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TOWARDS A MULTISECTORIAL MODEL FOR SWITZERLAND

by

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Abstract:

At previous input-output Conferences several papers have been presented dealing with the construction of input-output tables for Switzerland using mathematical adjustment techniques (due to the lack of direct observations in this country). Continuous improvement of these indirect methods has allowed for the evaluation of a rather reliable 1990 I/O table that is now in connection with the official development of national accounts.

The Swiss I/O table has already been integrated into a SAM framework to develop a General Equilibrium Model for Switzerland used in policy simulation in the fields of trade and energy. In addition to these works, a semi-aggregated simulation model has started to be developed along the lines of the INFORUM set of models.

The paper will present the first aspects of the development of this model, with special emphasis on the building of the SAM for 1990. It also gives some insight on the structure of the model and on the treatment on imports.

1. Introduction

In Switzerland, until last year National Accounts where established using the OECD framework from 1958. A big change occurred at the beginning of 1997 when the Swiss Statistical Office published the National Accounts according to the European framework from 1978 (ESA'78). It is planned to introduce the ESA'1995 version in 2001.

The main modifications introduced by the European framework consist in presenting the economic data into a sequence of accounts starting from the production account going through income creation and distribution account until consumption and accumulation. This is done for six institutional sectors and of course for the entire economy. At this level we also have a goods and services account as well as the Rest of the world account. This presentation is a big improvement in the case of Switzerland as we did not had before a disaggregation by institutional sectors. But of course this new framework introduces new concepts, new results which are computed in a very detailed way since 1990 and retropolated in a more aggregated version until 1980.

Concerning the building of a multisectoral model for Switzerland, these new framework and new set of data compelled us to first establish a Social Accounting Matrix for the base year 1990. This matrix is extremely useful, both to verify the coherence of our set of equations for the base year, and to help us in the modelisation.

This contribution gives in the first section some insight on the elaboration of the SAM. The second section presents the structure of the model, which belongs to the INFORUM's family model. The third part deals with the peculiarity of the model which introduces a very detailed treatment of imports.

2. Presentation of the accounts related to the entire economy

The accounts of the Swiss economy based on the European framework are presented hereafter. These accounts are first listed in the following table, where we see that they can be put together to allow a presentation closed from the one of the SNA 1968.

Table 1 : Correspondence of ESA with SNA

European system	SNA accounts
Goods and services Production	Production
Exploitation Income Outlay	Consumption
Accumulation	Accumulation

The content of these accounts is described below.

2.1 Production

Table 2 :Production

Outgoings	Incomings
GDP	Consumption • Private • Public Investments • Change in stocks • Gross fixed capital formation
Imports	Exports
" Global supply "	" Global demand "

2.2 Consumption

Table 3 :Consumption (Income / Outlay)

Outgoings	Incomings
Consumption (Inner) • Private • Public	GDP
Saving	(-) Consumption of fixed capital
Net current transfers	Net distributed factor income from abroad
"Utilisation of Disposable Income"	" Disposable Income "

2.3 Accumulation

Table 4 :Accumulation

Outgoings	Incomings
Investments (-) Consumption of fixed capital Surplus of the nation current transactions	Saving
Net Capital formation	Capital formation financing

The above accounts have to be completed with an account related to the rest of the world.

2.4 Rest of the world

Table 5 :Rest of the world

Outgoings	Incomings
Exports Net distributed factor income from abroad	Imports Net current transfers Surplus of the nation current transactions

2.5 A matrix representation

2.5.1 SNA framework

In the SNA 1968 we can find these accounts in the following frame:

Table 6 : SNA framework

	Production	Consumption	Accumulation	Rest of the world
Production		Consumption (Inner)	Investment	Exports
Consumption	GDP		(-) Consumption of fixed capital	Net distributed factor income payments
Accumulation		Saving		
Rest of the word	Imports	Net current transfer - Tourist balance	Surplus of the nation current transactions	

Thus the SNA framework allows to present the previous accounts into a matrix form where each item appears once as an incoming value for a specific account and once as an outgoing value, for another account. In the matrix representation, the rows are incomings and columns are outgoings.

