SimFin

a simulation model of financial needs and government budget options for the functioning of the health system

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GENERAL PRESENTATION

Budgeting as part of health planning : macro and micro aspects

Health systems, particularly in the developing countries, are facing a difficult dilemma: on the one hand, populations may have important needs for better health and on the other hand the financial resources they can mobilize are limited. Choices have to be made all the time: households allocate part of their budget to health, donors have to decide what proportion of their financial contribution to assign to health, and governments have to establish their health budget under budgetary constraints.

With **SimFin**, we will focus on government's behaviour with regard to their budgets for publicly provided health services. Budgeting will be seen as a part of the planning process. In a planning process, we start from the present situation and indicate the objectives one wishes to achieve within a given period as well as ways in which that is to be achieved. Yearly budgets can then be considered as different points in the planning process.

This approach presupposes that the decision-makers have a relatively clear idea about health policy and the way in which they intend to implement it. They must therefore make some technical choices about the health services pyramid, the role of prevention and curative care, the importance of primary health care, the need for supervision, staff qualifications, etc. However, all these choices have financial repercussions. The question is : to what extent are these choices financially feasible ?

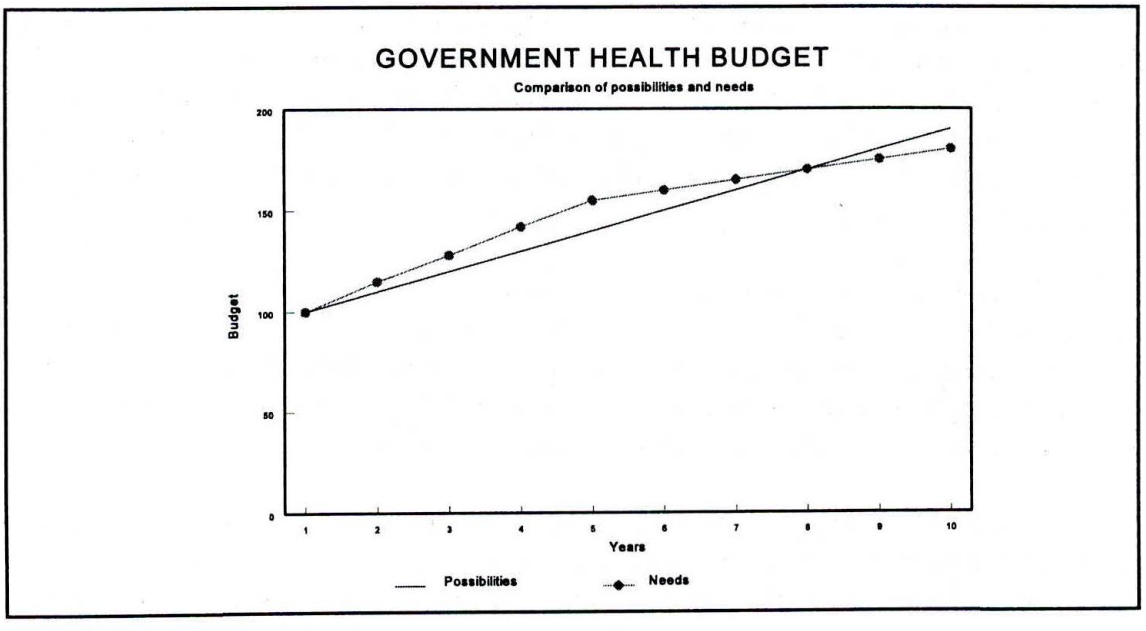
For the health policy-maker, planning means therefore that they are able to propose, for the coming years, how the government's health policy and expenditure on health should develop. These proposals, which will subsequently need to be ratified by the government bodies, in particular through a national plan, will be the outcome of a comparison between the budgetary possibilities on the one hand and the financial needs of the health sector on the other hand:

- **The budgetary possibilities** express the constraints on resources. These constraints are determined in part by national economic activity as well as by the international environment. They also depend on the choices made by the government (with regard to the role of health in the government budget. This analysis of budgetary possibilities can be called a "macro" approach, and is facilitated by SimFin's macro submodel called **MacroFin.**

- **The financial needs** for the functioning of the health system call for a "micro" approach. This consists of determining the financial needs related to the health services at different levels of the health system (health centres, hospitals at the district, regional and national level), and to the administration. The financial needs depend, of course, on the objectives that are set for these health services and the administration. This particular analysis is facilitated by SimFin's micro submodel called **MicroFin**.

Confronting needs with possibilities

The comparison between financial needs and financial possibilities may be illustrated by the following graph:



In this graph it can be seen that at the start of the simulation period the financial needs for operating the health system, as established in accordance with the hypotheses selected by the decision-maker, exceed the budgetary possibilities determined by the macroeconomic approach. At the end of the period, on the other hand, the financial needs are less than the budgetary possibilities.

(i) How would the policy-makers react ? At the start of the period the policy-makers would have to revise their needs downwards by changing some of the hypotheses selected for the calculations, or else seek extra budgetary financial resources (increase in community financing, external aid), or persuade the government to increase the funding it allocates to the health sector.

(ii) At the end of the period, on the other hand, they would be able to increase health expenditure without requesting government to alter its global budget policy.

SimFin and its two submodels

The micro and macro aspects of government budgeting for health can be studied by the submodels MicroFin and MacroFin, respectively. These submodels can be used separately. However, SimFin becomes truly meaningful whn the user establishes a link between the two submodels. Note that as a simulation model. SimFin does not presuppose any prior knowledge of statistics or econometrics, and is therefore easily accessible.

PART I : THE FINANCIAL NEEDS FOR THE FUNCTIONING OF THE HEALTH SYSTEM

1. GENERAL OUTLINE

1.1 Introduction

The purpose of this part of the model, namely MicroFin, is to analyse the financial resources that the government needs to allocate to the functioning of publicly provided health services. At the starting point of the model - that is the base year - this requires a breakdown of the expenditure the government has allocated to health. This breakdown is in accordance with two major functions: (i) the production of services by government health structures; and (ii) the overall management and supervision of the system by the health administration.

Beyond the base year, MicroFin enables the user to estimate the trend in government expenditure on health according to various hypotheses. Some of these are external to the health sector - population growth, for example - while others are based on health policy choices and thus are fully dependent on the policy-maker; others again concern the demand for health services by the population.

It should be clear that SimFin, together with its submodels, is not a forecasting model that seeks to predict what the expenditure of the Ministry of Health **will** be. On the contrary, the model aims to help the decision-maker to measure the repercussions of the decisions he wishes to take. It therefore seeks to reply to the question: "if I as a decision-maker take such-and-such a decision, what will be the repercussions of my decision in the years to come on government health expenditure ?" For example, if I decide that in order to attain good quality of services at health centres, expenditure on drugs per case should eventually be five dollars, what is the consequence of this decision for the government budget? Next, by comparing this result with those provided by MacroFin, the decision-maker can see whether his decision is feasible.

The model works over a 10-year period. This reflects that things cannot change overnight: it takes time before decisions and objectives can be achieved. By working over a 10-year period the model indicates the trend, the direction health expenditure will take in the future. The user will have to specify quite a number of objectives to be reached by the end of the 10-year period, or the target-year. To revert to the above example, drug expenditure per case today could be 2 US$, whereas the objective in the target year would be 5 US$.

Technically speaking, the changes that will be made between the base year and the target year will be gradual. To return once more to the above example, it will be assumed that the change in expenditure on drugs from two dollars in the base year to five dollars in the target year will be made step by step: 2.3 dollars in $t + 1$, 2.6 dollars in $t + 2$, and so on. The model therefore implements gradual and regular changes.

1.2. Health services

The model presupposes that the health pyramid has three levels:

- Health centres : This is the first level of the health pyramid, which provides basic care for the population. The model permits four categories of health centres to be distinguished. Note that in reality, health centres" may have a variety of names: health posts, health huts, health and welfare centres, etc. The classification may thus differ from one country to another (see below), but these health centres are assumed to operate in comparable ways.

- Referral hospitals: The model can distinguish between two types of referral hospital: first-referral hospitals, (district hospitals), and second-referral hospitals (regional, provincial, or, county hospitals). In MicroFin, we refer to them as hospitals of level II and III, respectively.

- National referral hospitals: These are the highest referral hospital in the health pyramid, such as specialised hospitals, teaching hospitals, etc. We refer to these as hospitals of level IV.

1.3. Health administration

The model assumes that the health system is supervised by the health administration which is divided into three levels:

- Basic administration: This is the administration that supervises the health centres and first-referral infrastructure: we shall call it the district administration though being aware that different terms are used in different countries.

- Intermediate administration: This is the administration intermediate between the basic and central administration: we shall call it the regional administration, but here again the terms vary from one country to another.

- Central administration: This is the national administration, i.e. in practice the Ministry of Health. It comprises the traditional departments found at the central level, but may also include institutions or specific services.

It should be noted that this model does not include training establishments.

1.4. General overview of the structure of MicroFin

The model operates in three major stages.

1.4.1 First stage: Expenditure by category of health facility and administration

During this stage, two steps must be distinguished.

1.4.1.1 Step 1: Calculations relating to a standard health facility and administration

For each of the 10 years of the projection period, the calculations are designed to determine:

- the number of staff with qualification k who are needed to operate a "standard" or average health facility and administration;
- expenditure on drugs for each standard health facility;
- operating expenditure of a standard health facility and administration.

1.4.1.2 Step 2: Determination of the number of health facility and administrative offices

For each of the 10 years of the projection period, the calculations are designed to determine the number of health facility and administrative offices that will be needed. This step does not of course apply to the central hospital and the central administration.

Combining the information from steps 1 and 2, we obtain :

(i) the number of staff with qualification k who are needed in the health facilities and administrative offices;
(ii) the expenditure on drugs by the different categories of health facilities;
(iii) the operating expenditure of health facilities and the administration.

1.4.2 Second stage: National expenditure on health facilities and administration

Adding the results obtained for each category of health facilities and administration, we obtain results at the national level :

(i) total number of staff with qualification k who are needed to operate all the health facilities and administrative offices managed by the government's Ministry of Health (MoH).
(ii) total drug expenditure at all the health facilities;
(iii) total operating expenditure of all the health facilities and administrative offices in the country.

Note that the national expenditure arrived at here includes expenditure by government, communities and donors. Government includes central as well as local/provincial/regional government. Sources of funding are not taken into account during this stage.

1.4.3 Third stage: MoH expenditure on health facilities and administration

By making hypotheses concerning the financial contribution paid for by the MoH, we arrive at:

(i) the number of staff with qualification k who are paid by the MoH. Multiplying this number by the salary (or remuneration) for each qualification k produces the MoH expenditure on health and administrative personnel in all structures;
(ii) the MoH expenditure on drugs for all health facilities;
(iii) the MoH operating expenditure for all health facilities and administrative offices.

The types of main results of MicroFin are presented on page 7.

SUMMARY TABLE OF THE MAIN RESULTS OF MicroFin

	Personnel		Drug expenditure	Other operating costs	Expenditure on supervision	Food expenditure	Total expenditure
	Number	Expenditure					
- Health centres							
-Hospitals II							
-Hospitals III							
-National hospital							
-District administration							
-Regional administration							
-Central administration							
-Total							

N.B.: Shading of fields means "not applicable": for example, there is no expenditure on patient's food in the central administration

2. THE "HEALTH CENTRES"

2.1 Introduction

The principle of this module is based on the concept of a "standard health centre". The information that will be introduced into the model does not therefore concern each individual health centre in the country: such an approach would have been possible in theory, but for highly populated countries would have led to far too large a database to be processed. Accordingly, the user of the model will often have to do quite a large amount of work in advance to obtain a standard or mean value for each of the data used in the model. It is indeed only this mean value that will be introduced into the model.

It must be borne in mind that this module only permits a maximum of four categories of health centres to be taken into account. It is therefore advisable to subdivide the country's health centres in accordance with an appropriate classification. Obviously, this will vary from country to country: a distinction will be made, for example, between rural health centres, urban health centres with beds, health centres without beds, and small, medium-sized and large health centres.

It must be stressed that the objective of this module is to arrive at the government expenditure on health centres. Consequently, all health centres that receive a financial contribution from the government in one form or another must be taken into account in the model: we are concerned not just with purely public structures but also with private structures (religious, non-profit or otherwise) that receive a contribution from the government.

Health centre expenditure has been divided into three categories:

(i) personnel expenditure. But it is also desirable to know the number of people working in the centre, with a breakdown by category of staff;
(ii) expenditure on drugs, reagents, vaccines, etc.
(iii) other operating expenditure: this is the expenditure, other than on drugs, required for the day-to-day operation of a health centre.

Clearly the evolution in this health centre expenditure depends on a number of factors that need to be taken into account simultaneously:

(i) future demand: expenditure is dependent on the number of people attending the health centre. In turn the latter depends on the size and growth of the population where the health centre is located and on the population's preference for the health centre services;
(ii) general economic considerations: for example, the evolution in real income;
(iii) the type of activities carried out at the health centre: for example, it matters to the population whether health centres perform deliveries or not, or practise outreach strategy or not, etc.;
(iv) the production technology of these activities, i.e., the way in which the various factors of production (e.g., different categories of personnel, drugs, etc...) are combined for the production of services.

The activities carried out by the staff of a health centre have been divided into five categories:

(i) curative consultations : these are activities that the staff perform during direct contact with an individual: consultations, minor treatment, minor surgery, follow-up visits, etc.;
(ii) maternal and child health services : these again entail direct contact with an individual: prenatal and postnatal consultations, child consultations, vaccination, family planning;
(iii) deliveries;
(iv) Information, Education and Communication (IEC) and outreach activities: administration committees, awareness meetings, collective campaigns, group activities, family planning, etc.;
(v) administrative tasks : statistics, mail, staff supervision, meetings, district-level contacts;

2.2. General overview of the structure of the "health centres" module

The model operates in three major stages:

2.2.1 First stage: Analysis by category of health centre

It should be borne in mind that this module can take into account four categories of health centre. During this first stage, again two steps need to be distinguished:

2.2.1.1 Step I: Calculations relative to an average health centre

For each of the 10 years and for each category of health centre, the calculations performed during this phase are designed to determine:

- the number of staff with qualification k who are needed to operate a standard health centre;
- expenditure on drugs for a standard health centre;
- other operating expenditure of a standard health centre.

2.2.1.2 Step 2: Determination of the number of health centres

For each of the 10 years and for each category of health centre, the calculations are designed to determine the number of health centres that will be needed.

2.2.1.3.Step 3 : Results by category of health centre

For each of the 10 years and for each category of health centre, multiplying the results obtained in Step 1 by the number of health centres, produces the following results:

- number of persons with qualification k who are needed to operate the health centres in the category;
- expenditure on drugs by health centres in the category;
- other operating expenditure of the health centres in the category.

2.2.2 Second stage: Results at the national level

Summing of the results obtained for each category of health centre produces the following results:

(i) total number of staff with qualification k who are needed to operate all the health centres to which the government contributes;
(ii) total expenditure on drugs at all the health centres;
(iii) total other operating expenditure of all the health centres;

Sources of funding are not taken into account during this stage.

2.2.3 Third stage: MoH expenditure on health centres

By formulating hypotheses concerning the fraction of expenditure paid for by the MoH, we arrive at:

(i) the number of staff with qualification k paid by the government. Multiplying this number by the salary for each qualification k produces the MoH's expenditure on staff in all health centres;
(ii) MoH financing of total expenditure on drugs at all health centres;
(iii) MoH financing of total other operating expenditure at all health centres.

2.3 Analysis by category of health centre (first stage) : detailed structure

2.3.1 Step 1: Calculations relating to a standard health centre

2.3.1.1 Categories of staff needed for the operation of a standard health centre,

The staff working in a health centre has been divided into five categories:

- physicians;
- nurses: this covers all the various categories of nurses: registered nurses, enrolled nurses, etc.;
- midwives;
- health workers these are all the other health personnel involved in health services and not listed above, for example nursing aides;
- non-health personnel: these are the staff with no health activities: caretakers, maintenance staff, administrative and secretarial staff, etc.;

2.3.1.2 Estimation of health personnel needs

- Health care

The reasoning below is valid for three categories of health centre activities : curative consultations, MCH services and deliveries. Basically, the needs for staff are estimated by calculating the time needed to produce the three services mentioned above.

This particular time is then related to a staff member's working time in order to make the conversion into numbers of staff needed.

The time needed for carrying out activities of this type depends on the following two criteria:

1) the number of cases treated in a health centre. For the base year of the model this information is known. For subsequent years it is estimated on the basis of the size of the population in the geographical area (POPZONE) where the health centre is located as well as by and the demand by this population, expressed by the number of cases per inhabitant (CASEC);

$$CASE_{i,c} = POPZONE_{c} * CASEC_{i,c} \qquad \textbf{(1)}$$

where i = curative care, MCH activities, deliveries
c = category of health centre

2) the time that staff with qualification k devote to "producing" a service i: for example, the time that a nurse spends on producing a curative procedure. This time itself is a function of two factors :

2a) the average time taken to produce a procedure i *($AVTIME_{i}$)*. For example, it could be estimated that the production of a curative consultation should take 20 minutes. It is important to note that the average time for a service is not the actual duration of the "medical" service but the total time needed to produce the service (e.g. including any administrative time needed);

2b) the time contribution by a staff with qualification k *($CTR\%_{i,c,k}$)* in the production of service i. We therefore have:

$$TIME_{i,c,k} = AVTIME_{i,c} * CTR\%_{i,c,k} \qquad \textbf{(2)}$$

For example, it may be thought that the involvement of the midwife in a delivery should represent 80% of the average total time needed, the other 20% being provided by a nurse. Surely, these two categories of staff should not always be present simultaneously during all deliveries; it is simply estimated that on average a delivery will involve a midwife for 80% of the time and a nurse for 20%.

The time needed for staff with qualification k for all activities i is arrived at as follows:

$$TIME_{c,k} = \sum_{i} (CASE_{i,c} * TIME_{i,c,k}) \qquad \textbf{(3)}$$

- IEC[1] and outreach

The time needed for staff with qualification k to contribute to those activities is arrived at by multiplying the total time spent on IEC and outreach in the health centre by the time contribution of people with qualification k to those activities:

$$TIMEIEC_{c,k} = TIMEIEC_{c} * CTRIEC\%_{c,k} \quad \textbf{(4)}$$

- Administration

The time needed for staff with qualification k to carry out activities is arrived at by multiplying the total time spent on administration by the contribution of staff with qualification k to administration:

$$TIMEADM_{c,k} = TIMEADM_{c} * CTRADM\%_{c,k} \quad \textbf{(5)}$$

- Staff of qualification k needed

Making use of equations (3) to (5), we arrive at the total time needed for each of the staff of qualification k:

$$TTIME_{c,k} = TIME_{c,k} + TIMEIEC_{c,k} + TIMEADM_{c,k} \quad \textbf{(6)}$$

By dividing the total time needed for staff qualification k by the working time of a person with qualification k *(WORKTIME)*, we arrive at the number of staff with qualification k needed to operate the standard health centre:

$$PER_{c,k} = \frac{TTIME_{c,k}}{WORKTIME_{c,k}} \quad \textbf{(7)}$$

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1 IEC : information, education and communication

BOX 1 : PRODUCTION FUNCTION OF ACTIVITIES

One of the specific features of this model concerns what may be called the production function of activities, i.e. the way in which each of the persons with qualification k contributes to implementing one of the five scheduled activities i. This would amount to having information presented in the following form:

	Curative care	MCH	Deliveries	IEC	Administration
Physicians					
Nurses					
Midwives					
Other health care personnel					
Total	100%	100%	100%	100%	100%

Each field indicates the contribution made by personnel with qualification k to the production of an activity i.

