	gas	111	Extraction of crude petroleum and natural gas (part)
		112	Service activities incidental to oil and gas extraction excluding surveying (part)
18	omn	12	Mining of uranium and thorium ores
		13	Mining of metal ores
		14	Other mining and quarrying
27	tex	17	Manufacture of textiles
		243	Manufacture of man-made fibres
28	wap	18	Manufacture of wearing apparel; dressing and dyeing of fur
29	lea	19	Tan and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
30	lum	20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
31	ppp	21	Manufacture of paper and paper products
		22	Publishing, printing and reproduction of record media
32	p_c	231	Manufacture of coke oven products
		232	Manufacture of refined petroleum products
		233	Processing of nuclear fuel
33	crp	241	Manufacture of basic chemicals
		242	Manufacture of other chemical products
		25	Manufacture of rubber and plastics products
34	nmm	26	Manufacture of other non-metallic mineral products
35	i_s	271	Manufacture of basic iron and steel
		2731	Casting of iron and steel
36	nfm	272	Manufacture of basic precious and non-ferrous metals
		2732	Casting of non-ferrous metals
37	fmp	28	Manufacture of fabricated metal products, except machinery and equipment
38	mvh	34	Manufacture of motor vehicles, trailers and semi-trailers
39	otn	35	Manufacture of other transport equipment
40	ele	30	Manufacture of office, accounting and computing machinery
		32	Manufacture of radio, television and communication equipment and apparatus
41	ome	29	Manufacture of machinery and equipment n.e.c.
		31	Manufacture of electrical machinery and apparatus n.e.c.
		33	Manufacture of medical, precision and optical instruments, watches and clocks
42	omf	36	Manufacturing n.e.c.
		37	Recycling
43	ely	401	Production, collection and distribution of electricity
44	gdt	402	Manufacture of gas; distribution of gaseous fuels through mains
		403	Steam and hot water supply
45	wtr	41	Collection, purification and distribution of water
...

Number	Code	Code	Description
46	cns	45	Construction
47	trd	50	Sales, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
		51	Wholesale trade and commission trade, except of motor vehicles and motorcycles
		521	Non-specialized retail trade in stores
		522	Retail sale of food, beverages and tobacco in specialized stores
		523	Other retail trade of new goods in specialized stores
		524	Retail sale of second-hand goods in stores
		525	Retail trade not in stores
		526	Repair of personal and household goods
		55	Hotels and restaurants
48	otp	60	Land transport; transport via pipelines
		63	Supporting and auxiliary transport activities; activities of travel agencies
49	wtp	61	Water transport
50	atp	62	Air transport
51	cmn	64	Post and telecommunications
52	ofi	65	Financial intermediation, except insurance and pension funding
		67	Activities auxiliary to financial intermediation
53	isr	66	Insurance and pension funding, except compulsory social security
54	obs	K	Real estate, renting and business activities
55	ros	92	Recreational, cultural and sporting activities
		93	Other service activities
		95	Private households with employed persons
56	osg	75	Public administration and defense; compulsory social security
		80	Education
		85	Health and social work
		90	Sewage and refuse disposal, sanitation and similar activities
		91	Activities of membership organizations n.e.c.
		99	Extra-territorial organizations and bodies
57	dwe	n.a.	n.a.

B Aggregation of GTAP Sector for GEMINI-E3

GEMINI		GTAP	
ID	Description	ID	Description
1	Coal	15	Coal
2	Oil	16	Oil
3	Gas	17	Gas
		44	Gas manufacture, distribution
4	Petroleum Products	32	Petroleum, coal products
5	Electricity	43	Electricity
6	Agriculture	1	Paddy rice
		2	Wheat
		3	Cereal grains nec
		4	Vegetables, fruit, nuts
		5	Oil seeds
		6	Sugar cane, sugar beet
		7	Plant-based fibers
		8	Crops nec
		9	Cattle,sheep,goats,horses
...