2.5.2 SNA 1968 representation

For Switzerland in 1990, the results in millions of Swiss francs are :

Table 7 : SNA 1968, Swiss data of 1990

	Production	Consumption	Accumulation	Rest of the World	Total
Production		229'108	89’640	102'175	420'923
Consumption	317'303 (GDP)		-56'230	13’598	274'671
Accumulation		46’174			46'174
Rest of the World	103'620	2’469 - 3'079	12’763		115'773
Total	420'923	274'672	46'173	115'773	

If we want to consider the 1993 SNA framework, we need to make a correction. The main difference between the SNA of 1968 and the new SNA published in 1993, at this level of aggregation, concerns the position of the "Consumption of fixed capital" which moves in the intersection between “Accumulation” and “Production”. So in order to be coherent with the account closure, we need to replace the GDP by the NDP (Net Domestic Product).

2.5.3 SNA 1993 representation

Table 8 : SNA 1993, Swiss Data of 1990

	Production	Consumption	Accumulation	Rest of the World	Total
Production		229'108	89’640	102'175	420'923
Consumption	261'073 (317’303-56'230) (NDP)			13’598	274'671
Accumulation	56'230	46’174			102'404
Rest of the World	103'620	2’469 - 3'079	12’763		115'773
Total	420'923	274'672	102'403	115'773	

2.6 An extension of the conceptual framework

The extension of the previous representation goes in many directions. First a goods and services account is introduced. It allows to make appear, in addition to final uses, the intermediate consumption as incomings and the total production as a complement of the imports on the outgoings side. Then two accounts presenting respectively the primary distribution and the redistribution of income appear.

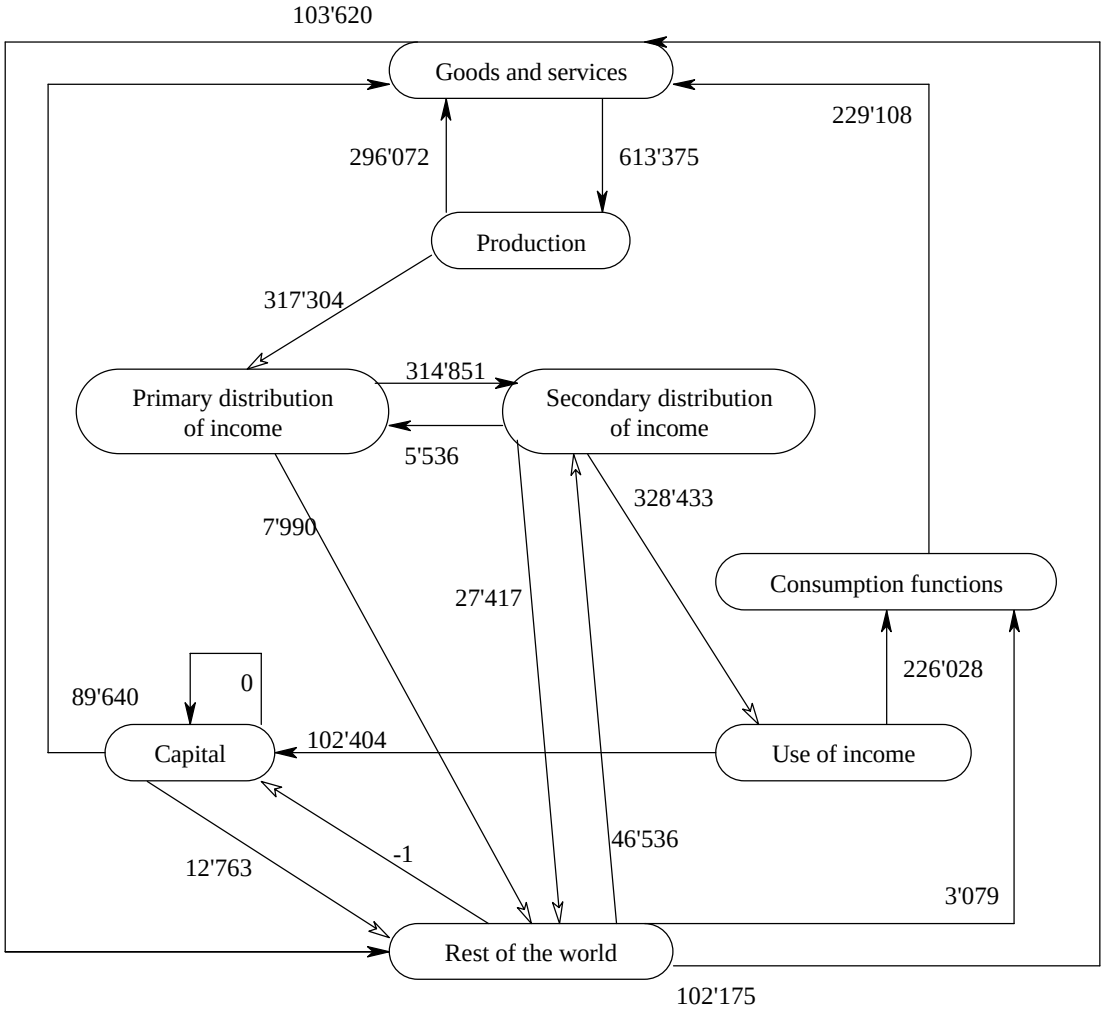
The third extension consists into a disaggregation of the consumption account which allows to create two new accounts, one dealing with the use of income and the second introducing the notion of consumption functions.