For the base year, such information would no doubt be difficult to collect. Consequently, the two essential components in the model, the production function and the average time for an activity, have been estimated as follows:

1. Estimation of the components of the production function

- The users of the model should obtain information on the time budget of each of the personnel categories, i.e. on the way in which the personnel spend their time. For example, nurses devote on average 70% of their time to curative care, 15% to IEC and outreach 15% to administration and nothing to other activities. This information is then recorded as $t\%_{i,c,k}$. It must be noted that this information corresponds to the above table, the only important difference being that the total of 100% appears in the rows and not in the columns.
- Also known is the average number of persons with qualification k working in a health centre and the normal weekly working time.

With this information, the simulation model first of all calculates the time spent by personnel of category k on producing an activity i:

$$T_{i,c,k} = t\%_{i,c,k} * WORKTIME_{c,k} * PER_{c,k}$$

Addition of the times calculated above for each of the personnel categories k produces the time that is devoted by all the staff of the health centre to this activity i namely:

$$T_{i,c} = \sum_{k} T_{i,c,k}$$

Next, the ratio $\mathbf{T}_{i,c,k} / \mathbf{T}_{i,c}$ produces an estimate of the components of the production function described above, i.e the contribution by staff with qualification k to producing an activity i. This leads us to the coefficients:

$$CTR\%'_{i,c,k} \ , \ CTRIEC\%_{c,k} \ \text{or} \ CTRADM\%_{c,k}$$

2. Estimation of the average time for an activity: $(AVTIME_{i,c})$

This time is arrived at by dividing the time spent on activity i by the entire staff of the health centre by the number of cases (which is a datum collected). This gives the average time spent on a delivery, on a curative procedure and on an individual MCH procedure. In other words:

$$AVTIME_{i,c} = \frac{T_{i,c}}{CASE_{i,c}}$$

2.3.1.3 Estimation of needs for non-health care personnel

For the base year and for each of the categories of health centre c, the number of non-health care personnel at a health centre is given. For the following years the user needs to assign a value to this variable. The average number of non-health care personnel per category of health centre is denoted by: $PERNH_c$.

2.3.1.4 Expenditure on drugs

For the base year of the model, and for each of the categories of health centre c, the expenditure on drugs at a standard health centre is given. It is stressed that this is the total expenditure on drugs, whatever the source of funding: the user is requested to take care to assign a value to any donations of drugs as far as possible.

For the projection years, this expenditure at a standard health centre is estimated on the basis of two criteria:

- a number of services i, namely $CASE_{i,c}$
- average expenditure on drugs by services , namely : $hdr_{i,c}$

Drug expenditure for services i is therefore:

$$hcdr_{i,c} = \overline{hcdr}_{i,c} * CASE_{i,c} \qquad \textbf{(8)}$$

2.3.1.5 Other operating expenditure of a standard health centre

For the base year of the model and for each of the categories of health centre c, the other operating expenditure of an average health centre is given. This consists of all the expenditure required for the current operation of the health centre, except for expenditure on drugs. It is stressed that other operating expenditure are taken into account whatever the source of funding: again the user must therefore assign a value to donations as far as possible.

For the projection years, other operating expenditure of a standard health centre is estimated on the basis of two criteria:

- the number of services i ,
- the other average operating expenditure for services i: ($ho_{i,c}$). Operating expenditure for services i is therefore :

$$ho_{i,c} = \overline{ho}_{i,c} * CASE_{i,c} \qquad \textbf{(9)}$$

It is known that, in reality, some operating expenditure is not linked to the volume of services. Since such expenditure does not represent the majority, however, the decision to regard operating expenditure as entirely variable was given in by the desire for simplicity.

2.3.2 Step 2 Determination of the number of health centres

In the base year of the model, for each of the four categories of health centre, the number of health centres is known *(HC_c)*. Similarly, the average population of a reference geographical zone *($POPZONE_c$)* is also a known item of information. By multiplying these two data,

therefore, we obtain the total population served by all the health centres of the category under consideration:

$$POPHC_c = HC_c * POPZONE_c \quad \textbf{(10)}$$

Moreover, knowing the country's overall population (POP), the model calculates the proportion of the population that is served by each of the four categories of health centre:

$$POPHC\%_c = POPHC_c / POP \quad \textbf{(11)}$$

For example, health centres of category I could serve 50% of the population, health centres of category II 20%, those of categories III and IV serve 10% each: 10% of the population is therefore not served by any health centre funded by the Ministry of Health.

For the projection years, knowing the demographic growth rate, the model calculates the trend in the country's total population. A demographic growth rate is also applied to the average population in the geographical zone covered by each of the categories of health centre.

The user then, after observing the current values of $POPCH\%_c$, must fix an objective regarding the proportion of the population that is served by each of the categories of health centre. After inputting this proportion and knowing the total population, the model calculates the total population served by each of the four categories of health centre.

$$POPHC_c = POP * POPHC\%_c \quad \textbf{(12)}$$

Dividing $POPHC_c$ by the population covered by the standard health centre of the corresponding category $(POPCOV_c)$ forecasts the number of health centres needed in the category concerned.

$$HC_c = \frac{POPHC_c}{POPCOV_c} \quad \textbf{(13)}$$

Note here that over the projection period, $POPCOV_c$ will grow according to population growth.

2.3.3 Step 3 : Results by category of health centre

For each of the 10 years and for each of the categories of health centre c, multiplication of the results obtained in Step 1by the number of health centres, determined in Step 2 produces the following results:

- the total number of persons with qualification k needed to operate the health centres of the category concerned:

$$TPER_{c,k} = PERS_{c,k} * HC_c \quad (14)$$

- total expenditure on drugs by each category of health centre

$$hdr_c = \overline{hdr_c} * HC_c \quad (15)$$

- total other operating expenditure of the health centres in the category:

$$ho_c = \overline{ho_c} * HC_c \quad (16)$$

2.4 Results at the national level (second stage) : detailed structure

Addition of the results obtained or each category of health centre produces results at the national level :

2.4.1 Total number of persons with qualification k needed to operate the health centres:

$$TPER_k^{hc} = \sum_{c=1}^{4} TPER_{c,k} \quad (17)$$

2.4.2 Total expenditure on drugs at all the country's health centres:

$$hcdr^{hc} = \sum_{c=1}^{4} hcdr_c \quad (18)$$

2.4.3 Total other operating expenditure of all the health centres:

$$ho^{hc} = \sum_{c=1}^{4} ho_c \quad (19)$$

2.5 MoH expenditure on health centres (third stage) : detailed structure

This third stage is used to determine which of the national needs arrived at during the previous stage will be covered by the MoH [2].

[2] Note that in MacroFin, we refer to "domestic financing", whenever the MoH is "directly" responsible for financing via domestic resources.

2.5.1. MoH expenditure on health centre personnel:

This expenditure is estimated in two stages. First of all the model determines which personnel will be covered by the government out of the total number of persons with qualification k required to operate the health centres considered. For the base year of the model, the percentage of personnel with qualification k is calculated from observed data; for the following years this proportion is determined by the user:

$$TPER^{hc}_{mi,k} = TPER^{hc}_{k} * TPER\%_{mi,k} \quad \textbf{(20)}$$

In the second step, multiplying this number of persons with qualification k paid by the MoH by the salary rates for qualification k *(sal_k)*, produces the total government expenditure on health centre personnel:

$$hsal^{hc} = \sum_{k=1}^{n} hsal^{hc}_{mi,k} \quad \textbf{(21)}$$

$$whereby\ hsal^{hc}_{mi,k} = TPER^{hc}_{mi,k} * Sal_k \quad \textbf{(22)}$$

For the base year, the salary rate for each of the qualifications k is given; for the subsequent years, the user determines an annual real growth rate.

2.5.2 MoH expenditure on drugs at health centres:

This expenditure is arrived at by multiplying the total expenditure on drugs by all health centres by the proportion of this expenditure paid by the government:

$$hcdr^{hc}_{mi} = hcdr^{hc} * HDR\%^{hc}_{mi} \quad \textbf{(23)}$$

From the base year data, the proportion *($HDR\%^{hc}_{mi}$)* is calculated from the data; for subsequent years, the user determines the proportion that should be obtained at the target year.

2.5.3 MoH expenditure on the other operating expenditure of health centres:

This expenditure is arrived at by multiplying the total operating expenditure of all the health centres by the proportion of this expenditure paid by the government:

$$ho^{hc}_{mi} = ho^{hc} * HO\%^{hc}_{mi} \quad \textbf{(24)}$$

For the base year of the model, this proportion is calculated from the data; for the subsequent years, the user determines the proportion that should be arrived at by the end of the projection period.

2.5.4 Total MoH operating expenditure

Total MoH operating or recurrent expenditure on the health centres is arrived at by adding the three types of expenditure above:

$$hre_{mi}^{hc} = hsal_{mi}^{hc} + hcdr_{mi}^{hc} + ho_{mi}^{hc} \quad (25)$$

2.6 Determinants of future MoH expenditure

Starting from a situation observed in the base year, the model sets out to estimate the trend in MoH expenditure for the health centres during the next 10 years. These estimates are based on a number of hypotheses concerning a number of variables. The hypotheses relate to what the user expects or wishes the trend to be for these variables during the forecasting years. Thus, the user has an important role to play in the setting of values of what are called "exogenous variables". The values of exogenous variables are fixed outside the model, but they are the ones to influence the model's "endogenous variables". The latter are determined **via** the model only.

In the simulation model, there are two kinds of exogenous variables: (i) those that **in reality** are endogenous or partly endogenous, but that are **treated** as exogenous by the model, (ii) variables that are directly determined by policy-makers.

2.6.1 Variables treated as exogenous by the simulation model

(i) An important example concerns the nation's population. The latter will determine a.o. total health expenditure. It is evident that over the years of simulation, population is likely to grow. It is the user now who must introduce the annual population growth rate. Again, we recognize that in reality population growth may be partly endogenous, i.e. it is dependent upon a host of socio-economic variables. However, in the simulation model we treat it as truly exogenous.

(ii) Health expenditure is a function of patients' attendance at health centres. This level of attendance is itself a function of socio-economic factors such as individual or family income level, their educational level, the epidemiological pattern in the area concerned, and of supply characteristics (density of the health facility network, quality of services, etc.) The simulation model does not determine the level of this demand on the basis of a demand function taking all the above elements into account. Still, the user should still give an indication of how this demand will develop during the yeas of simulation. To do so he/she is asked to indicate the "annual number of cases per inhabitant", ($CASE_{i,c}$) in the target year.

2.6.2. Policy variables

Policy variables are those over which the health policy-maker has direct influence. This influence is exerted in different ways:

(i) *Through budgetary decisions.*
The policy variables are:

- The annual rate of salary adjustment (the rates may differ according to the staff qualification.
- The contribution of the MoH to financing health expenditure. A number of policy variables can be used to reflect the government's willingness to finance health care. These are :

$$TPRE\%_{mi,k}\ ,\ HDR\%_{mi}^{hc}\ and\ HO\%_{mi}^{hc} \qquad (26)$$

(ii) *Through the network of health facilities*

The health policy-maker may act in two ways. He may decide to transform the characteristics of the health centres, which is equivalent to altering the relative importance of each of the four categories of health centre. However, he may also decide to plan for an increase or decrease of the coverage rate of the health centres. It is the variable $POPHC\%_c$ that can be used to reflect such policy actions. The user will need to indicate the value of this variable which should be attained in the target year.

It should be noted that the average size of a health centre, for each of the categories of centre, was determined for the base year by dividing the total population served by the health centres in the category by the number of centres in the category. For subsequent years no policy objective has been established as to the average size of these centres. However, the average size is assumed to change according to an annual growth rate specified by the user. The latter may well differ, however, from the overall population growth rate in the country.

(iii) *Through the quality of care*. In the model this is expressed by several policy variables:

- The standards concerning average expenditure per service on drugs and current operating expenditure: $\overline{hdr_c}$, $\overline{ho_c}$.

This is of course an imperfect indicator of quality, as quality is not just a matter of expenditure.

- The standards in terms of the time that has to be devoted to group activities and to the administration of a standard health centre $TIMEIEC_c$, $TIMEADM_c$.
- The standards in terms of time required to produce a health service *i*.
- The standards in terms of modes of production of activities at a standard health centre, i.e., the way in which the various staff qualifications are combined in performing these activities: $CTR\%_{i,c,k}$, $CTRADM\%_{c,k}$, $CTRIEC\%_{c,k}$.

2.7 Data input

2.7.1 List of data to be collected for the base year

2.7.1.1 General data

- Total population
- Population growth rate
- Duration of work:
  - · Number of days worked per year;
  - · Number of holiday days per year;
  - · Number of hours of work per day;
- Average monthly salary for qualification k. The purpose is to arrive at a total salary cost paid via the MoH: consequently, all the salary must be taken into account: gross salary, bonuses, various benefits, etc.
- Proportion of imported drugs in the MoH expenditure on drugs ;
- Proportion of imported drugs in the expenditure for drugs financed by donors.

2.7.1.2 Data for standard health centres

- Number of health centres in the category;
- Average population covered by each centre;
- Growth rate of this population;
- Data on the services:
  - · Number of curative consultations per year;
  - · Number of MCH services per year;
  - · Number of deliveries per year;

Percentage distribution of working time for qualification k and for each of the activities, according to the matrix below:

	Curative care	MCH	Delivery	IEC and outreach	Administration	Total
Physicians						100%
Nurses						100%
Midwives						100%
Other health care personnel						100%

- Distribution of staff for each of the qualifications k (including non-health care personnel), by source of funding (MoH, community financing, external aid);
- Expenditure on drugs by source of funding (MoH, community financing, external aid);
- Other operating expenditure by source of funding (MoH, community financing, external aid).

2.7.2 *Data input for exogenous variables*

- Annual population growth
- Annual growth of the population covered by each type of health centre
- Number of health services *i* per capita per type of health centre : $CASEC_{i,c}$

2.7.3 *Data input for policy variables*

- Annual rate of growth of salaries per qualification k
- MoH financing:
  - Percentage of personnel with qualification k paid by the MoH:

$$TPER\%_{mi,k}$$

- Percentage of expenditure on drugs paid for by the MoH:

$$HDR\%_{mi}^{hc}$$

- Percentage of operating expenditure paid for by the MoH:

$$HO\%_{mi}^{hc}$$

- Percentage of the country's population served by each of the categories of health centre:

$$POPHC\%_{c}$$

- Average expenditure on drugs per service for each of the categories of health centre c:

$$\overline{hdr}_{i,c}$$

- Average other operating expenditure per service for each of the categories of health centre c:

$$\overline{ho}_{i,c}$$

- Total time that the staff of a health centre have to spend on IEC and outreach, for each of the categories of health centres c. This is time per week:

$$TIMEIEC_{c}$$

- Total time that the staff of a health centre have to spend on administrative activities. This is time per week:

$$TIMEADM_c$$

- For each of the categories of health centre c, the average time needed to produce a service i :

$$TIME_{i,c,k}$$

- Contribution of one staff member with qualification k to the production of an activity at the health centre:

$$CTR\%_{i,c,k}$$

$$CTRADM\%_{c,k}$$

$$CTRIEC\%_{c,k}$$

- Percentage distribution of working time for qualification k and for each of the activities according to the matrix below :

	Curative activities	MCH	Delivery	IEC and outreach	Administration
Physicians					
Nurses					
Midwives					
Other health care personnel					
Total	100%	100%	100%	100%	100%

- Number of non-health-care personnel for a standard health centre per category of health centre c.

3. REFERRAL HOSPITALS

3.1 Introduction

The general logic of the simulation model related to these hospitals (Hospitals of level II and III) is quite similar to that used for the health centres. However, a hospital's operations are more complex than a health centre's. A hospital is structured in district services which each have their own ways of operating and their own logic. Even if there are clear links between them, each of these services constitutes an entity.

In the present version of MicroFin eight types of services have been distinguished:
- inpatient departments : (four)
- outpatient clinic;
- operating theatre;
- radiology;
- laboratory;
- administration;
- ambulance service;
- catering service.

For each service, total cost will therefore be determined by service-specific number of staff of qualification k, the operating expenditure, the expenditure on drugs and the expenditure on food.

3.2 Calculations concerning each of the eight types of services

For each of the 10 years, the following items are determined for each of the levels of hospital (h =I,II) and for each of the eight types of services:

- the number of staff of professional qualification k needed;
- drug expenditure;
- other operating expenditure;
- expenditure on food (for the catering service only).

3.2.1. Inpatient departments

3.2.1.1 Number of beds

The number of beds in one of the four in-patient departments is the outcome of the following steps :

(i) the total number of admissions per year determined by the population of the area *(POP_h)* and of the admissions per capita *($ADMC_h$)*. Note that $ADMC_h$ is an indicator of demand, that the user determines for the target year;

$$ADM_h = POP_h * ADMC_h \qquad (27)$$

(ii) the number of admissions per year to each of the inpatient departments i *(ADM_{ih})* is the result of the total number of admissions multiplied by the percentage share of admissions associated with in-patient department i *($ADM\%_{i,h}$)*:

$$ADM_{i,h} = ADM_h * ADM\%_{i,h} \qquad (28)$$

Note that $ADM\%_{i,h}$ is fixed by the user for the target year.

(iii) the number of hospitalization days per year in department i is obtained by multiplying the number of admissions to department i by the length of stay in department i *($LOS_{i,h}$)*:

$$HDAYS_{i,h} = ADM_{i,h} * LOS_{i,h} \qquad (29)$$

(iv) the number of beds needed for the department i *(BEDS $_{i,h}$)* is equal to the number of hospitalization days in department i divided by 365. Nevertheless, to allow for some irregularity in the bed requirement according to the time of year or simply for unforeseen factors, the model introduces an adjustment coefficient *(ADJ)*[3]:

$$BEDS_{i,h} = (HDAYS_{i,h} \ / \ 365) * ADJ \qquad \textbf{(30)}$$

The model allows for four different in-patient departments (i=1,...4). The key variable is the number of beds. It is assumed that the number of beds determines both the number of staff with professional qualification k, drug expenditure and other operating expenditure.

3.2.1.2 Staff requirement

The total staff requirement per professional qualification k is a function of the number of beds in the department under consideration and the number of persons with professional qualification k per bed *(PERBED $_{i,h,k}$)* :

$$PER_{i,h,k} = BEDS_{i,h} * PERBED_{i,h,k} \qquad \textbf{(31)}$$

The number of staff k per bed is a given for the base year and a policy objective to be fixed by the user for the target year.

3.2.1.3 Drug expenditure

The expenditure on drugs for each of the inpatient departments i is arrived at by multiplying the number of beds by the drug expenditure per bed*(hdrb $_{i,h}$)*.

$$hdr_{i,h} = BEDS_{i,h} * hdrb_{i,h} \qquad \textbf{(32)}$$

3.2.1.4 Other operating expenditure

Other operating expenditure is calculated as above, namely by multiplying the number of beds by the other operating expenditure per bed *(hob $_{i,h}$)*.

$$ho_{i,h} = BEDS_{i,h} * hob_{i,h} \qquad \textbf{(33)}$$

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[3] For the first year, the number of beds needed is calculated from collected data on the number of hospitalization days. The number of beds needed is not necessarily equal to the "observed" number of beds.

3.2.2. Out-patient clinic

3.2.2.1 Number of outpatient consultations

The key variable is the annual number of outpatient consultations performed in the clinic. This number of outpatient consultations per annum is itself a function of the population in the hospital's catchment-area ($POPCOV_h$) and of the number of outpatient consultations per inhabitant (OPC_h) :

$$OP_h = POPCOV_h * OPC_h \quad \textbf{(34)}$$

3.2.2.2 Staff requirement

This number of annual consultations is then distributed among each of the staff with qualification k that performs outpatient consultations, using the distribution coefficient $OP\%_{h,k}$:

$$OP_{h,k} = OP_h * OP\%_{h,k} \quad \textbf{(35)}$$

We can now determine the number of outpatient consultations that can be performed in one year by a person with qualification k. This number is a function of the number of days worked per year[4] and the number of outpatient consultations that one person can perform per day ($\underline{OP}_{h,k}$). The latter number is calculated for the base year and fixed by the user for the target year.

$$OPS^*_{h,k} = DAYSW * \underline{OP}_{h,k} \quad \textbf{(36)}$$

When the number of outpatient consultations to be performed by people with qualification k is divided by $OPS^*_{h,k}$, or the number of outpatient consultations that "can" be performed by one person with qualification k per year, we obtain the number of staff with qualification k needed for the functioning of the outpatient clinic :

$$PER_{op,h,k} = OP_{h,k} / OPS^*_{h,k} \quad \textbf{(37)}$$

3.2.2.3 Drug expenditure

The drug expenditure for the outpatient clinic is a function of the number of outpatient consultations per year and of the drug expenditure per outpatient consultation ($\underline{hdr}_{op,h}$) :

$$hdr_{op,h} = OP_h * \underline{hdr_{op,h}} \quad \textbf{(38)}$$

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[4] Number of working days per year after deducting weekends and holidays.