GEMINI		GTAP	
ID	Description	ID	Description
		10	Animal products nec
		11	Raw milk
		12	Wool, silk-worm cocoons
		14	Fishing
7	Forestry	13	Forestry
8	Mineral Products	18	Minerals nec
		34	Mineral products nec
9	Chemical, rubber, Plastic	33	Chemical,rubber,plastic prods
10	Metal and Metal products	35	Ferrous metals
		36	Metals nec
11	Paper products publishing	31	Paper products, publishing
12	Transport nec	48	Transport nec
13	Sea Transport	49	Sea transport
14	Air Transport	50	Air transport
15	Consuming goods	19	Meat: cattle,sheep,goats,horse
		20	Meat products nec
		21	Vegetable oils and fats
		22	Dairy products
		23	Processed rice
		24	Sugar
		25	Food products nec
		26	Beverages and tobacco products
		27	Textiles
		28	Wearing apparel
		29	Leather products
		30	Wood products
16	Equipment goods	37	Metal products
		38	Motor vehicles and parts
		39	Transport equipment nec
		40	Electronic equipment
		41	Machinery and equipment nec
		42	Manufactures nec
17	Services	45	Water
		46	Construction
		47	Trade
		51	Communication
		52	Financial services nec
		53	Insurance
		54	Business services nec
		55	Recreation and other services
		56	PubAdmin/Defence/Health/Educat
18	Dwelings	57	Dwellings

C ETH SAM structure

C.1 Sectoral disaggregation

ID	Description
01	Agriculture, hunting and related service activities
02	Forestry, logging and related service activities
05	Fishing, fish farming and related service activities
10-14	Mining and quarrying (includes also NOGA 10-13)
15-16	Manufacture of food products and beverages; Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastic products
26	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n.e.c.
30-31	Manufacture of office machinery and computers; Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers and semi-trailers
35	Manufacture of other transport equipment
36	Manufacture of furniture; manufacturing n.e.c.
37	Recycling
40-41	Electricity, gas, steam and hot water supply; Collection, purification and distribution of water
45	Construction
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
51-52	Wholesale trade and commission trade, except of motor vehicles and motorcycles; Retail trade, except of motor vehicles and motorcycles; repair of personal goods
55	Hotels and restaurants
60	Land transport; transport via pipelines
61	Water transport
62	Air transport
63	Supporting and auxiliary transport activities; activities of travel agencies
64	Post and telecommunications
65	Financial intermediation, except insurance and pension funding (includes also part of NOGA 67)
66	Insurance and pension funding, except compulsory social security (includes also part of NOGA 67)
70, 96-97	Real estate activities (incl. private households)
71, 74	Renting of machinery and equipment without operator and of personal and household goods; Other business activities
72	Computer and related activities
73	Research and development
75	Public administration and defence; compulsory social security
80	Education
85	Health and social work
90	Sewage and refuse disposal, sanitation and similar activities
91-92	Activities of membership organizations n.e.c.; Recreational, cultural and sporting activities
93-95	Other service activities; Activities of households as employers of domestic staff

C.2 Other row headers

Row ID	Description
LAB	Wages and salaries and social contribution
PTX_OS	Net production taxes and gross operating surplus
VAT	(Non deductible) Value added taxes
NETTAX	Other net commodity taxes (taxes minus subsidies, excl. import tariffs)
TAR	Import tariffs
IMP	Imports c.i.f.

D Data

D.1 Swiss SAM 2001 from GTAP 6 database

Figure 5 shows the Swiss SAM for 2001 calculated using the GTAP 6 database.

	Coal	Oil	Gas	Petroleum Products	Electricity	Agriculture	Forestry	Mineral Products	Chemical, rubber, Plastic	Metal and Metal products	Paper products publishing	Transport/sea	Sea Transport	Air Transport	Consuming goods	Equipment	Services	Dwellings	Total	Investment	Household Consumption	Government consumption	Export	Total Uses	
Coal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Gas	0	1086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Petroleum Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Forestry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Chemical, rubber, Plastic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Metal and Metal products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Paper products publishing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Transport sea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Sea Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Consuming goods	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Dwellings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Total	0	1086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Value Added	0	1086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1086	0	0	0	0	1086	
Indirect tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tax on intermediate consumption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Coal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Petroleum Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Forestry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Chemical, rubber, Plastic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Metal and Metal products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Paper products publishing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Transport sea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sea Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Consuming goods	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dwellings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TVA on HC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tax on investment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tax on Government consumption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tax on factor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Fix Factor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Labor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Import	13	1022	524	2594	1302	3102	3102	51	3577	24781	4846	61000	558	3712	18335	63367	13148	0	0	0	0	0	0	160749	
Import Margins	2	64	20	123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61023
Import Duties	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6095
Export subsidies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	428
Total Resources	16	1086	605	8689	14370	11902	1215	13442	82569	42217	27606	28495	3050	10679	62018	183368	365037	27560	911414	0	0	0	0	911414	

Figure 5: Swiss SAM 2001 from GTAP 6 database