The new framework is presented below as well as the corresponding results for Switzerland.

	Goods and services	Production	Primary distribution of income	Secondary distribution of income	Consum-ption functions	Use of income	Capital	Rest of the world
Goods and services		Intermediate consumption			Domestic final consumption		Gross capital formation	Exports of goods and services
Production	Output (MAKE matrix)							
Primary distribution of income		Gross domestic product		Subventions				
Secondary distribution of income			Compensation of employees and operating surplus	Distribution and redistribution of income				Compensation of employees and property income from ROW
Consumption functions						National final consumption		Expenses of the non-residents in the country
Use of income				Gross disposable income				
Capital						Savings	Capital transfers	Capital transfers from/to the ROW
Rest of the world	Imports of goods and services		Compensation of employees to ROW	Net current transfers	Expenses of the resident in the ROW		Net lending (+) / Net borrowing (-) of the total economy	

	Goods and services	Production	Primary distribution of income	Secondary distribution of income	Consumption functions	Use of income	Capital	Rest of the world	Total
Goods and services		296072			229108		89640	102175	716995
Production	613375								613375
Primary distribution of income		317304		5536					322840
Secondary distribution of income			314851	0				46536	361387
Consumption functions						226028		12874	238902
Use of income				328433					328433
Capital						102404	0	-1	102403
Rest of the world	103620		7990	27417	9795		12763		161585
Total	716995	613376	322841	361386	238903	328432	102403	161584	

All these data can also be presented in the following way :



2.7 The institutional sectors

The Swiss national account system considers six different institutional sectors:

1. Non-financial enterprises
2. Financial institutions
3. Insurance enterprises
4. General government
5. Social insurance
6. Households and private non-profit institutions

In Switzerland Social Insurance is a separate institutional sector; the SEC'78 framework is more restrictive about this notion because it considers social insurance as a sub-sector of general government.
The explanation of this difference is that in Switzerland social insurance is provided not only by government (public) but also by private enterprises. For example health insurance is under government responsibility in France (we speak about Social security insurance), but in Switzerland this sector is partly private.

The following table is a reduced representation of the Social Accounting Matrix obtained after having disaggregated the macro information into different institutional sectors as well as into consumption functions and goods and services.