3.2.2.4 Other operating expenditure

Other expenditure is arrived at as above, namely by multiplying the number of outpatient consultations per year by the other operating expenditure per outpatient consultation ($ho_{op,h}$)

$$ho_{op,h} = OP_h * \overline{ho_{op,h}} \quad \textbf{(39)}$$

3.2.3 Operating theatre

3.2.3.1 Number of surgical interventions

The key variable here is the number of surgical interventions per year. It will be assumed that the number of operations is a fraction of the number of hospital admissions ($ADMSURG\%_h$) :

$$SURG_h = ADM_h * ADMSURG\%_h \quad \textbf{(40)}$$

3.2.3.2 Staff requirement

We suppose that surgical intervention are done by staff teams, whose composition is to be fixed by the user. First, the model calculates the number of interventions **per year** that can possible be undertaken by a team. It is obtained by multiplying the number of interventions **per day** that can be done by one team ($\overline{SURGT_h}$) by the number of workdays (DAYSW):

$$SURGT_h = \overline{SURGT_h} * DAYSW \quad \textbf{(41)}$$

The variable $\overline{SURGT_h}$ represents the staff team productivity.

Next, by dividing the number of interventions to be performed at the hospital by the yearly number of operations per team, one obtains the required number of teams:

$$SURGTEAM_h = SURG_h / SURGT_h \quad \textbf{(42)}$$

Note that $\overline{SURGTEAM_h}$ could be less than 1, implying that the team spends a fraction of its time on other tasks in the hospital.

Finally, we obtain the number of staff in the qualification k needed for the operations by multiplying $SURGTEAM_h$ by the number of persons with qualification k needed in a surgical team:

$$PER_{su,h,k} = SURGTEAM_h * \overline{PER_{su,h,k}} \quad \textbf{(43)}$$

3.2.3.3 Drug expenditure

The expenditure on drugs for the operating theatre is a function of the number of operations per year and of the expenditure on drugs for one operation ($\overline{hdr}_{su,h}$)

$$hdr_{su,h} = SURG_h * \overline{hdr}_{su,h} \quad \textbf{(44)}$$

3.2.3.4 Operating expenditure

This expenditure is arrived at by multiplying the number of operations per year by the other operating expenditure per surgical intervention :

$$ho_{su,h} = SURG_h * \overline{ho}_{su,h} \quad \textbf{(45)}$$

3.2.4 Radiology department

3.2.4.1 Number of X-rays

The key variable is the number of X-rays performed by the hospital per year. It will be assumed that this number is a function of the number of admissions and of the number of X-rays performed per admission ($\overline{XRAY}_h$):

$$XRAY_h = ADM_h * \overline{XRAY}_h \quad \textbf{(46)}$$

3.2.4.2 Staff requirement

First, we define the number of X-rays that can be performed **per year** by a person with qualification k:

$$XRAY_{h,k} = DAYSW * \overline{XRAY}_{h,k} \quad \textbf{(47)}$$

Where $\overline{XRAY}_{h,k}$ is the number of X-rays that can be done **per day** by a person with qualification k.

Secondly, we calculate the number of staff with qualification k needed for the radiology department as follows:

$$PER_{ra,h,k} = XRAY_h \; / \; XRAY_{h,k} \quad \textbf{(48)}$$

3.2.4.3 Expenditure for medical supplies

The expenditure on medical supplies for the radiology department is a function of the number of X-rays per year and of the expenditure on medical supplies perscribed per X-ray ($\overline{hms}_{ra,h}$).

$$hms_{ra,h} = XRAY_h * \overline{hms}_{ra,h} \quad \textbf{(49)}$$

3.2.4.4 Other operating expenditure

This expenditure is arrived at by multiplying the number of X-rays per year by other operating expenditure per X-ray ($\overline{ho}_{ra,h}$) :

$$ho_{ra,h} = XRAY_h * \overline{ho}_{ra,h} \quad \textbf{(50)}$$

3.2.5 Laboratory department

The key variable is the number of laboratory tests performed by the hospital concerned per year. The calculations performed by the model are identical to those made for the radiology department.

3.2.5.1 Number of tests

The key variable is the number of performed by the hospital per year. It will be assumed that this number is a function of the number of admissions and of the number of tests performed per admission:

$$XLAB_h = ADM_h * \overline{XLAB}_h \quad \textbf{(51)}$$

3.2.5.2 Staff requirement

First, we define the number of tests that can be performed **per year** by a person with qualification k:

$$XLAB_{h,k} = DAYSW * \overline{XLAB}_{h,k} \quad \textbf{(52)}$$

Where $XLAB_{h,k}$ is the number of tests that can be done **per day** by a person with qualification k.

Secondly, we calculate the number of staff with qualification k needed for the radiology department as follows:

$$PER_{ra,h,k} = XLAB_h \; / \; XLAB_{h,k} \quad \textbf{(53)}$$

3.2.5.3 Expenditure for medical supplies

The expenditure on medical supplies is a function of the number of tests per year and of the expenditure on medical supplies perscribed per test ($\overline{hms}_{ra,h}$).

$$hms_{ra,h} = LAB_h * \overline{hms}_{ra,h} \quad (54)$$

3.2.5.4 Other operating expenditure

This expenditure is arrived at by multiplying the number of tests per year by other operating expenditure per test : ($\overline{ho}_{ra,h}$)

$$ho_{ra,h} = LAB_h * \overline{ho}_{ra,h} \quad (55)$$

3.2.6 Administration

Note, first, that in this case we define administration (secretariat, management, accounting, etc.) to include the maintenance services.

3.2.6.1 Staff requirement

The key variable determining staffing needs is the number of beds in the four inpatient departments. The total number of staff of qualification k is obtained by multiplying the total number of beds by the personnel requirement (of qualification k) per bed :

$$PER_{ad,h,k} = [\sum_{i=1}^{4} BEDS_{i,h}] * \overline{PER}_{ad,h,k} \quad (56)$$

where $\overline{PER}_{ad,h,k}$ is the number of staff with qualification k per bed.

3.2.6.2 Operating expenditure

First, an average operating expenditure amount per expenditure administrative staff is fixed $\overline{ho}_{ad,h}$. Total operating expenditure then follows easily:

$$ho_{ad,h} = [\sum_{k} PER_{ad,h,k}] * \overline{ho}_{ad,h} \quad (57)$$

3.2.7 Ambulance service

3.2.7.1 Staff requirement

Data for the number of teams (*AMBTEAM)* and the composition of each team is put in for the base year. Subsequently, both the number and composition of teams are fixed by the user for the target year.

3.2.7.2 Other operating expenditure

First, we calculate the number of journeys per year, that is equal to the population covered ($POPCOV_h$) times the number of journeys per capita ($AMBJC_h$) :

$$AMBJ_h = POPCOV_h * AMBJC_h \quad \textbf{(58)}$$

Secondly, we obtain other operating expenditure by multiplying the number of journeys by the operating expenditure per journey ($\overline{ho}_{am,h}$)

$$ho_{am,h} = AMBJ_h * \overline{ho}_{am,h} \quad \textbf{(59)}$$

3.2.8 Catering service

3.2.8.1 Catering requirement

The number of persons needed to operate this service is calculated by multiplying the number of hospitalization days by the number of catering service personnel per hospitalization day ($\overline{PER}_{ca,h}$).

$$PER_{ca,h} = \sum_i HDAYS_{i,h} * \overline{PER}_{ca,h} \quad \textbf{(60)}$$

3.2.8.2 Food expenditure

The expenditure on food for this service is arrived at by multiplying the number of hospitalization days by the food expenditure per hospitalization day ($\overline{hfd}_{ca,h}$).

$$hfd_{ca,h} = \sum_i HDAYS_{i,h} * \overline{hfd}_{ca,h} \quad \textbf{(61)}$$

3.2.8.3 Other operating expenditure

The operating expenditure for the catering service is arrived at by multiplying the number of hospitalization days by the other operating cost per hospital day ($\overline{ho}_{fd,h}$) :

$$ho_{fd,h} = \sum_i HDAYS_{i,h} * \overline{ho}_{fd,h} \quad \textbf{(62)}$$

3.3 Determination of the number of hospitals

Beyond the number observed for the base year, the number of hospitals is determined by the user. Indeed, contrary to the submodel for the health centres, the user himself determines this number for each of the forecasting years.

3.4 Results at the national level and MoH expenditure on hospitals

The types of calculations to obtain the results at national level and MoH expenditure are identical to those made in the module for the health centres.

3.5 The determinants of future MoH expenditure

As in the model for health centres, expenditure in hospitals of levels II and III is determined by exogenous and policy variables :

3.5.1 Variables treated as exogenous

Other things being equal, health expenditure is a function of the population in the zone where the hospital is situated ($POPCOV_h$). The latter is an exogenous variable.

Secondly, we have the number of days worked.

Thirdly, health expenditure also depends on the population's demand for health services. Demand is expressed via the number of admissions and outpatient consultations. For the purpose of the simulation model, the latter variables are taken to be exogenous.

3.5.2 Policy variables

These are variables over which the policy-maker exerts a direct influence. This influence is exerted in different ways:

(i) *through budgetary adjustments*: we refer to the annual growth rate of salaries and to the contribution by the MoH to financing expenditure;

(ii) *through the density of the hospital network*: the policy-maker establishes the number of hospitals in the country, for each of the two hospital levels;

(iii) *through production technology of health services*:

* utilization of personnel: this concerns the way in which personnel is used when a service is produced:
- inpatient departments: number of staff with qualification k per bed;
- outpatient clinic: number of outpatient consultations that can be administered per day by a staff with qualification k, distribution of outpatient consultations among the various staff with qualification k;
- operating theatre: composition of the operating theatre team, number of operations per working day in which a staff with qualification k can take part;

- radiology: number of X-rays that a person with qualification k can perform per working day;
-laboratory: number of laboratory tests that a person with qualification k can perform per working day;
-administration: number of administrative staff with qualification k per bed (total of inpatient departments);
- ambulance service: composition of the ambulance of team, number of teams;
- catering: number of catering staff with qualification k per hospitalization day;

* regulation of demand: while a good many activities of the hospital services are governed by the number of admissions, i.e., by demand, the decision-maker can nevertheless take measures to regulate demand. The length of stay in the inpatient departments is one example: obviously, the length of stay is conditioned by the type of health problem the patient has to face, but it is also well known that the length of stay for the same health problem may vary considerably, depending on the local practices and habits. The same applies to many other variables: "% of inpatients who undergo an operation", "Number of X-rays per admission", "Number of laboratory tests per admission", "Number of ambulance journeys per inhabitant of the area";

* unit costs for operation and drugs: for each component of a service, the user should determine the unit cost:
- inpatient departments: expenditure per bed;
- outpatient clinic: expenditure per consultation;
- operating theatre: expenditure per operation;
- radiology: expenditure per X-ray;
- laboratory: expenditure per laboratory test;
- ambulance: cost of one journey;
- administration: operating expenditure per administrative staff member;
- catering: expenditure per hospitalization day;

3.6. DATA INPUT

3.6.1 List of data to be collected for the base year

GIVEN
3.6.1.1 General data - Number of hospitals - Population served by an average hospital of the category concerned and its growth rate - Total number of admissions
3.6.1.2 Data for standard hospitals **A. For the average hospital as a whole:** - Distribution of expenditure: · on drugs by origin of funds: MoH, community financing, external aid; · on operation, by origin of funds: MoH, community financing, external aid; - Distribution of staff paid by the MoH, by category - Imported drugs: by the MoH, by donors

B. By department

***In-patient departments**

- Number of beds
- Number of admissions per year
- Average length of stay
- Number of staff:
  - · General practitioner
  - · Specialist
  - · Midwives
  - · Nurses
  - · Other health care personnel
- Total expenditure on drugs
- Total other operating expenditure

***Operating theatre**

- Number of operations per year
- Total number of staff:
  - · Surgeons
  - · Anaesthetists
  - · Physicians
  - · Nurses
  - · Other health care personnel
- Total expenditure on drugs
- Total other operating expenditure
- Composition of a team:
  - · Surgeons
  - · Anaesthetists
  - · Physicians
  - · Nurses
  - · Other health care personnel

***Out-patient department**

- Number of consultations per year
- Staff:
  - · Specialists
  - · General practitioners
  - · Midwives
- Total expenditure on drugs
- Total other operating expenditure

***Radiology** - Number of X-rays (procedures) per year - Staff: · Specialist · Technician · Other health care personnel - Expenditure on consumable supplies - Other operating expenditure
***Laboratory** - Number of procedures per year - Staff: · Physicians · Technicians · Other health care personnel - Expenditure on consumable laboratory supplies - Other operating expenditure
***Ambulance** - Number of journeys per year - Personnel: ·Driver ·Nurse - Other operating expenditure
***Administration and general services** - Staff: · Senior managers · Pharmacists · Clerical staff including secretaries · Technicians · Service personnel - Other operating expenditure
***Catering** - Service personnel - Food expenditure - Other operating expenditure

3.6.2 Data input for exogenous variables

GIVEN
- Number of admissions per inhabitant
- Number of outpatient consultations per inhabitant

3.6.3 Data input for policy variables

GIVEN
- Paid for by the MoH: . Percentage of personnel with qualification k paid by the MoH . Percentage of expenditure on drugs paid by the MoH . Percentage of operating expenditure paid by the MoH . Percentage of expenditure on food paid by the MoH
- Number of hospitals for each of the hospital levels
- Inpatient departments: . Number of persons with qualification k per bed
- Outpatient clinic . Number of outpatient consultations that a person with qualification k can do in one day . Distribution of outpatient consultations among the various staff qualifications k
Operating theatre: . Composition of the operating theatre team . Number of operations per working day in which a person with qualification k can participate
- Radiology: . Number of X-rays that a person with qualification k can perform per day
- Laboratory: . Number of laboratory tests that a person with qualification k can perform per working day
- Administration: . Number of administrative staff with qualification k per bed
- Ambulance: Number of teams
- Catering: Number of catering staff with qualification k per bed day
- Length of stay in each of the inpatient departments
- Percentage of patients who undergo an operation
- Number of X-rays per admission
- Number of laboratory tests per admission
- Number of ambulance journeys per inhabitant

- Other operating costs and drug costs (if applicable), medical supplies (if applicable) for:
· Inpatient departments
· Outpatient clinic
· Operating theatre
· Radiology
· Laboratory
· Ambulance
· Administration
· Catering
· Adjustment coefficient

4. NATIONAL REFERRAL HOSPITAL

This module concerns the national referral hospital. It is assumed that there is only one such hospital in the country.

This module works exactly in the same way as the module for the level II and III hospitals, except for the following:

(i) the number of inpatient departments that is taken into account is 10 instead of 4,

(ii) a dental department and emergency department are included; these two departments are assumed to operate like the laboratory department, except that:

- in the data for the base year, the number of laboratory tests is replaced by the number of dental procedures per year for the dental department and by the number of emergency cases per year for the emergency department;

- for the target year, the number of dental procedures per inhabitant is introduced for the dental department, while for the casualty department the number of emergency cases is determined as a percentage of hospital admissions.

Because of the similarity of the structure of this component with that of hospitals of level II and III, we have omitted the presentation of equations.

5. ADMINISTRATION

5.1 Administration of the district and regional level

This component operates in two stages, instead of three as for the preceding modules: stage II does not exist, as it is assumed that the administration costs are wholly covered by the MoH.

5.1.1 First stage: analysis by management category

This module distinguishes two levels of management: (ad=1,2) the district level and the regional level.

5.1.1.1 Step 1: Calculations related to an average administrative office

For each of the 10 years and for each of the two categories of management, the following items are calculated:

(i) the number of persons with professional qualification k required for the operation of an average district or a regional administration. For the base year, this information is a given; for the target year, the user determines the composition of the administrative teams;

(ii) the other operating expenditure for an administration at district and regional level (apart from supervision, which is taken into account later). To arrive at this expenditure, the notion of costs per management staff member is used: thus the model calculates the number of management staff including the chief medical officer and multiplies this number by the operating expenditure per staff member ($\overline{ho}_{ad}$) (calculated for the base year from the allocation for the operation of an average administrative office and determined by the user for the target year):

$$ho_{ad} = PER_{ad} * \overline{ho}_{ad} \qquad \textbf{(63)}$$

(iii) the supervision expenditure[5] for an average district and an average region:

$$hsup_{ad} = SUP_{ad} * \overline{hsup}_{ad} \qquad \textbf{(64)}$$

where SUP_{ad} and $\overline{hsup}_{ad}$ are the number of supervisions to be carried out per year and the average supervision expenditure, respectively. The number of supervisions is arrived at differently for the district and for the region :

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5 This does not include the cost of salaries due to supervision.

- for the district: the number of supervisions per year (SUP_D) takes into account the number of health centres to be supervised, both public and private, and the number of visits per year that should be made to each type of health centre:

$$SUP_D = (\sum_c HC_c * \overline{VISPUB}) + (HCPRIV * \overline{VISPRIV}) \quad \textbf{(65)}$$

where $\overline{VISPUB}$ *and* $\overline{VISPRIV}$ refer to the number of visits per year to a government health center and a private health center, respectively, and where *HCPRIV* refers to the number of private health centres;

- for the region: the number of supervisions per year (SUP_R) is arrived at by multiplying the number of districts in the region (*DISTR*) by the number of visits that should be made to each district per year (*VISDISTR*) :

$$SUP_R = DISTR * VISDISTR \quad \textbf{(66)}$$

5.1.1.2 Step 2 : Number of districts and regions

For the base year these numbers are known. For the target year the user determines the number of districts and regions in the country.

5.1.2 Third stage : MoH expenditure on administration

In the present case, there is no second stage, because all expenditure is covered by the MoH. Hence, the calculations in this module move directly to the third stage. Here the MoH expenditure on staff, on other operating expenditure and on supervision are calculated using the same reasoning as in the previous modules.

5.1.3 Determinants of changes in future MoH expenditure

As for the previous modules, the user must specifiy the values of a certain number of variables:

- composition by professional qualification k of the team at district and regional level
- the average other operating cost per staff at the district and regional levels;
- the cost of one supervision at the district and regional levels;
- the number of visits per year to be made to a government health centre and to a private health centre at the district level;
- the number of visits per year to a district, at the regional level;
- the number of districts and regions in the country.

5.1.4 Data input [6]

5.1.4.1 Administration of the district

List of information to be collected for the base year

- Total number of physicians working in the district administration
- Number of senior staff apart form the district medical officer
- Number of clerical staff
- Number of service personnel
- Operating budget excluding personnel and supervision
- Personnel budget for senior managers excluding district medical officers
- Personnel budget for clerical staff
- Budget for service personnel
- Monthly salary of the district medical officer
- Distribution of the time of the district medical officer:
    - · on supervision
    - · on administration

Data on all the districts

- Total number of annual supervision of government health centres
- Total number of annual supervision of private health cenntres
- Total number of private health centres
- Total supervision budget for all the districts
- Number of districts

5.1.4.2 Administration of the region

Data on an average region

- Total number of physicians working in the regional administration
- Number of senior managers apart from the regional medical director
- Number of clerical staff
- Number of service personnel
- Operating budget excluding personnel and supervision
- Personnel budget for senior managers excluding regional medical director
- Personnel budget for clerical staff
- Budget for service personnel
- Monthly salary of the regional medical director
- Distribution of the time of the regional medical director:
    - · on supervision
    - · on administration

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[6] For the variables listed below, both values for the base year as well as for the target year need to be given by the user. They could therefore be seen as policy variables.