	Goods and services	**Production**	**Primary distribution of income**	**Secondary distribution of income**	**Consum-ption functions**	**Use of income**	**Capital**	**Rest of the world**
Goods and services		*USE* (37x7)			*CFI* (37x14)		*FBC* (37x7)	*x* (37x1)
Production	*MAKE* (7x37)							
Primary distribution of income		*PIB* (8x7)						
Secondary distribution of income			*RPI* (10x8)	*RR* (10x10)				*RRRM* (10x1)
Consum-ption functions						*CFN* (14x6)		*DNRP (14x1)*
Use of income				*RNB* (6x10)				
Capital						*EP* (7x6)	*CC* (7x7)	*STC* (7x1)
Rest of the world	m (1x37)		*SVRM* (1x8)	*RVRM* (1x10)	*DRE* (1x14)		*SBOC* (1x7)	

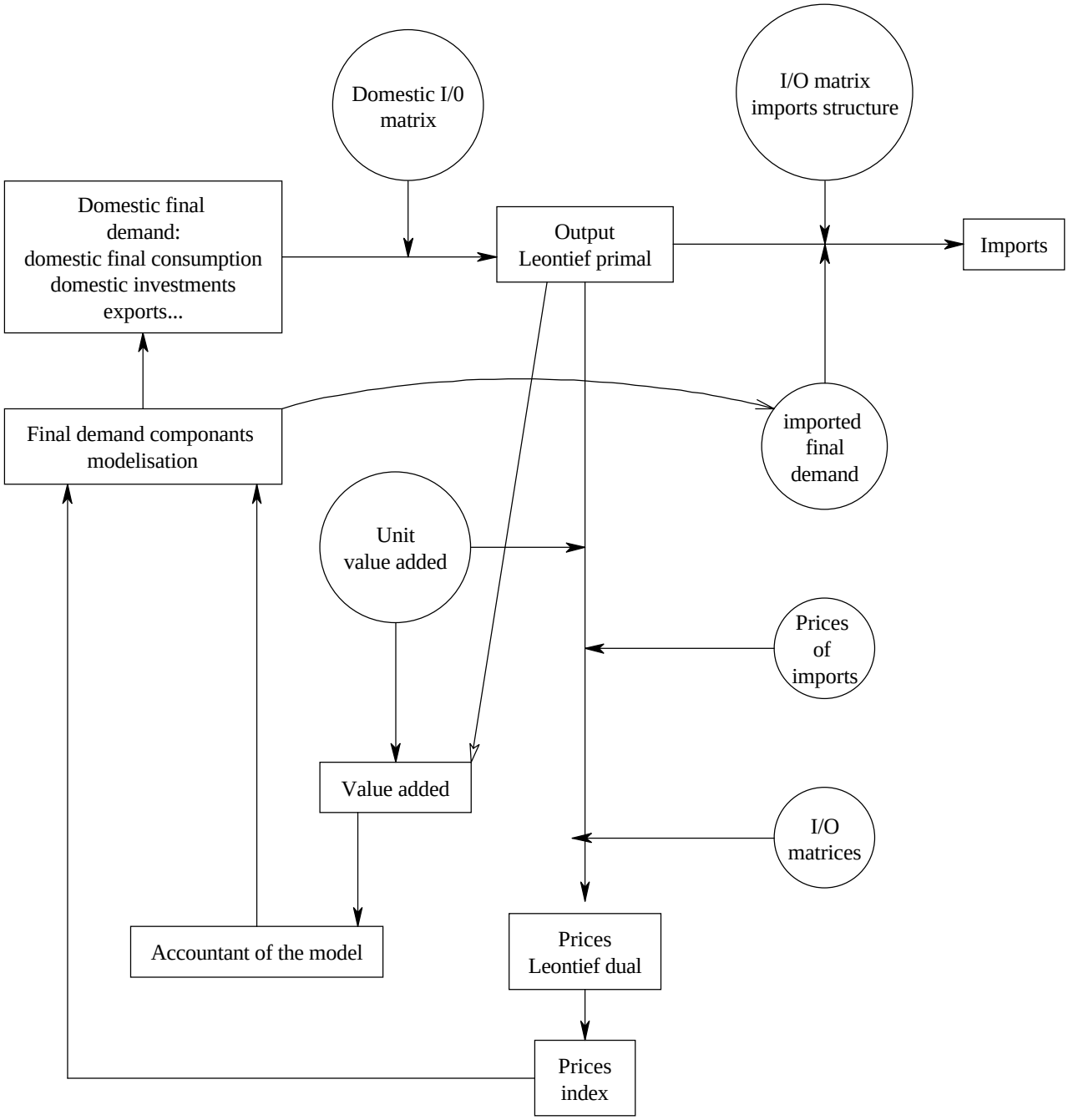
The matrices which are given in negative concern the input-output framework. Let us mention that in this framework the make and use matrices are 37 * 37. As the statistical units used in the input-output tables for Switzerland are enterprises, we were able to aggregate the enterprises into institutional sectors.