Data related to all regions

- Total number of annual supervisions of districts
- Total supervision budget for all regions
- Number of regions

5.2 Central administration

5.2.1 MoH expenditure on central administration

The present module does not include stages I and II like in the preceding modules, since central administration is by definition unique and is assumed to be wholly financed by the MoH.

The purpose of this module is to calculate the MoH expenditure on remuneration and operating costs.

(i) MoH expenditure on the remuneration of staff

For the base year the composition of the staff of the central administration by professional qualification is known. For the target year the user determines this composition. MoH expenditure on the remuneration of the management staff is arrived at by multiplying the number of persons by the corresponding salary level.

(ii) MoH other operating expenditure

On the basis of the above results the model calculates the number of staff in the central administration. Then, an operating cost per staff member is determined. For the base year this cost is arrived at by dividing the other operating expenditure of the central management by the number of staff. For the target year the user determines the desired value of this other operating cost. Multiplying the operating cost per staff member by the number of staff results in the MoH other operating expenditure.

5.2.2 Data input[7]

- Operating budget (except for personnel)
- Personnel budget
  - . Senior managers
  - . Clerical staff
  - . Service personnel
- Number of personnel
  - . Senior staff including physicians
  - . Clerical staff
  - . Service personnel

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[7] For the variables listed below, both values for the base year as well as for the target year need to be given by the user. They could therefore be seen as policy variables.

PART II GOVERNMENT BUDGET OPTIONS FOR THE FUNCTIONING OF HEALTH SYSTEM

6. GENERAL OUTLINE

6.1 Introduction

The health sector does not operate in isolation from the rest of the economy.The economic plight of many developing countries, especially over the last decade, has affected the public sector and therefore the level of public expenditure on health. This has reminded decision-makers that the health sector is linked to the economy. Countries have realized that the improvements they wish to see in health are constrained by the current state of the economy and by its growth.

Government-financed health systems therefore became particularly fragile at a time when many health policy problems were still to be solved. How are countries to finance the investment and recurrent costs of the necessary expansion of primary health care? How will countries finance referral care, the need for which will arise with the development of primary health care? To what extent will governments be able to rely on international aid and/or households for additional financing?

In order to plan the health sector properly, we have to understand how it works as an integral part of the economy. This calls for a macroeconomic approach to help decision-makers establish appropriate development policies and devise health system reforms and new schemes to finance them.The advantages of this approach are basically twofold: in the first place, macroeconomic analysis shows planners the links between the global economy and the health sector. For example, the policy pursued in the face of a very serious trade deficit may restrict imports of essential drugs. Another example is the case where general economic growth in a country can facilitate the financing of health care by the government, thanks to a larger overall government budget.

Secondly, it offers an overview of the resources available for health. Involvement of all the partners in planning of national health activities makes for planning that takes account of the budgetary constraints of each. This approach is useful in that it allows for more realistic planning.

As in the MicroFin, the user of MacroFin is able to work on a ten-year period. An important feature of MacroFin is that it enables users, i.e. decision-makers and their advisers, to:

(i) improve their analysis of government options with respect to health policy alternatives;

(ii) better assess the possible impact of macroeconomic changes on the global Government budget and hence on the health budget;

(iii) gain a better grasp of the potential role of other economic agents such as donors and the private sector (households, businesses, nongovernmental organizations, health insurance companies and plans) in the financing of health care.

6.2 General overview of the structure of MacroFin

6.2.1 Equations

This sub-model consists of the following sets of equations:

(i) Population

The population for the base year is given. Then, the rate of demographic growth is determined so that the total population of the country can be calculated.

(ii) Value added by sector

For each sectoral value added, a growth rate is determined. The sum of the value added of the different sectors results in the gross domestic product (GDP).

(iii) Use of resources

The use of the main components of GDP is analysed : private and government consumption, investment and international trade. The resulting values are used to estimate the various tax bases and the trade balance.

(iv) International transactions

The rate of growth of various international transactions (net revenue from abroad, net transfers, long- and short-term capital flows) are defined. This allows one to obtain the current account and the net foreign currency reserves of the nation.

(v) Prices

The rates of growth of various prices (consumer price index, GDP deflator, expenditure deflator and foreign price index) are determined in order to calculate the level of the price indexes. Subsequently these price indices are used to convert variables at constant prices into current prices.

(vi) The exchange rate

An estimate of the exchange rate of the national currency (against the US dollar by default) is given by the user in order to calculate requirements for imported drugs in national currency. The exchange rate is used also to estimate external aid requirements in US dollars.

(vii) Government revenue

Rates of taxation (on consumption, on international trade) and estimated rates of growth of other Government revenue (other fiscal income, non-fiscal revenue and gifts) are used to calculate the overall revenue of the Government.

(viii) Government expenditure

The user sets the rates of growth of the various headings of current expenditure (in accordance with the "economic" classification) and of capital expenditure, in order to calculate overall government expenditure.

(ix) Government expenditure on health

As was explained in the description of MicroFin, the user has the option of importing the estimates of financial needs requirements (related to the operational expenditure of the health

system) into MacroFin. Obviously, the real meaning of the model becomes clear when the needs expressed for the various levels of the health sector are analysed within the context of the macroeconomic environment.

Nevertheless, there are cases where, due to shortage of data, the user is not yet in a position to use MicroFin effectively. Also, in some circumstances, a rapid preliminary analysis of is requested. In such cases, MacroFin can be directly used for predicting health expenditure. The user must supply growth rates for the various headings of current expenditure and capital expenditure in the health sector. The aim, of course, is to calculate overall Government expenditure on health.

(x) Health expenditure of other ministries

In some countries, ministries other than the health ministry also provide health services. The ministry of defence, for example, may have a network of clinics for military personnel and their dependents. There are also countries where the ministry of education or even the ministry of transport might organize and finance health services. The user can input the rates of growth of current and capital expenditure in those ministries, in order to calculate the total expenditure over the period covered by the forecast.

(xi) Health expenditure in the private sector

The agents in the private sector are households, companies, nongovernmental organizations and missions, and health insurance funds. The rates of growth of current and capital expenditure for health by these agents may also be defined. The aim is to obtain a forecast of the overall levels of health expenditure in the private sector.

6.2.2 Results

The results include the following parts: the macroeconomic environment, health expenditure at current prices, and health expenditure at constant prices, the structure of health expenditure and the Government contribution to health financing (presented in the form of a graph).

The results for the macroeconomic environment cover mainly GDP, the balance of trade, net foreign exchange reserves, and the Government budget deficit. Regarding health expenditure at current prices, the model also presents the share of health expenditure in total Government spending, and external aid for health as a proportion of total external aid.

For health expenditure at constant prices, the model also shows real growth in per capita health expenditure. The results for the structure of health spending by the MoH show current and capital costs as part of total health expenditure, national health expenditure by source of finance (financing by the MOH, other ministries and the private sector) and financing of health expenditure by domestic and external sources.

6.2.3 The role of the user

The equations used in the model follow the basic principles of national accounting and public finance. Such principles lead to the formulation of basic equations[8], which the user must consider as given. Nevertheless, the initial figures and the growth rates of the various variables, the use of GDP and rates of taxation are all determined by the user. It follows that all the macroeconomic forecasts are influenced by the hypotheses made by the user.

One example concerns the size of the public sector. The user may formulate hypotheses concerning government expenditure, which therefore concern the role of the public sector. The economy of a developing country where government revenue has traditionally represented 20% of GDP is not suddenly likely to switch to 40%. The latter is likely to be possible over a certain perido of time, which the user should then reflect in the hypotheses he formulates year per year. In other words, a good dose of realism is therefore required.

An obvious question is whether the user in a Ministry of Health is conversant with macroeconomic trends. Where direct information is lacking, we recommend that the user consult colleagues in the ministry of finance and/or planning. It is worth discussing the "realism" of the hypotheses with the ministries concerned.

Financial requirements are confronted with macroeconomic variables mainly through the forecasted share of health expenditure in overall Government spending, and in the forecast share of total international aid that is allocated to health. Initial hypotheses may produce shares that are too high. For example, the proportion for health in 1997 might be of the order of 10%, whereas in 1994 it was only 3%. Such a development can be regarded as unlikely, given the other government projects outside health that would block such a rise in its share. Another example would be that of a country in which the international aid desired for health amounts to 15% in the forecast period whereas it had not usually exceeded 7% before. Such an increase might be regarded as unfeasible. In those cases, the use must revise the initial hypotheses. The user would then go through the model once, twice or more, until acceptable results are obtained.

While the above examples refer to actual constraints on health expenditure, the model can also be used to claim an increase in such expenditure. Suppose, for example, the rate of growth of GDP in a given country is higher than in the past, leading to increased government revenue and expenditure. In a first run of the model, a fall in the health sector's share in the government budget is found. This is probably because the user has not taken into account the current economic development and has formulated hypotheses that underestimate the budgetary capacity of the government. In subsequent runs, the user could adjust the hypotheses in order to recuperate a fair share for health in the government budget.

We repeat that MicroFin, like the financial needs sub-model does not automatically calculate a "final" result. The model as a whole therefore calls for considerable input from the user. This, however, has the great advantage of enabling users to increase their capacity for

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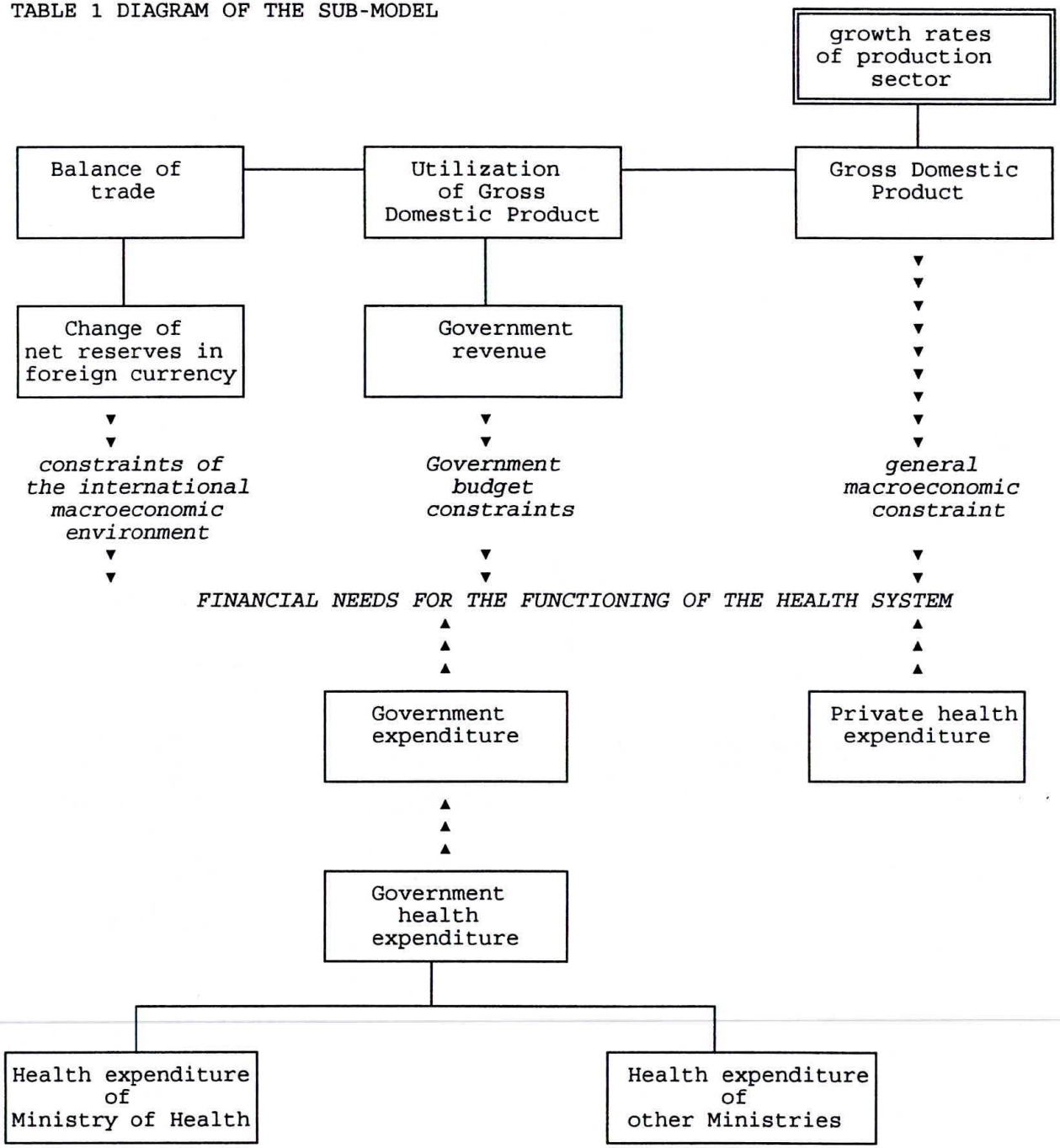
[8] There are several types of equations: (i) "behaviour" equations, which show the utilization of GDP; (ii) "institutional" equations, such as those which represent taxation; (iii) equations presented as "identities", such as the definition of GDP; and (iv) the equations showing patterns in "policy variables": an example is Government expenditure for which the user must determine the rates of growth.

analysing health financing issues and formulating policy options. In this sense, users from health ministries will be better able to present their case to colleagues from, for example, the Finance and Planning Ministry.

Diagram of MacroFin

See Table 1.

TABLE 1 DIAGRAM OF THE SUB-MODEL



6.3. Detailed structure of MacroFin

6.3.1 The base year

Use of MacroFin begins with definition of the base year. By adding the forecast period of ten years to the selected year, we obtain the final year of the forecast. For example, if the base year is 1994, the final forecast year will be 2004.

6.3.2 The population

The population **(POP)** in year t is obtained simply by taking the population level for the previous year and multiplying it by the demographic growth rate[9] **(rpop)**:

$$POP_t = POP_{t-1} * (1 + rpop_t) \qquad \textbf{(67)}$$

This value is used in order to obtain values of variables expressed in per capita terms.

6.3.3 Value added by sector[10]

(i) Value added (va) may be regarded as the net contribution of a sector to a nation's production. We have four sectors: (a) agriculture; (b) manufacturing industry; (c) other industry; (d) services. The value added in these sectors (j=1 to 4) in time t is determined by taking into account the value of the previous year (t-1) and the rate of growth (rva):

$$va_{t,j} = va_{t-1,j} * (1 + rva_{t,j}) \qquad \textbf{(68)}$$

(ii) The gross domestic product is a good measure of economic activity in a country. Gross domestic product at factor cost[11] (gdpf) is then the sum of added values from the various sectors:

$$gdpf_t = \sum_j va_{t,j} \qquad \textbf{(69)}$$

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[9] Henceforth, all growth rates are represented by symbols beginning with "r". The subscript "t" denotes time, in this case, the years.

[10] Henceforth, symbols for variables in lower case refer to variables (except growth rates) in constant prices. The same symbols in upper case refer to variables in current prices.

[11] Unlike GDP at market prices, GDP at factor cost does not include net indirect taxes.

Gross domestic product in current prices is obtained by multiplying gdp by the gdp deflator (PRGDP) :

$$GDPF_t = gdpf_t * PRGDP_t \quad \textbf{(70)}$$

(iii) Net indirect taxes are defined as a fraction of gross domestic product:

$$TXIN_t = a_{t,1} * GDPF_t \quad \textbf{(71)}$$

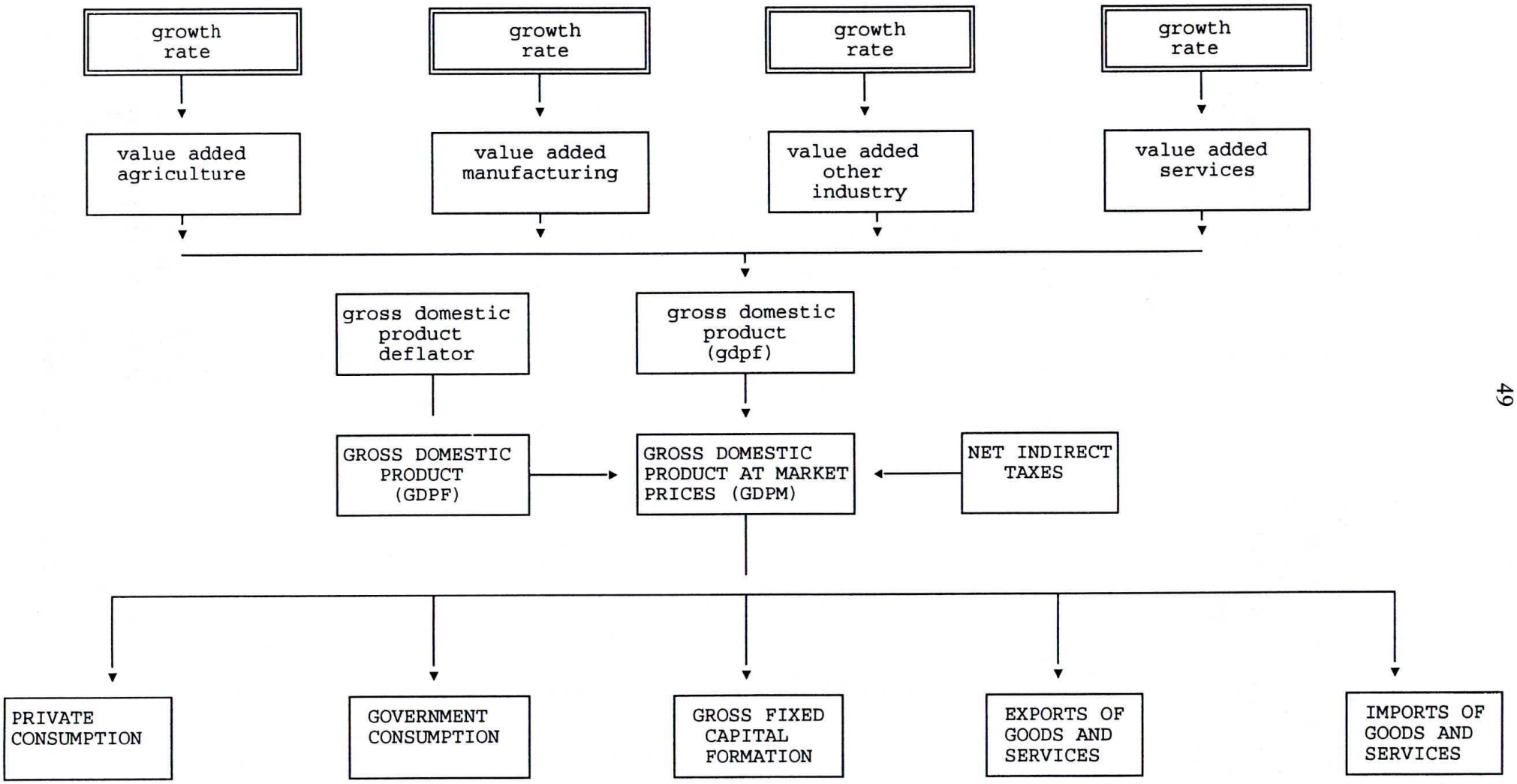
Addition of net indirect taxes to the gross domestic product at factor cost gives the gross domestic product at market prices (GDPM):

$$GDPM = GDPF_t + TXIN_t \quad \textbf{(72)}$$

The gross domestic product at market prices is then used in calculation of the utilization of resources.

(iv) Table 2 shows the role of value added in the model.

TABLE 2 VALUE ADDDED BY SECTOR, GROSS DOMESTIC PRODUCT AND ITS UTILISATION



6.3.4 Utilization of resources

(i) For the base year the values of the different utilizations of GDPM are given by the user. These are private consumption (PC), public consumption (GC), gross fixed capital formation (FC), imports of goods (MG) and of services (MS), as well as exports of goods (EG) and of services (ES). The model then calculates what share of gross domestic product for the base year these utilizations represent. Those shares take the form of coefficients in the following equations:

$$PC_t = a_{t,2} * GDPM \quad \textbf{(73)}$$

$$GC_t = b_{t,2} * GDPM_t \quad \textbf{(74)}$$

$$FC_t = c_{t,2} * GDPM_t \quad \textbf{(75)}$$

$$EG_t = d_{t,2} * GDPM_t \quad \textbf{(76)}$$

$$ES_t = e_{t,2} * GDPM_t \quad \textbf{(77)}$$

$$MG_t = f_{t,2} * GDPM_t \quad \textbf{(78)}$$

$$MS_t = g_{t,2} * GDPM_t \quad \textbf{(79)}$$

Note that the coefficients in the seven equations above can be modified for the forecast period.

(ii) Note that Table 2 shows the links between value added and utilization of resources.

6.3.5 International transactions

(i) We already have all elements needed to calculate the balance of trade ($BALT_t$) :

$$BALT_t = EG_t + ES_t - MG_t - MS_t \quad \textbf{(80)}$$

(ii) The other components of international transactions are net foreign income (NFI), net foreign transfers (NFT), and short- and long-term capital flows (CPF). The value of a transaction in year t is obtained by applying the rate of growth to year t-1:

$$NFI_t = NFI_{t-1} * (1+rnfi_t) \quad \textbf{(81)}$$

$$NFT_t = NFT_t * (1+rnft_t) \quad \textbf{(82)}$$

$$CPF_t = CPF_{t-1} * (1+rcpf_t) \quad \textbf{(83)}$$

(iii) The change of net reserves in foreign currencies (RES) is defined as follows:

$$RES_t = BALT_t + NFI_t + NFT_t + CPF_t \quad \textbf{(84)}$$

and in US dollars as:

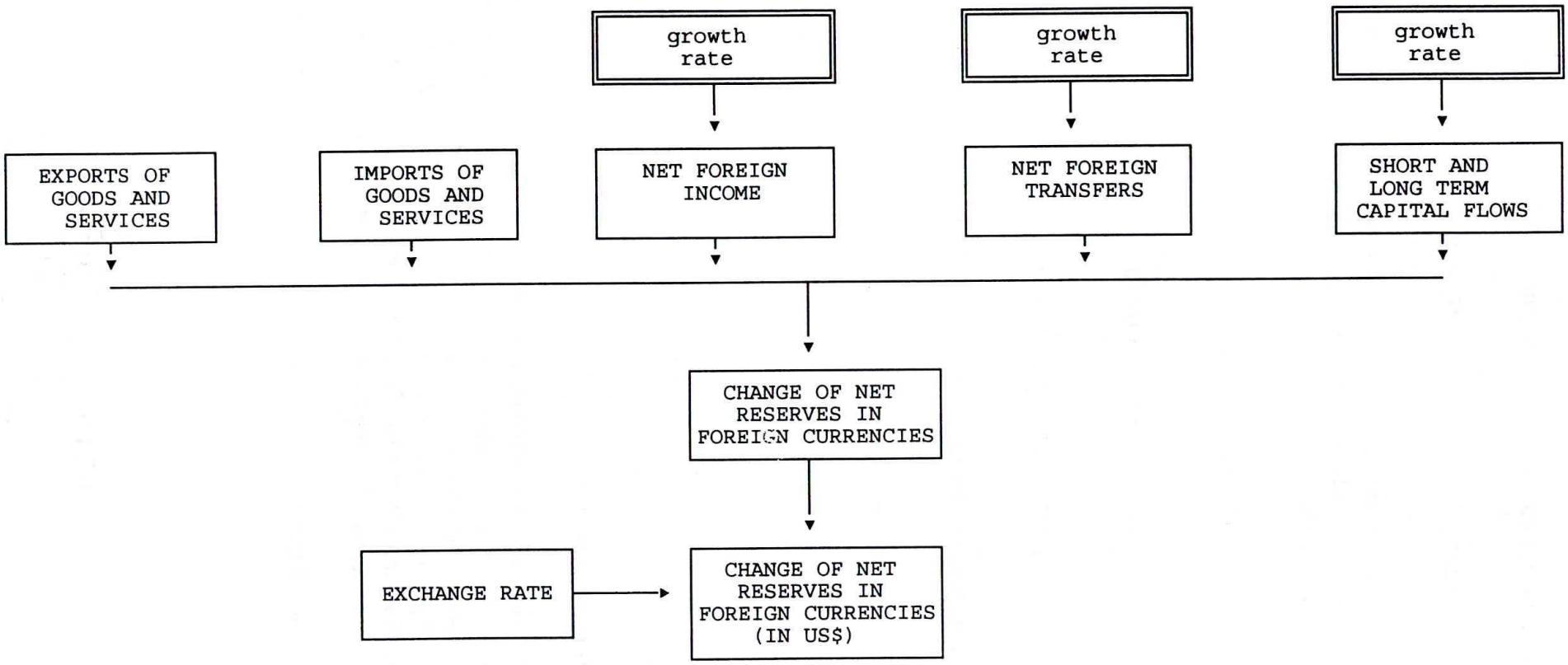
$$RES\$_t = \frac{RES_t}{RXCH_t} \quad \textbf{(85)}$$

where RXCH is the exchange rate.

The balance of trade and the change in net foreign currency reserves are presented among the results of the model. These two variables show among other things the international position of the economy in question. For example, a negative balance of trade continuing for several years could explain a drop in net reserves. Such net reserves could hinder the desired purchase of imported goods such as drugs by the health sector. Conversely, a positive balance of trade may help to increase reserves, and this could allow the purchase of drugs to be stepped up.

(iv) See Table 3 for the diagram of the equations concerning international transactions.

TABLE 3 INTERNATIONAL TRANSACTIONS



6.3.6 Prices

(i) All price indexes for the base year are fixed at 100. For the forecasting period, the consumer price index (PRC), the expenditures deflator (PRE) and the GDP deflator (PRGDP) are defined as follows:

$$PRC_t = PRC_{t-1} * (1 + rprc_t) \quad \textbf{(86)}$$

$$PRE_t = PRE_{t-1} * (1 + rpre_t) \quad \textbf{(87)}$$

$$PRGDP_t = PRGDP_{t-1} * (1 + rprgdp_t) \quad \textbf{(88)}$$

The consumer price index is used to convert current expenditure (such as that incurred by the government or by the private sector) at constant prices to current expenditure at current prices. We use the expenditure deflator to convert capital expenditure at constant prices into capital expenditure at current prices. The GDP deflator is used to calculate the gross domestic product at current prices.

(ii) The foreign price index (PRF) is defined as:

$$PRF_t = PRF_{t-1} * (1 + rprf_t) \quad \textbf{(89)}$$

This index is used to convert imports of drugs at constant foreign prices into imports at current foreign prices.

6.3.7 Exchange rate

(i) The user gives the exchange rate observed for the base year. There are then two different ways of estimating the future rate of exchange. One is to put in one's own estimates, in which case it might be worth consulting the Ministry of Finance or even the Central Bank in order to arrive at an acceptable estimate. The other option is to instruct the model to calculate the exchange rate following the theory of purchasing power parity (PPP). This theory maintains that in the long term, the rates of exchange between the US dollar and a national currency should fully reflect any difference between the rate of inflation of the country studied and the foreign rate of inflation, in order to guarantee the equivalence of the purchasing power of the two currencies. Using this theory, we find that for Guinea, for example, one US dollar is worth 1000 Guinean francs in 1995. This means, in terms of the PPP theory, that one dollar could finance the same range of goods and services as 1000 Guinean francs.

The following equation determines the standard PPP rate of exchange:

$$RXCH_t = RXCH_{t-1} * \frac{(1 + rpre_t)}{(1 + rprf_t)} \quad \textbf{(90)}$$

One notices that inflation, in equation (90) is measured via the expenditure deflator (PRE).

(ii) The exchange rate is used to convert foreign currency values into values expressed in local currency. We refer especially to the budgeting of Government health expenditure where the exchange rate plays an important role. Forecasts about imports of drugs are first made in US$, whereupon the exchange rate is used for the conversion into local currency.

(iii) The exchange rate is used also to convert local currency values into values expressed in foreign currencies, as for example in forecasting of international aid for health in US dollars. In the current version of the model, such aid is first of all formulated as the difference between the total desired budget (in local currency) and the amount financed by national resources. The aid desired is then expressed in US dollars by using the exchange rate.

6.3.8 Government revenue

(i) First of all, two types of indirect tax are defined: indirect taxation of private and public consumption (TXCO) and taxation of foreign trade (TXFT). The levels of these taxes are given for the base year. Estimates are then made for the forecasting period with the following equations:

$$TXCO_t = a_{t,3} * (PC_t + GC_t) \quad \textbf{(91)}$$

$$TXFT_t = b_{t,3} * (EG_t + ES_t + MG_t + MS_t) \quad \textbf{(92)}$$

For the base year, the coefficients above are calculated by the model. They can be interpreted directly as taxation rates. The user may then enter his or her own hypotheses about those rates for the forecasting period.

(ii) Secondly, direct taxation on household income and company profits (TXIP) are identified. The same approach is taken as for indirect taxation. For the forecasting period, those taxes are linked to the gross domestic product:

$$TXIP_t = c_{t,3} * GDPF_t \quad \textbf{(93)}$$

The coefficient in this last equation is thus interpreted as the income tax rate.

(iii) Thirdly, we identify other government revenue: non-fiscal revenue (nfr), grants (grt) and other fiscal revenue (ofr). Once again the values for the base year are given. The following equations are then proposed:

$$ofr_t = ofr_{t-1} * (1 + rofr_r) \quad \textbf{(94)}$$

$$nfr_t = nfr_{t-1} * (1 + rnfrt_t) \quad \textbf{(95)}$$

$$grt_t = grt_{t-1} * (1 + rgrt_t) \quad \textbf{(96)}$$

(iv) Multiplication of other government revenue, described above, by the GDP deflator, produces the values of that revenue in current prices:

$$OFR_t = orf_t * PRGDP_t \quad \textbf{(97)}$$

$$NFR_t = nfr_t * PRGDP_t \quad \textbf{(98)}$$

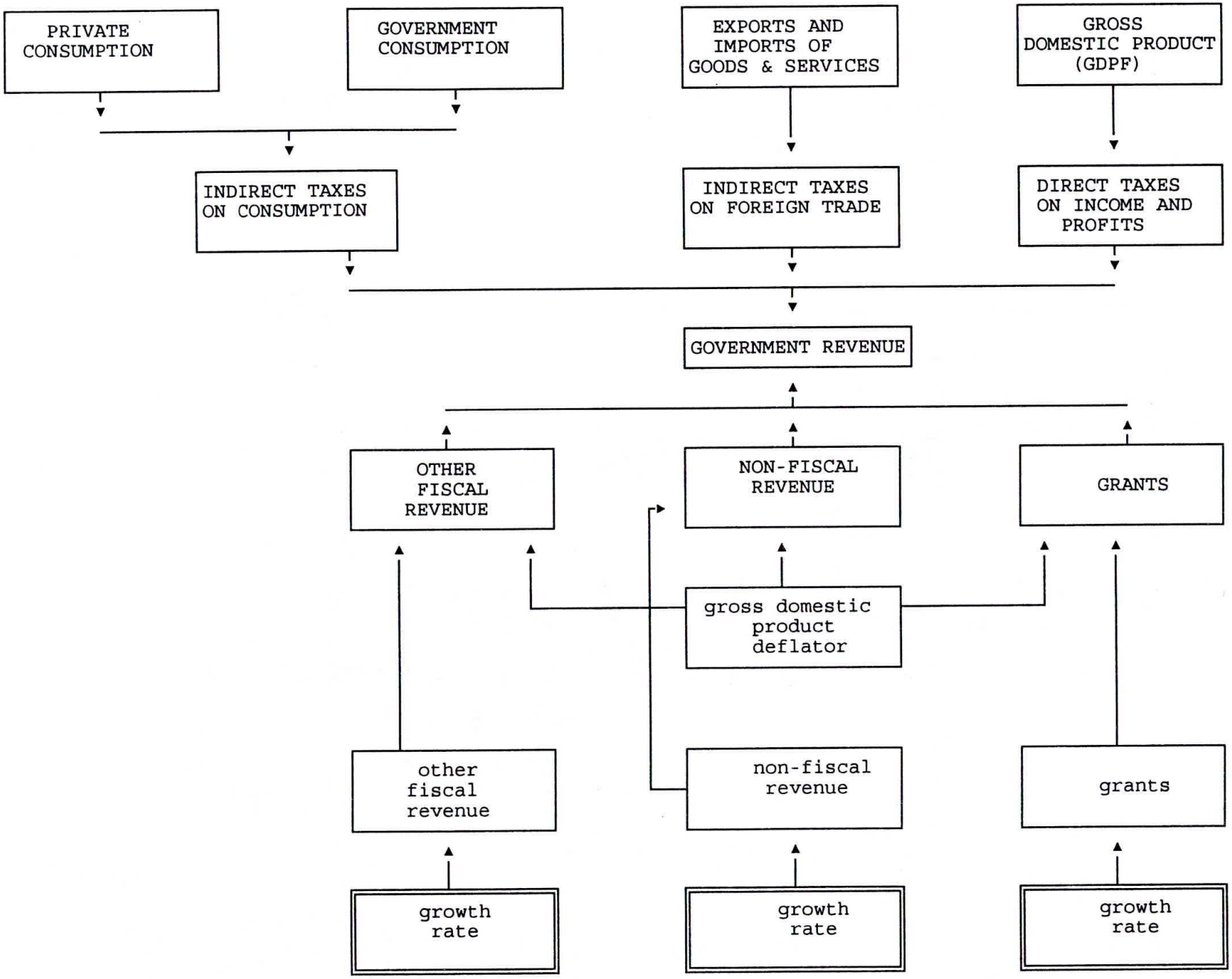
$$GRT_t = grt * PRGDP_t \quad \textbf{(99)}$$

(v) Total government revenue (GRV) can now be calculated:

$$GRV_t = TXCO_t + TXFT_t + TXIP_t + OFR_t + NFR_t + GRT_t \quad \textbf{(100)}$$

(vi) Table 4 shows the set of equations related to government revenue.

TABLE 4 GOVERNMENT REVENUE



6.3.9 Government expenditure

6.3.9.1 Expenditure at constant prices

(i) Current expenditure includes salaries and remuneration (gsal), purchase of goods and services (ggs), subsidies and transfers (gsub) and interest on debt (gint). The user gives the values of such expenditure for the base year. Expenditure for the simulation period is then calculated with the following equations:

$$gsal_t = gsal_{t-1} * (1 + rgsal_t) \quad \textbf{(101)}$$

$$ggs_t = ggs_{t-1} * (1 + rggs_t) \quad \textbf{(102)}$$

$$gsub_t = gsub_{t-1} * (1 rgsub_t) \quad \textbf{(103)}$$

$$gint_t = gint_{t-1} * (1 + rgint_t) \quad \textbf{(104)}$$

Recurrent costs at constant prices and financed from domestic resources (gdre) are defined as follows:

$$gred_t = gred_{t-1} * (1 + rgred_t) \quad \textbf{(105)}$$

(ii) For the base year, observed expenditure is entered by the user. For the forecasting period, capital expenditure at constant prices (gce) in year t is obtained by applying the rate of growth of investment expenditure to expenditure in year t:

$$gce_t = gce_{t-1} * (1 + rgce_t) \quad \textbf{(106)}$$

Expenditure financed by domestic resources (gced) is determined as follows:

$$gced_t = gced_{t-1} * (1 + rgced_t) \quad \textbf{(107)}$$

6.3.9.2 Expenditure at current prices

(i) The general purpose of producing first of all forecasts in constant prices is explained in Box 2.

(ii) Current expenditure at current prices is obtained by multiplying expenditure at constant prices by the consumer price index:

$$GSAL_t = gsal_t * PRC_t \quad \textbf{(108)}$$

$$GGS_t = ggs_t * PRC_t \quad \textbf{(109)}$$

$$GSUB_t = gsub_t * PRC_t \quad \textbf{(110)}$$

$$GINT_t = gint_t * PRC_t \quad \textbf{(111)}$$

Total government current expenditure (GRE) is then determined as follows:

$$GRE_t = GSAL_t + GGS_t + GSUB_t + GINT_t \quad \textbf{(112)}$$

Current expenditure from domestic financing is defined as:

$$GRED_t = gred_t * PRC_t \quad \textbf{(113)}$$

(iii) Capital expenditure at current prices is calculated with the expenditure deflator:

$$GCE_t = gce_t * PRE_t \quad \textbf{(114)}$$

$$GCED_t = gced_t * PRE_t \quad \textbf{(115)}$$

Box 2

Budgeting

In this model, budgeting for all expenditure (by the Government, the Ministry of Health, other ministries and the private sector) is done in two stages. Firstly, an estimate is made of spending requirements at constant prices (or real expenditure). Secondly, to obtain expenditure at current prices, the constant price expenditure is adjusted with the appropriate inflation indicator. Recurrent expenditure is obtained by using the consumer price index. Capital expenditure is adjusted with the expenditure deflator.

The advantage of this procedure is that the user is able to plan for quantities first. Indeed, the estimate of the value at constant prices takes account of the volumes required. If a plan were based directly on current prices, there would be a risk, especially in a period of inflation, of obtaining quantities smaller than those that were really desired.

Two further points should be noted:

(i) In each of the budgets studied in this model, salaries and remuneration are adjusted by the consumer price index. In countries where such an adjustment is not automatic, the user should adjust the (real) growth rate of salaries and remuneration in such a way as to obtain the planned wage bills in current prices.

(ii) In the Ministry of Health budget, imports of drugs and vaccines are planned first of all in constant US dollars. They are then adjusted with the external price index and the exchange rate between local currency and the US dollar, so as to obtain the value of imports at current prices in local currency.