The entire SAM is given in the annex.

3. The model structure

As the model belongs to the family of Inforum it is centered around the input-output framework. The determination of production and value added at constant prices by activity and, in a second step, by institutional sector is driven by the final uses. Given the treatment of imports, theses final uses have to be split into domestic and imported final uses. In order to close the model at constant prices, the components of the value added entered a block of equation called in the Inforum framework « the accountant » . Such an accountant has to be built for each institutional sector, it allows among others to determine the available income which enters then in the explanation of final uses. At this stage, the SAM framework is very useful as it gives us detailed contents of the income formation account of each institutional sector. Concerning the price determination it follows the traditional way of modelisation used in input-output.

This structure can be represented by the following diagram.



4. Treatment of imports

4.1 Theoretical presentation

In using a decomposition of the technical coefficients matrix *A* between domestic and imported intermediate uses such as :

$$A = A^d + A^m$$

where

A^d matrix of domestic technical coefficients

A^m matrix of imported technical coefficients,

we obtain the following specification for the determination of production and imports :

$$\begin{cases} q = A^d \cdot q + f^d \\ m = A^m \cdot q + f^m \end{cases}$$

called the Leontief primal,

where

q is the vector of production by commodity (goods and services),

f^d are the domestic final uses and

f^m the imported final uses.

The total final uses are given by: $f = F \cdot \iota = f^d + f^m$

This decomposition between domestic and imported intermediate uses has also to be taken into consideration in the determination of prices, as we have :

$$p = A^{d\prime}\, p + A^{m\prime}\, p_m + v$$

called the Leontief dual,

with

p_m vector of imported prices, by commodity

v vector of value added coefficients, by commodity

4.2 Building of the intermediate coefficient matrices, commodity x commodity.

The following matrices have first to be elaborated :

U^d intermediate domestic uses, commodity by activity
U^m intermediate imported uses, commodity by activity

To do so we determine the vector of total imported intermediate uses for each commodity. This vector is given by e^m :

$$e^m = m - m^C - m^I$$

where

m total imports by commodity.
m^C imports of consumption goods and services
m^I imports of investments goods.

The e^m vector is equal to the row total of U^m: $e^m = U^m \cdot \iota$

As we have no complementary information concerning the structure of imported intermediate uses by activity, we have to introduce the hypothesis that the e^m vector is distributed in the matrix U^m in the same way that the total intermediate uses in the matrix U . We thus obtain :

$$U^m = \hat{e}^m \cdot \tilde{U}$$

et

$$U^d = \widehat{(U \cdot \iota - e^m)} \cdot \tilde{U}$$

with

$\tilde{U} = \widehat{(U \cdot \iota)} \cdot U$ matrix of the row coefficients of U

These equations verify : $U^d + U^m = U$

The matrix of technical coefficients, commodity by activity, being defined as

$B = U \cdot (\hat{q}^*)^{-1}$

where

q^* is the vector of production by activity

One can, using the same definition, evaluate the following matrices :

$B^d = U^d \cdot (\hat{q}^*)^{-1}$ matrix of domestic technical coefficients, commodity x activity

$B^m = U^m \cdot (\hat{q}^*)^{-1}$ matrix of imported technical coefficients, commodity x activity.

Using the hypothesis of technology by commodity, one obtain :

$$A^d = B^d \cdot C^{-1} \quad \text{et} \quad A^m = B^m \cdot C^{-1}$$

where

C is the matrix containing the contribution of each commodity to the production of an activity

Finally M^d et M^m result from :

$$M^d = A^d \cdot \hat{q}$$

$$M^m = A^m \cdot \hat{q}$$

5. References

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6. Annex