6.3.9.3 Total government expenditure

Total government expenditure (GE):

$$GE_t = GRE_t + GCE_t \quad \textbf{(116)}$$

6.3.9.4 External financing of total government expenditure

The financing of total government expenditure with external funds (GEX) or international aid, is calculated as the difference between total expenditure and domestically financed expenditure:

$$GEX_t = GE_t - GRED_t - GCED_t \quad \textbf{(117)}$$

International aid including both grants and development loans can then be defined in US$:

$$GEX\$_t = \frac{GEX_t}{RXCH_t} \quad \textbf{(118)}$$

6.3.9.5 The government budget deficit

The government budget deficit (GBD) is defined as follows:

$$GBD_t = GRV_t - GE_t \quad \textbf{(119)}$$

and as a percentage of GDP at factor cost:

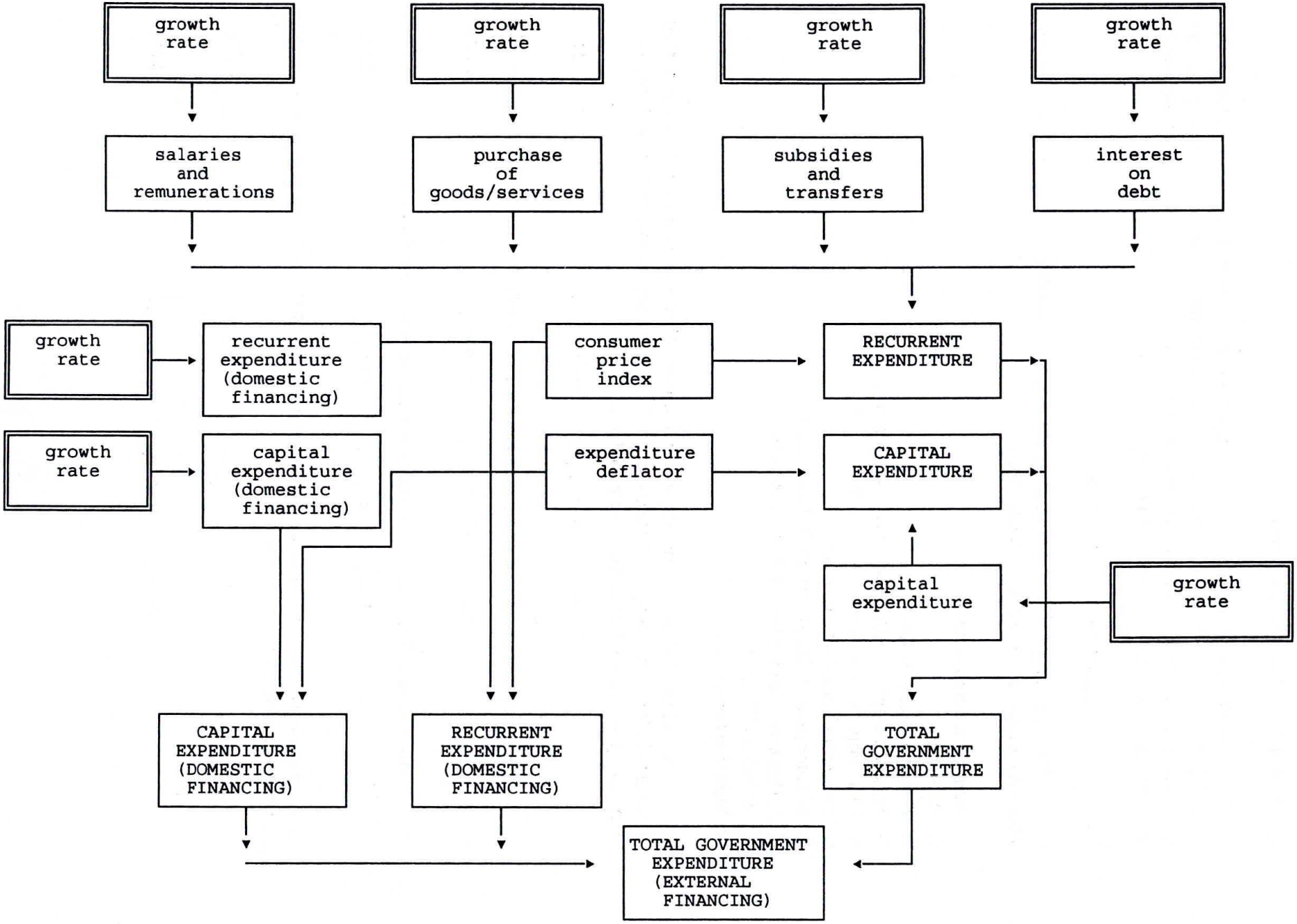
$$PGBD_t = \frac{GBD_t}{GDPF_t} \quad \textbf{(120)}$$

This last indicator will appear among the results on the macroeconomic environment. How is it used? Suppose that in a developing country, a structural adjustment programme aims to reduce government deficits. An adjustment programme may well include gradual reduction of a deficit of 10% of GDP to 4%, over a period of 5 to 10 years. The user of the model is then confronted with the constraints on government expenditure. If the country in question cannot enjoy a strong economic growth and/or a considerable increase in government income, then the government must curtail its expenditure in order to achieve the new deficit targets. The results of MacroFin will make it easier for the user to understand why the Ministry of Finance would want to limit social spending, among other things, or why it should want to subject health spending to a stricter control. Such a situation also gives the planner a chance to review health programmes, and to possibly concentrate more on the efficient ones.

6.3.9.6 The set of equations relating to government expenditure :

See Table 5.

TABLE 5 GOVERNMENT EXPENDITURE



6.3.10 Ministry of Health expenditure

We remind the user that he can either import the results MicroFin into MacroFin, or use MacroFin "directly". Where a "link" is made between the two sub-models, only current expenditure is transferred. In both cases (linked or direct use), however, the user must introduce forecasts on capital expenditure in MacroFin.

6.3.10.1 Expenditure at constant prices

(i) We shall adopt the economic classification of expenditure. We have chosen the following categories for current expenditure :

1. Salaries and remuneration
2. Training
3. Equipment and supplies
4. Medical supplies (other than drugs and vaccines)
5. Drug imports (in millions of US dollars)
6. Drug purchases (local market)
7. Maintenance of equipment and infrastructure
8. Utilization of equipment and infrastructure
9. Social mobilization
10. Miscellaneous.

(ii) The values of the base year are given by the user. For the simulation period, the current expenditure of the MoH ($hre_{mi,j}$) of category j (j = 1,...,10) in year t is the result of multiplication of the value of year t-1 by the rate of growth ($rhre_{mi,j}$):

$$hre_{t,m,j} = hre_{t-1,mi,j} * (1 + rhre_{t,mi,j}) \quad \textbf{(121)}$$

Total current expenditure therefore equals the sum of the values of 10 categories:

$$hre_{t,mi} = \Sigma_j \; hre_{t-1,mi,j} * (1 + rhre_{t,mi,j}) \quad \textbf{(122)}$$

The domestic financing of this expenditure is determined as follows:

$$hred_{t,mi} = hred_{t-1,mi} * (1 + rhred_{mi,t}) \quad \textbf{(123)}$$

(iii) Capital expenditure (hce) and capital expenditure financed by domestic resources, are determined, respectively, as follows:

$$hce_{t,mi} = hce_{t-1,mi} * (1 + rhce_{t,mi}) \quad \textbf{(124)}$$

$$hced_{t,mi} = hced_{t-1,mi} * (1 + rhced_{t,mi}) \quad \textbf{(125)}$$

(iv) Total expenditure (he) and total domestically financed expenditure (hed) are calculated, respectively, as follows :

$$hed_{t,mi} = hred_{t,mi} + hced_{t,mi} \quad \textbf{(126)}$$

6.3.10.2 Expenditure at current prices

(i) To obtain expenditure at current prices, we multiply expenditure at constant prices by an appropriate price index. To calculate the value of imports at current prices in national currency (HRE_5), we proceed as follows: we multiply imports at constant prices, and in US$, by the external price index; and then multiply further by the exchange rate. The latter is expressed in the following equation:

$$HRE_{t,mi,5} = hre_{t,mi,5} * PRF_t * RXCH_t \quad \textbf{(127)}$$

For other categories of current expenditure and domestically financed current expenditure, the consumer price index is used to calculate expenditure at current prices:

$$HRE_{t,mi,j} = hre_{t,mi,j} * PRC_t \quad \textbf{(128)}$$

for j=1 to 4 and j=6 to 10

Total current expenditure is therefore defined by:

$$HRE_{t,mi} = \sum_j HRE_{t,mi,j} \quad \textbf{(129)}$$

ii) Capital expenditure at current prices (HCE) and domestically financed capital expenditure at current prices (HCED) are obtained by using the expenditure deflator.[12] This leads to the following equations:

$$HCE_{t,mi} = hce_{t,mi} * PRE_t \quad \textbf{(130)}$$

and

$$HCED_{t,mi} = hced_{t,mi} * PRE_t \quad \textbf{(131)}$$

[12] Ideally, we should use the investment price index, but this datum is often absent from statistics for developing countries. We have therefore opted for the expenditure deflator, which reflects at least in part, changes in the cost of capital.

(iii) The next stage is simply to define total expenditure by the Ministry of Health (HE) as the sum of current and capital expenditure:

$$HE_{t,mi} = HRE_{t,mi} + HCE_{t,mi} \quad \textbf{(132)}$$

6.3.10.3 External financing of Ministry of Health expenditure

Health expenditure to be financed by external donors (HEX) is calculated as the difference between total health expenditure and domestically financed health expenditure:

$$HEX_{t,mi} = HE_{t,mi} - HRED_{t,mi} - HCED_{t,mi} \quad \textbf{(133)}$$

Using the exchange rate, external aid for health in US$ can now be defined as follows:

$$HEX\$_{t,mi} = \frac{HEX_{t,mi}}{RXCH_t} \quad \textbf{(134)}$$

It then becomes easy to express external aid for health as a proportion of total international aid:

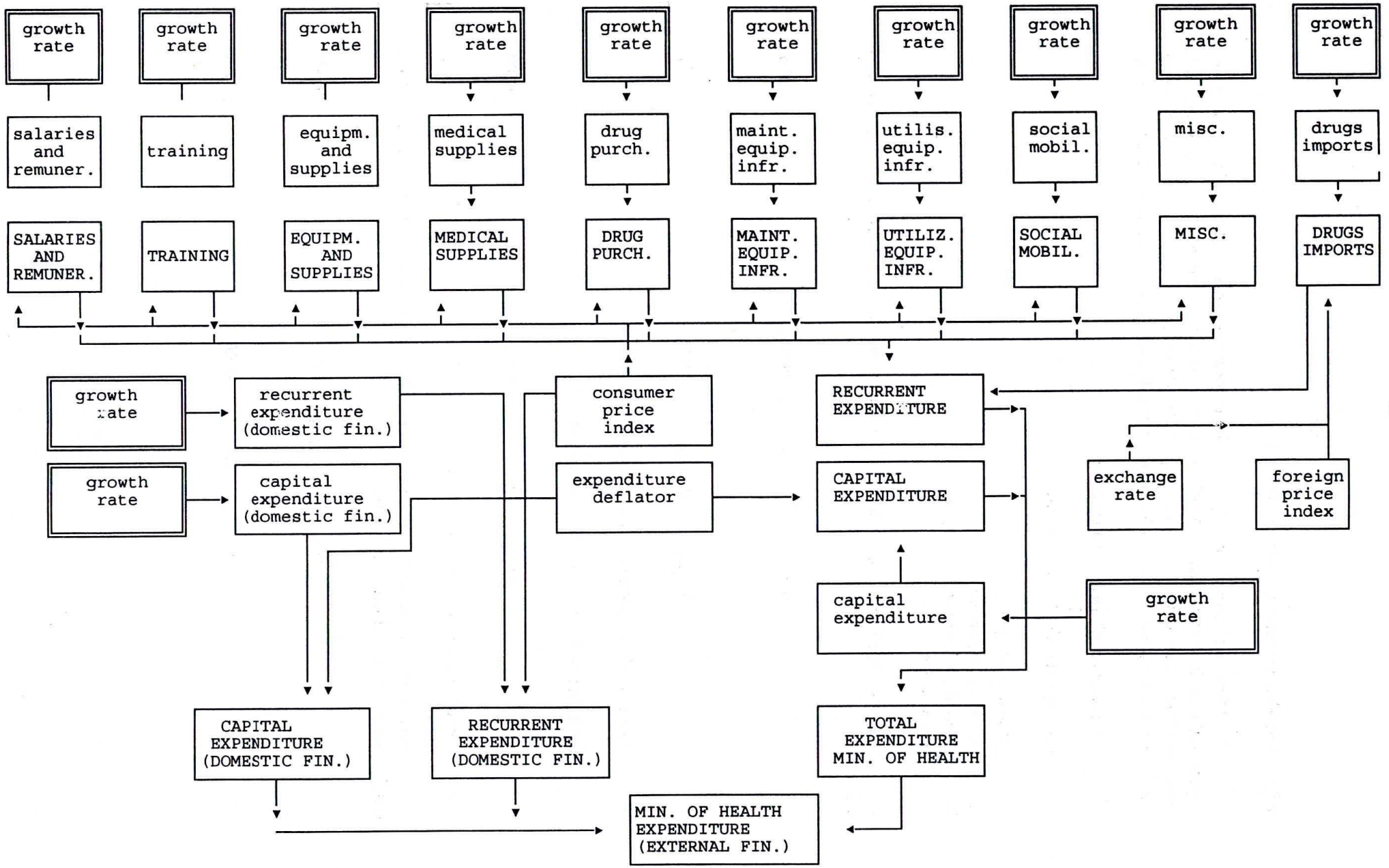
$$PHEX_{t,mi} = \frac{HEX\$_{t,mi}}{GEX\$_t} \quad \textbf{(135)}$$

The latter is an indicator that enables the MoH to monitor the importance accorded to health in internal aid and if necessary to request a larger share of the total aid provided.

6.3.10.4. The set of equations related to Ministry of Health expenditure

See Table 6.

TABLE 6 MINISTRY OF HEALTH EXPENDITURE



6.3.11 Health expenditure by other ministries

The MoH is often not the only one to incur health expenses. Other ministries can also engage in the health expenditure. The following set of equations can be used in analyzing (i) the respective roles of the ministries in financing health services; (ii) how government interventions can be better coordinated with a view to increasing the effectiveness of government funding.

6.3.11.1 Health expenditure at constant prices

We have chosen four categories:

1. The Ministry of Defence
2. The Ministry of Labour
3. The Ministry of Education
4. Other ministries.

Current expenditure (hre) and capital expenditure (hce) are defined, respectively, as follows:

$$hre_{t,oth\,j} = hre_{t-1,oth,j} * (1 + rhre_{t,oth,j}) \quad \textbf{(136)}$$

and

$$hce_{t,oth,j} = hce_{t-1,oth,j} * (1 + rhce_{t,oth,j}) \quad \textbf{(137)}$$

where j (j=1,...,4) refers to the category of ministry.

Total expenditure is therefore defined as:

$$he_{t,oth} = \Sigma_j hre_{t,oth,j} + \Sigma_j hce_{t,o,thj} \quad \textbf{(138)}$$

6.3.11.2 Health expenditure at current prices

For current expenditure at current prices (HRE) and capital expenditure at current prices (HCE), we have the following equations:

$$HRE_{t,oth,j} = hre_{t,oth,j} * PRC_1 \quad \textbf{(139)}$$

$$HCE_{t,oth,j} = hce_{t,oth,j} * PRE_t \quad \textbf{(140)}$$

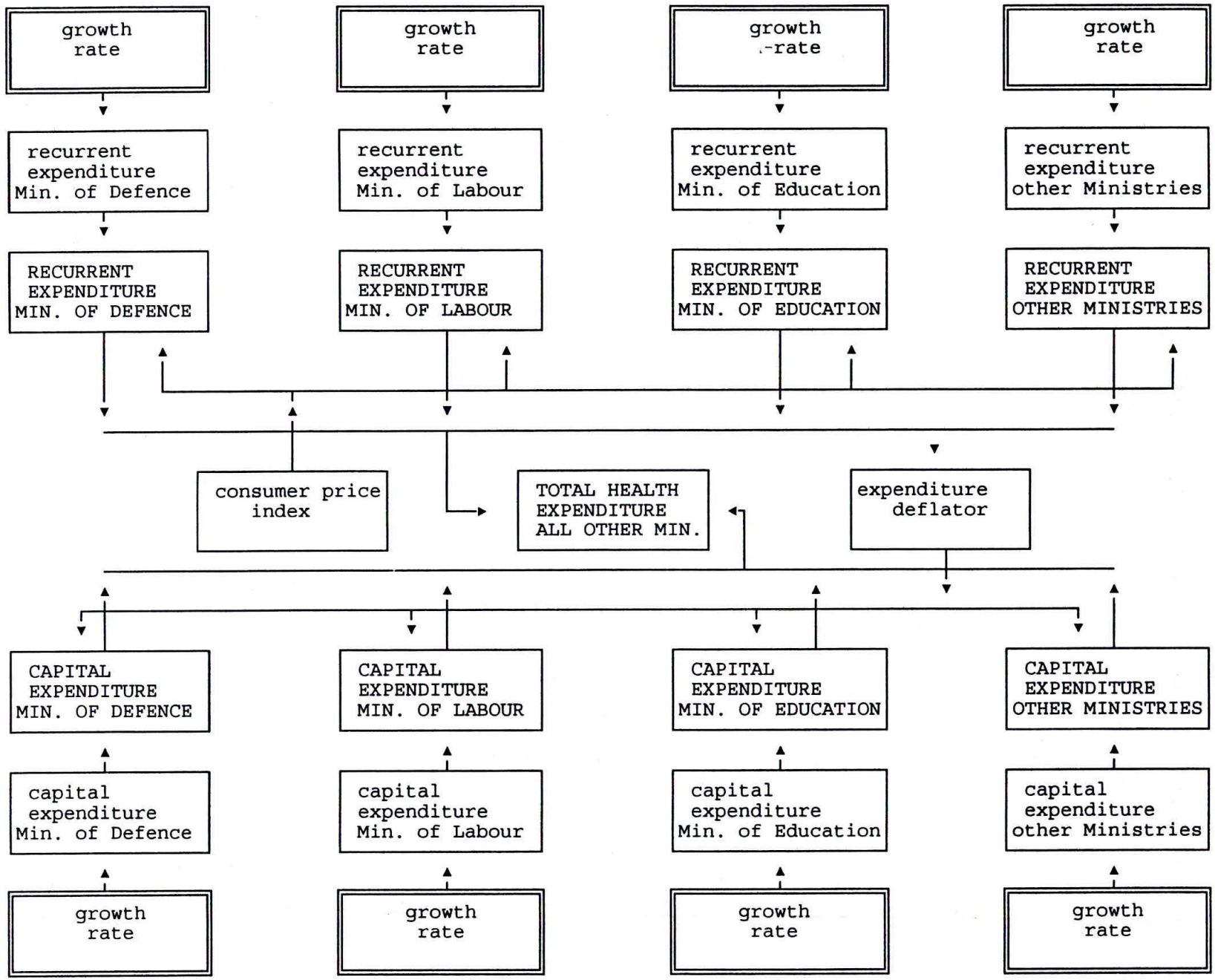
Total expenditure of all the other ministries equals:

$$HE_{t,oth} = \Sigma_j HRE_{t,oth,j} + \Sigma_j HCE_{t,oth,j} \quad \textbf{(141)}$$

6.3.11.3 Set of equations on expenditure of other ministries

See Table 7.

TABLE 7 HEALTH EXPENDITURE OTHER MINISTRIES



6.3.12 Health expenditure in the private sector

In this module, the user is called upon to specify the expected degree of private sector expenditure. In this way the volume of resources available for health apart from those allocated by the government is estimated. How can this information be used? Obviously, each country selects its appropriate health system, including optimal sharing of responsibilities between the government and private sectors. This module will help us to reflect on the financing possibilites of such a system. Take the example of a country wishing to establish a system of health services regulated and guided by the government but co-financed by households. This co-financing could be called into question by the presumed lack of capacity of households to pay for health. On the other hand, the information could show that households already spend considerable sums on a variety of services such as drugs from private pharmacies. Such information could help us to dispel certain misconceptions about the actual situation.

6.3.12.1 Expenditure at constant prices

We have selected four headings to cover private expenditure on health:

1. households,
2. health insurance plans,
3. nongovernmental organizations,
4. enterprises.

Current expenditure (hre) and capital expenditure (hce) are defined as:

$$hre_{t,pr,j} = hre_{t-1,pr,j} * (1 + rhre_{t,pr,j}) \quad \textbf{(142)}$$

and

$$hce_{t,pr,j} = hce_{t-1,pr,j} * (1 + rhce_{t,pr,j}) \quad \textbf{(143)}$$

where j (j=1,...4) refers to the source of private expenditure.

Total private expenditure is defined as follows:

$$he_{t,pr} = \Sigma_j hre_{t,pr,j} + \Sigma_j hce_{t,pr,j} \quad \textbf{(144)}$$

6.3.12.2 Expenditure at current prices

Current expenditure at current prices (HRE) and capital expenditure at current prices (HCE) are defined as follows:

$$HRE_{t,pr,j} = hre_{t,pr,j} * PRC_t \quad \textbf{(145)}$$

and

$$HCE_{t,pr,j} = hce_{t,pr,j} * PRE_t \quad \textbf{(146)}$$

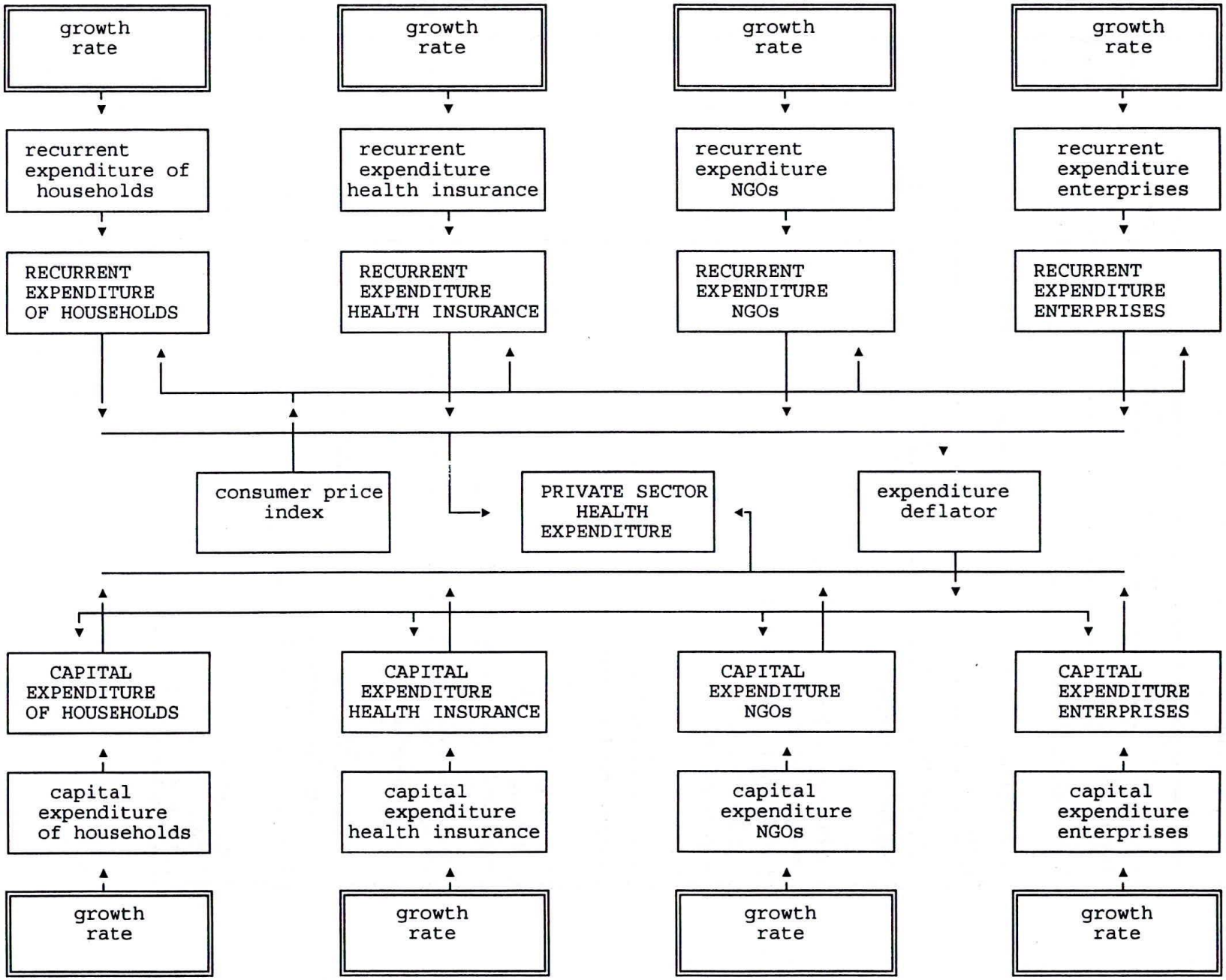
Total private expenditure is defined as follows:

$$HE_{t,pr} = \Sigma_j HRE_{t,prj} + \Sigma_j HCE_{t,pr,j} \quad \textbf{(147)}$$

6.3.12.3 The set of equations related to private health expenditure

See Table 8.

TABLE 8 PRIVATE SECTOR HEALTH EXPENDITURE



6.4 DATA INPUT

6.4.1 List of data to be collected for the base year

VARIABLE	SYMBOL[13]
Population	POP
Value added by sector j (j=1,...,4) (j=agriculture, manufacturing industry, other industry, services, agriculture) (sic)	va_j
Net indirect taxation	TXIN
Utilization of resources	
Private consumption	CP
Public consumption	GC
Fixed capital gross formation	FC
Imports of goods	MG
Imports of services	MS
Exports of goods	EG
Exports of services	ES
International transactions	
Net foreign income	NFI
Net foreign transfers	NFT
Short- and long-term capital flow	CPF
The exchange rate	RXCH
Government revenue	
Indirect taxation of private and public consumption	TXCO
Taxation of foreign trade	TXFT
Taxation on income and profits	TXIP
Non-fiscal revenue	nfr
Grants	grt
Other fiscal revenue	ofr

[13] To simplify, we omit the subscript "t" from the symbols in the following tables.

Government expenditure	
Current expenditure:	
Salaries and remuneration	gsal
Purchase of goods and services	ggs
Subsidies and transfers	gsub
Interest on debt	gint
Current expenditure (domestically financed)	gnfr
Capital expenditure	gce
Capital expenditure (domestically financed)	gced
Ministry of Health expenditure	
Current expenditure by category j (j=1,...10):	$hre_{mi,j}$
(j=salaries and remuneration, training, equipment and supplies, medical consumption, drug imports in US$, drug purchases, maintenance of equipment and facilities, use of equipment and facilities, social mobilization, other operating costs)	
Current expenditure (domestic financing)	$hred_{mi}$
Capital expenditure	hce_{mi}
Capital expenditure (domestic financing)	$hced_{mi}$
Health expenditure by other ministries	
Current expenditure by category j (j=1,...4) j=Ministry of Defence, Ministry of Labour, Ministry of Education, other ministries	$hre_{oth,j}$
Capital expenditure by category j (j=1,...,4)	$hce_{oth,j}$
Health expenditure in the private sector	
Current expenditure by source of finance j (j=1,...,4)	$hre_{pr,j}$
(j=households, health and insurance plans, nongovernmental organizations, enterprises...)	
Capital expenditure by source of finance j (j=1,...4)	$hce_{pr,j}$

6.4.2 Data input for exogenous and policy variables

VARIABLE	SYMBOL
Rate of growth of the population	rpop
Rate of growth of value added by sector j (j=1,...4) (j=agriculture, manufacturing industry, other industry, services, agriculture)	rva_j
Net indirect taxation as a proportion of gross domestic product	a_1
The following resources as proportions of gross domestic product: The contribution to gross domestic product of: private consumption public consumption fixed capital gross formation exports of goods exports of services imports of goods imports of services	 a_2 b_2 c_2 d_2 e_2 f_2 g_2
Rates of growth of international transactions: Net foreign income Net foreign transfers Short- and long-term capital flow	 rnfr rnft rcpf
Rates of growth of price indexes: Consumer price index Expenditure deflator Deflator of gross domestic product	 rprc rpre rprgdp
Exchange rate Two options: a. The user supplies the figures for the exchange rate b. The user takes the parity of purchasing power (PPP) option	 RXCH Special parameter in the software, set equal to 1

Government revenue	
Rate of taxation on:	
public and private consumption	a_3
international trade	b_3
income	c_3
Rates of growth of:	
Other fiscal income (constant prices)	rofr
Non-fiscal income (constant prices)	rnfr
Grants (constant prices)	rgrt
Rate of growth of government expenditure (constant prices):	
Salaries and remuneration	rgsal
Purchase of goods and services	rggs
Subsidies and transfers	rgsub
Interest payments on debt	rgint
Current expenditure (domestic financing)	rgred
Capital expenditure (constant prices)	rgce
Capital expenditure (domestic financing)	rgced
Rate of growth of Ministry of Health expenditure (constant prices)	
Current expenditure by category j(j=1,...,10):	$rhre_{mi,j}$
(j=salaries and remuneration, training, material and equipment, medical consumption, imports of drugs in US dollars, drug purchases, maintenance of equipment and facilities, utilization of equipment and facilities, social mobilization, other operating costs)	$rhred_{mi}$
Current expenditure (domestic financing)	$rhce_{mi}$
Capital expenditure	$rhced_{mi}$
Capital expenditure domestic financing	

Rate of growth of health expenditure of other ministries (in constant prices)	
Current expenditure by category j (j=1,...,4) (j=Ministry of Defence, Ministry of Labour, Ministry of Education, other ministries)	$rhre_{oth,j}$
Capital expenditure by category j (j=1,...4)	$rhce_{oth,j}$
Rate of growth of health expenditure in the private sector (at constant prices)	
Current expenditure by source of finance j (j=1,...,4) (j=Households, health insurance companies and plans, nongovernmental organizations, businesses)	$rhre_{pr,j}$
Capital expenditure by source of finance j (j=1,...4)	$rhce_{pr,j}$

6.4.3 Remarks about rates of growth and coefficients

When asked to enter the rates of growth, the user has two options: (i) to change the rate of growth for any year in the simulation period; (ii) to fix the rate of growth for the entire simulation period. A special option enables the user to set the rate of growth of Government expenditure and/or MoH expenditure equal to the real rate of growth of gross domestic product.

In introducing coefficients, the user has similar options : (i) changing coefficients for any year in the simulation period; (ii) fixing the coefficients so that they are valid for the whole period.

6.5 Results

There are three tables with results. The first presents mainly changes in health expenditure at constant prices and changes in per capita expenditure. The second presents the macroeconomic environment and changes in health expenditure at current prices. In the third table, we show the structure of health expenditure or the classification of expenditure by different criteria: by current and capital expenditure, and by domestic and external finance. The third table also includes the economic classification of current MoH expenditure. Finally, a graph shows the financial effort of the government for health. It shows real growth in government health expenditure and the percentage of total government expenditure allocated to the MoH.

Some indicators such as rates of growth or per capita values are derived from the basic output. Annex 1 shows the equations associated with these additional indicators.

Tables 9 to 11 are detailed summaries of the results displayed by the program. They can stimulate thought and discussion about the volume and allocation of resources for health. Examples of policy questions that might arise are presented. The question numbers feature in the tables 9 to 11 where they are associated with the most appropriate results.

6.6 Sample questions on health system financing policy

6.6.1 Questions about the volume of resources for health

Q1

The MoH may ask itself : should the resources not increase at the same pace as gross domestic product (gdpf)? Otherwise, the share of MoH expenditure in gdpf will decline.

Q2

What is health expenditure by all partners as a proportion of gross domestic product? This information will help evaluate the efficiency of health spending, among other things.

Q3

How does health expenditure compare with that of other countries? A comparison must be made in an international currency; a PPP-type exchange rate is recommended, to take account of the purchasing power of the currency in the countries compared.

Q4

What is the trend in the percentage of MoH expenditure in total Government spending? Are the percentages adequate? Should more resources for health be sought from the Government?

Q5

Would it be possible for the MoH to increase its budget in real terms? Would such an increase be justifiable given the current state of public finance? In other words, are there budget deficit problems that would make a real increase difficult or impossible?

Q6

How has external aid for health changed as a proportion of total international aid? Does aid for health deserve an increase?

6.6.2 Questions on allocation of resources for health

Q7

Would the MoH be in a position to considerably increase imports of drugs? Or might there be objections from the Ministry of Finance if the balance of trade is too negative or if foreign currency reserves are diminishing?

Q8

Is there a satisfactory balance between current and capital expenditure by the MoH?

Q9

(i) Is current expenditure by the MoH on salaries and remuneration acceptable in view of the other financial requirements for the functioning of government health care services?

(ii) What are the implications for health expenditure on staff of an employment policy that increases or reduces recruitment of health personnel and/or provides for regular increase in real salaries?

Q10

Is the MoH's budget allocation for drugs sufficient to satisfy the objectives of a policy whereby the Government covers the financing of essential drugs?

Q11

Is the policy for external financing of health expenditure sustainable? Is external finance increasing too fast? Is the share of external aid in total aid for health developing in a way that is acceptable to donors and government?

Q12

(i) Should the planned breakdown of national expenditure on health between partners (MoH, other ministries, private sector) be maintained? Or could one redistribute resources among ministries to improve the utilisation of resources?

(ii) How large is the private sector? Would it be possible to use the current paying capacity to pay for the improvement of the quality of government health services (e.g., by cost-sharing with households)?

Table 9: GOVERNMENT EXPENDITURE AT CONSTANT PRICES

RESULTS	SYMBOL	QUESTION
MoH expenditure	he_{mi}	Q5
including current expenditure	hre_{mi}	Q5
and capital expenditure	hce_{mi}	Q5
Rate of growth of total expenditure	rhe_{mi}	Q1
Expenditure (domestic financing)	hed_{mi}	
MoH expenditure per capita		
Per capita expenditure	hec_{mi}	
Per capita expenditure (domestic financing)	$hecd_{mi}$	
Per capita expenditure in US$	$hec\$_{mi}$	Q3
Rate of growth of per capita health expenditure	$rhec_{mi}$	Q1
National health expenditure		
Total	nhe	
Expenditure by other ministries	he_{oth}	
Expenditure by the private sector	he_{pr}	
Rate of growth of total expenditure	rnhe	Q2
Total per capita expenditure	nhec	Q2
Rate of growth of total per capita	rnhec	Q2
Reminder: growth of gross domestic product		
Gross domestic product (gdp) at factor prices	gdpf	Q1, Q2
Rate of growth of gdp	rgdpf	
Per capita gdp	gdpfc	
Rate of growth of per capita gdp	rgdpfc	Q1, Q2

Table 10: HEALTH EXPENDITURE AT CURRENT PRICES

RESULTS	SYMBOL	QUESTION
The macroeconomic context		
Balance of trade	BALT	Q7
Net change in reserves, in US$	RES$	Q7
Total government revenue	GRV	
Total government current expenditure	GRE	
Total government capital expenditure	GCE	
Total government expenditure	GE	
Total external aid in US$	GEX$	
Budget deficit	GBD	Q5
GDP at factor cost	GDPF	
Budget deficit as a % of GDP at factor cost	PGBD	Q5
Population	POP	
MoH expenditure		
Current expenditure	HRE_{mi}	
Capital expenditure	HCE_{mi}	
Total	HE_{mi}	
External aid to the MoH in US$	$HEX\$_{mi}$	
External aid for health as a proportion of total international aid	$PHEX\$_{mi}$	Q6, Q11
Current expenditure on health as a proportion of total Government current expenditure	$PHRE_{mi}$	
Capital expenditure on health as a proportion of total Government capital expenditure	$PHCE_{mi}$	
Total MoH expenditure as a proportion of total Government expenditure	PHE_{mi}	Q4
National expenditure on health		
Total	NHE	
including expenditure by other Ministries	HE_{oth}	
and expenditure by the private sector	HE_{pr}	
Total per capita	NHEC	
Total per capita in US$	NHEC$	
Total as a percentage of GDP (factor cost)	PNHE	
Total government health expenditure as percentage of Total government expenditure	PTGHE	Q4

Table 11: STRUCTURE OF MoH EXPENDITURE

RESULTS	SYMBOL	QUESTION
Ministry of Health		
Structure of expenditure (percentages)		
Current expenditure	$PHRE_{mi}$	Q8
Capital expenditure	$PHCE_{mi}$	Q8
Structure of current expenditure (percentages)		
Personnel expenditure	$PHRE_{mi,1}$	Q9
Pharmaceuticals expenditure	$PHREDR_{mi}$	Q10
including imports	$PHRE_{mi,5}$	Q7, Q10
Other current health expenditure	$POTHEH_t$	
Structure of financing		
Current expenditure (percentages)		
Domestic financing	$PHRED_{mi}$	
External financing	$PHREX_{mi}$	Q11
Capital expenditure (percentages)		
Domestic financing	$PHCED_{mi}$	
External financing	$PHCEX_{mi}$	Q11
Of total expenditure (percentage)		
Domestical financing	$PHED_{mi}$	
External financing	$PHEX_{mi}$	Q11
NATIONAL EXPENDITURE		
Structure by sector (percentages)		
Ministry of Health	PHE_{mi}	Q12
Other ministries	PHE_{oth}	Q12
Private sector	PHE_{pr}	Q12

PART III : USING *SimFin*

7. AN EXAMPLE

An example has been developed in order to clarify how the model functions and to demonstrate its potential.

Imagine a low income developing country with a population of 10 million. The public facilities do not cover the entire territory, and health care is also provided by private non-profit facilities. The government health sector has established a cost-recovery system, and donors also contribute to its functioning.

7.1 Base year data for MicroFin

7.1.1 General data

- Population	10 million
- Annual population growth rate	2%
- Number of working days per annum	260d
- Number of holidays per annum	20d
- Number of hours worked per day	8hrs
- Salary scale (in local currency units u.m.)	
(i) Health care personnel	
· Surgeon	450 000
· Specialist	400 000
· Physician	300 000.
· Midwife	180 000
· Nurse	120 000
· Other health care personnel	50 000
· Technician	100 000
· Clerical staff	200 000
(ii) Non health care personnel	
· Senior manager	300 000
· Technician	100 000
· Clerical staff	50 000

7.1.2 Health centres

7.1.2.1 Number of health centres, population covered and activities

Although the model allows for 4 categories of health centre, we will only use two in this example.

· Small health centres covering an average of 5 000 inhabitants;

· Large health centres covering an average of 20 000 inhabitants;

Variables	Large HC	Small HC
- Number of HCs in the country	200	400
- Average population covered	20,000	5,000
- Number of curative consultations per year	10,000	2,000
- Number of MCH activities per year	4,000	1,000
- Number of deliveries per annum	400	0

Note that :

(i) All small health centres combined cover a population of 2 million while large health centres cover a population of 4 million. Public health centres therefore cover a total population of 6 million. The remaining 4 million either have no access to health facilities in their area or are covered by private facilities.

(ii) The data for the various activities are the result of multiplying the population in the zone by a coefficient;

(iii) It is assumed that in small health centres, deliveries are not possible;

7.1.2.2 Breakdown of staff activities

Small health centres:

	Curative services	MCH	Delivery	IEC	Administration	Total
Physicians						100%
Nurses	40%	30%	%	10%	20 %	100%
Midwives						100%
Health care workers	90%			10%		100%

Large health centres:

	Curative consultations	MCH	Delivery	IEC	Administration	Total
Physicians	55 %	0 %	10 %	5 %	30 %	100 %
Nurses	85 %	10 %		5 %		100 %
Midwives	0 %	20 %	60 %	10 %	10 %	100 %
Health care workers	90 %			10 %		100 %

7.1.2.3 Breakdown of staff by qualification and source of financing

Staff	Large HC	Small HC
Physicians		
- MoH	0.8	
- Community financing		
- External aid		
Nurses		
- MoH	2.0	1.0
- Community financing	0.5	0.2
- External aid	0.5	0.3
Midwives		
- MoH	0.8	
- Community financing		
- External aid		
Health care workers		
- MoH	2.4	1.0
- Community financing	0.1	
- External aid	0.2	
Health care workers	0.5	
- MoH		
- Community financing		
- External aid		

7.1.2.4 Pharmaceutical supplies

Financial sources	Large HC	Small HC
- MoH	800, 000	210,000
- Community financing	200,000	20,000
- External aid	200,000	20,000

Note that in this example we have set an average per capita expenditure on drugs of 50 for small health centres and 60 for large health centres. In addition, note that the share of imported drugs in total drugs purchased is assumed to be 90 %, whether the drugs are financed by the MoH of via external aid.

7.1.2.5 Other operating expenditure

Financial sources	Large HC	Small HC
- MoH		
- Community financing		
- External aid	500,000	100,000

Note that in this example we have set an average per capita operating expenditure of 20 for small health centres and 50 for large health centres.

7.1.3 Referral hospitals (levels II and III) and the National Referral Hospital

Variables	District	Regional	National
Number of hospitals in the country	40	10	1
Average population covered	200,000	1,000,000	10,000,000
Number of beds	100	300	700
Number of admissions	3,000	5,000	20,000

7.1.3.1 Data per department:

In-patient department I: Internal medicine

Remember the key criterion for in-patient departments is the number of beds.

Variables	District	Regional	National
Number of beds	40	120	100
Number of admissions	1,200	2,000	2,000
Average length of stay	8	8	8
Number of specialists	0	0	3
Number of doctors	1	3	2
Number of midwives	0	0	0
Number of nurses	15	45	40
Number of health care workers	10	30	30
Drug expenditure	2,000,000	7,200,000	7,500,000
Other operating expenditure	4,000,000	18,000,000	20,000,000

Notes :

(i) Drug expenditure per bed is 50 000 in district hospitals, 60 000 in regional hospitals and 75 000 in the National Hospital.

(ii) Other operating expenditure per bed is 100 000 in district hospitals, 150,000 in regional hospitals and 200 000 in the National Hospital.

In-patient department II : "Paediatrics"

Variables	District	Regional	National
Number of beds	20	60	100
Number of admissions	600	1,000	3,000
Average length of stay	8	8	8
Number of specialists	1	3	2
Number of G.P.s	0	0	2
Number of midwives	1	3	5
Number of nurses	5	15	25
Number of health care workers	5	15	20
Drug expenditure	1,000,000	3,600,000	7,500,000
Operating expenditure	2,000,000	9,000,000	20,000,000

In-patient department III: "Gynaecology and obstetrics"

Variables	District	Regional	National
Number of beds	20	60	100
Number of admissions	600	1,000	3,000
Average length of stay	8	8	8
Number of specialists	1	3	4
Number of physicians	1	3	3
Number of midwives	6	18	25
Number of nurses	5	15	30
Number of health care workers	3	9	15
Drug expenditure	1,000,000	3,600,000	7,500,000
Other operating expenditure	2,000,0000	9,000,000	20,000,000

In-patient department IV

Variables	District	Regional	National
Number of beds	20	60	100
Number of admissions	600	1,000	3,000
Average length of stay	8	8	8
Number of specialists	0	0	3
Number of physicians	1	3	3
Number of midwives	0	0	0
Number of nurses	5	15	25
Number of health care workers	5	15	25
Drug expenditure	1,000,000	3,600,000	7,500,000
Other operating expenditure	2,000,0000	9,000,000	20,000,000

Note : In case of the national hospital, 3 more departments were considered; the latter are assumed to be identical to in-patient department IV.

Surgical unit

Variables	District	Regional	National
Number of operations per year	900	1,500	6,000
Total number of surgeons	1	3	10
Total number of anaesthetists	0	1	3
Total number of physicians	0	0	0
Total number of nurses	1	6	20
Total number of health care workers	1	3	10
Drugs expenditure	9,000,000	22,500,000	120,000,000
Other operating expenditure	9,000,000	22,500,000	120,000,000
Composition of a surgical team			
- Surgeons	1	1	1
- Anaesthetists	0	1	1
- Physicians	0	0	0
- Nurses	1	1	2
- Health care workers	1	1	1

Notes:

(i) The number of operations depends on the number of admissions: we have assumed that 30% of admitted patients undergo surgery;

(ii) Drugs expenditure and other operating expenditure is 10 000 per operation in district hospitals, 15 000 in regional hospitals and 20 000 in the National Hospital.

Out-patient consultations

The number of out-patient consultations is expressed as a percentage of the population in the reference zone : 2.5% for the district hospital, 1% for the regional hospital and 0.2% for the National Hospital.

Variables	District	Regional	National
- Number of consultations per year	5,000	10,000	20,000
- Number of specialists	0	0.5	4
- Number of physicians	1	1	2
- Number of midwives	0.5	0.	1
- Number of other health care workers	0	0	0
- Drug expenditure	500,000	2,000,000	5,000,000
- Other operating expenditure	50,000	200,000	5,000,000

Notes :

(i) Drug expenditure per consultation is 100 for district hospitals, 200 for regional hospitals and 250 for the National Hospital.
(ii) Other operating expenditure is 10% of expenditure on drugs.

X-Ray department

The number of X-rays is equal to the number of admissions to the hospital multiplied by a utilization ratio. In this example, this ratio is 20% for all levels of hospitals.

Variables	District	Regional	National
Number of X-rays per annum	600	1,000	4,000
Number of specialists	0	0	0
Number of technicians	1	2	4
Number of health workers	0	0	0
Expenditure on medical supplies	600,000	1,000,000	4,000,000
Other operating expenditure	60,000	100,000	400,000

Notes :

(i) Expenditure on medical supplies per X-ray is 1 000 for district and regional hospitals and for the National Hospital.
(ii) Other operating expenditure is 10% of expenditure on supplies:

Laboratory service

The number of laboratory tests is equal to the number of admissions to the hospital multiplied by a utilization ratio. In this example, this ratio is 50% for all levels of hospitals.

Variables	District	Regional	National
Number of test per year	1,500	2,500	10,000
Number of specialists	0	0	0
Number of technicians	1	2	4
Number of health care workers	0	0	0
Expenditure on medical supplies	375,000	1,250,000	7,500,000
Recurrent expenditure	37,500	125,000	750,000

Notes:

(i) Expenditure on medical supplies per test is 250 for district hospitals, 500 for regional hospitals and 750 for the National Hospital.

(ii) Other operating expenditure is a mere 10% of expenditure on supplies.

Dentistry

This service is provided only at the level of the National Hospital

The number of dental interventions is equal to the number of inhabitants in the country multiplied by a utilization ratio. The latter was set at 0.1%.

Variables	District	Regional	National
Number of interventions per year			10,000
Number of specialists			2
Number of technicians			2
Number of health care workers			0
Expenditure on medical supplies			30,000,000
Other operating expenditure			3,000,000

Notes:

(i) Expenditure on medical supplies is 3 000 per intervention.
(ii) Other operating expenditure is 10% of expenditure on supplies.

Emergency unit

Only the National Hospital has an emergency unit. The number of emergencies is equal to a fraction of the number of admissions. This fraction is set at 50%.

Variables	District	Regional	National
Number of emergencies per year			10,000
Number of physicians			3
Number of nurses			4
Number of health care workers			2
Expenditure on drugs			5,000,000
Other operating expenditure			500,000

Notes:

(i) Drug expenditure is 500 per emergency.
(ii) Other operating expenditure is 10% of expenditure on supplies.

Ambulance service

It is assumed that this service is not provided by district hospitals. The number of calls depends on the population of the area: It is assumed that 0.15% and 0.03% of the population call upon the ambulance services of regional hospitals and the National Hospital, respectively.

Variables	District	Regional	National
Number of calls per year		1,500	3,000
Number of drivers		1	2
Number of nurses		1	2
Other operating expenditure		4,500,000	9,000,000

It is assumed that each call-out costs 3000.

Administration

Variables	District	Regional	National
Number of senior managers	0	1	2
Number of pharmacists	0	1	2
Number of clerical staff	1	4	3
Number of technicians	1	10	20
Expenditure on service personnel	3	20	50
Operating expenditure	250,000	1,000,000	10,000,000

Catering

We assume there is no catering service in district hospitals.

Variables	District	Regional	National
Service personnel		4	10
Expenditure on food		20,000,000	80,000,000
Other operating expenditure		2,000,000	8,000,000

We assume that the cost of hospitalization is 500 per person per day.

7.1.3.2 Breakdown of expenditure according to source of financing :

Expenditure/source of financing	District	Regional	National
Drug expenditure . MoH	80%	80%	50%
. Community financing	0%	10%	25%
. External donors	20%	10%	25%
Operating expenditure . MoH	100%	100%	100%
. Community financing	0%	0%	0%
. External donors	0%	0%	0%

7.1.3.3 Breakdown of staff according to source of financing :

		District	Regional	National
Surgeons	Total	1	3	10
	MoH	0.5	2	5
Specialists	Total	2	7.5	31
	MoH	2	7.5	15
Physicians	Total	4	11	26
	MoH	4	8	20
Midwives	Total	7.5	21.5	31
	MoH	6.5	18.0	25
Nurses	Total	26	82	221
	MoH	25	80	180
Technicians	Total	2	4	10
	MoH	2	4	9
Health care personnel	Total	24	72	177
	MoH	20	60	150
Senior managers				
	Total	0	1	2
	MoH	0	1	2
Intermediate-level admin.				
	Total	1	4	3
	MoH	1	4	3
- Technicians	Total	1	11	22
	MoH	1	11	13
- Service personnel	Total	3	24	60
	MoH	3	24	40

Note the "total" is calculated automatically by MicroFin.

7.1.3.4 Imported drugs as a percentage of drugs purchased:

	District	Regional	National
By MoH	90%	90%	90%
Through external aid	90%	90%	90%

7.1.4 Administration

7.1.4.1 Data related to all of the districts

Total number of supervisory visits per year to government Hcs (1 visit per month)	7,200
Total number of supervisory visits per year to private health facilities (1 visit per month)	1,200
Total number of private health facilities	100
Total budget for supervision for all districts	168,000,000
Number of districts	50

It is assumed that one supervisory visit costs 20 000.

7.1.4.2 Collective data on regions

Total number of supervisory visits per year in the regions (1 visit per month)	600
Total budget for supervision for all regions	30,000,000
Number of regions	10

It is assumed that one supervisory visit costs 50 000.

7.1.4.3 Data related to an average district, an average region and the central administration

	District	Regional	National
Total number of physicians working in administration	1	3	10
Number of senior managers other than the district medical officer and Regional medical director	0	2	40
Number of clerical staff	5	5	20
Number of service personnel	5	10	60
Operating budget excluding staff and supervision	500,000	1,000,000	1,000,000
Budget allocated for senior managers excluding district medical officers and regional medical directors	0	8,400,000	210,000,000
Budget allocated for clerical staff	15,000,000	15,000,000	100,000,000
Budget allocated for service personnel	3,600,000	6,000,000	43,200,000
Monthly salary of District medical officer and Regional medical director	4,000,000	500,000	
Breakdown of working time of District medical officer and Regional medical director: - supervision - administration - time devoted to medical activities	 60% 30% 10%	 60% 30% 10%	

7.2 Base year data for MacroFin

7.2.1 Coherence of data between MacroFin and MicroFin

MacroFin can be used either separately or in conjunction with the MicroFin. Since each of the sub-models can be used separately, the values for base variables, such as population, annual demographic growth rate, etc are repeated here; if the sub-models are used in parallel it is important to check that base data are the same in both.

7.2.2 Population

Variables	Value
Population	10 million
Annual population growth rate	2%

7.2.3 Value added by sector

Value added	Value
Agriculture	729,000
Manufacturing industry	194,400
Other industry	81,000
Services	615,600

Net indirect taxes are 81,000.

7.2.4 Utilization of gross domestic product (GDP)

GDP utilization	Value	% of GDP
Private consumption	1,386,720	81.52
Public consumption	294,678	17.32
Gross fixed capital information	381,348	22.42
Exports of goods	121,338	7.13
Exports of services	69,336	4.08
Imports of goods	346,680	20.38
Imports of services	190,674	11.21

7.2.5 Balance of payments

The balance of trade can now be obtained but we still have to define three other variables in order to calculate the balance of payments:

Variables	Value
Net factor income	-16,200
Net transfers	255,420
Net capital flows	82,620

7.2.6 Exchange rate

The exchange rate for 1995 has been fixed at 500.

7.2.7 Taxes and taxation rates

Tax	Value	Taxation rate (%)
Net indirect taxes	81,000	5.00
Income tax	38,134.8	2.35
Taxes on public and private consumption	76,269.6	4.54
Taxes on international trade	80,000.0	10.99

7.2.8 Other government revenue

Other revenue	Value
Other fiscal revenue	0
Non-fiscal revenue	0
Grants	46,980

7.2.9 Government expenditure

Expenditure	Value
Personnel	142,884
Purchase of goods and services	30,618
Subsidies and current transfers	10,206
Interest payments	11,000
Current expenditure	calculated by the model: 194,708
Current expenditure (domestic financing)	194,708
Capital expenditure	116,640
Capital expenditure (domestic financing)	1,944

7.2.10 Ministry of Health expenditure

If MicroFin is used in conjunction with MacroFin, we suggest to put in the following data:

Expenditure	Value
Personnel	12,344.5
Training	0
Non medical supplies	0
Medical supplies (excl. drugs and vaccines)	0
Imports of pharmaceuticals (in US dollars)	2.164$
Purchases of domestic pharmaceuticals	120.21
Maintenance of equipment and infrastructure	0
Operation of equipment and infrastructure	0
Social mobilization	0
Other operating costs	2,575.3
Current expenditure	calculated by the model = 16,121.89
Current expenditure (domestic financing)	16,121.89
Capital expenditure	10,000
Capital expenditure (domestic financing)	1,000

"Miscellaneous" comprises the values of the following elements of MicroFin: supervision, food and other day-to-day operating expenses.

If MacroFin is used separately, the user is of course free to choose the values for the categories in the above table.

7.2.11 Health expenditure by other ministries and private health expenditure

All other expenditure on health has been ignored (the values are set at 0) in order to simplify the example.

7.3 A simulation example

7.3.1 Base case simulation

A "base case" simulation was carried. The main hypotheses for the forecasting period are :

(i) there is no change in the health system, hence, for instance, the various parameters of the production technology of health services remain constant ;

(ii) population growth is 2 %;

(iii) GDP growth is 2 %;

(iv) total government current and capital expenditure at constant prices grow by 1.5 % per year;

(v) current health expenditure in the forecasting period is taken from the results of MicroFin.

In general, we can say that health expenditure at constant prices increases at a yearly rate of less than 2 %; the growth rate is not exactly equal to population growth because health care costs comprise some "fixed" expenditure. Current Ministry of Health expenditure (*excluding current Ministry of Health expenditure in constant prices* increases by approximately 19 % over the ten-year period.

Note that in the base year, current health expenditure is broken down as follows:

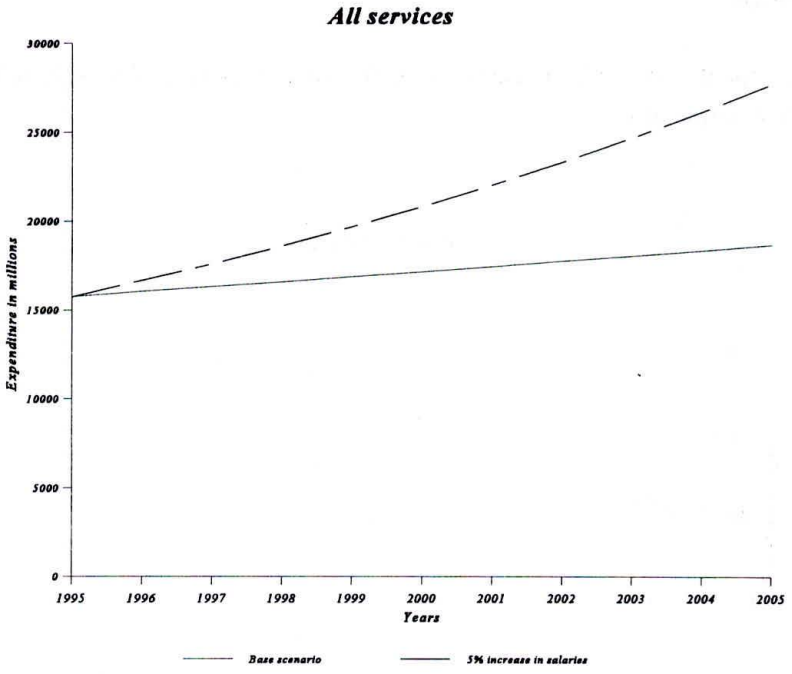
(i)	Health centres	19.7 %
(ii)	Hospitals (levels II and III)	59.6 %
(iii)	National Hospital	6.7 %
(iv)	Administration	13.8 %

We report on the base case values of selected variables below.

7.3.2 Health policy simulations using MicroFin

7.3.2.1 General salary increase

The annual (real) rate of salary increase is assumed to be 5% for all staff.



In the graph above, it is depicted that an annual increase of 5% in salaries results in an overall increase of 76% by the end of the 10-year projection period. The latter compares with the increase of 19 % in the base case simulation.

7.3.2.2 Policy regarding health centres

Three policy changes are analysed here :

(i) an increase in the number of health centres,
It is assumed that the number of "small health centres" increases from 400 to 600 and the number of "large health centres" from 200 to 250: This would raise national coverage population from 60% to 80%.

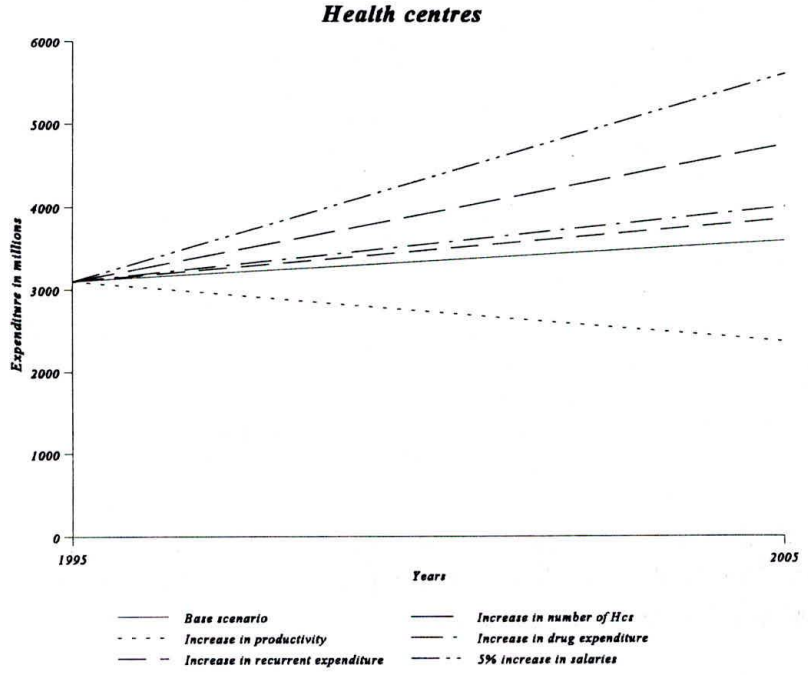
(ii) a change in the composition and tasks of health staff: A substantial increase in staff productivity is assumed resulting in the following average time needed:
- 1 curative consultation: 30'
- 1 MCH intervention: 15'
- 1 delivery: 120'

The latter represents a substantial increase in productivity compared to the base scenario;

iii) improvement in quality, via :
. an increase in drugs expenditure: drugs expenditure per intervention increases to 200.

. an increase in other operating expenditure: the latter increases to 100 per intervention.

Simulations are performed for each of the three policies. The following diagram gives the results of each simulation.



Note that in the base scenario health centre expenditure grow by 16% over the projection period. The simulations of the policy changes lead to the following results :

(i) a 5% increase in salaries leads to a growth of 81% in expenditure by the end of 2005;

(ii) an increase in the number of health centres leads to a growth in expenditure of 53% by 2005;

(iii) an improvement in the quality of care through increased expenditure on drugs per intervention leads to a growth of 29 % by 2005;

(iv) an improvement in quality through increased recurrent expenditure per intervention leads to growth of 24% by 2005;

(v) an increase in staff productivity leads to a 34% drop in expenditure, by 2005;

From a strictly financial point of view, these policies vary in their impact. Policies can also be combined, however. A suitable way to proceed is to:

(i) set the current budget for the period: this may be the budget of the base scenario or any other budget (for example one could take account of the macro-economic

constraints in setting the overall health budget, and within this, the budget for health centres;.

(ii) try out various combinations to see which one respects the budget constraint.

Let us assume, for example, that the budget constraint is that of the base scenario, with a total of 3 594 million at the end of the simulation period, and that the MoH is seeking an increase in productivity which would allow for an annual (real) growth rate of 5% in salaries. Suppose staff productivity improves along the lines of the scenario on increased productivity (see above). In this case, it is possible indeed to remain within the budget limit set for the end of the period [14] and allow for an annual 5% growth in salaries.

7.3.2.3 Policy regarding hospitals

In this example we will consider the effects of policy changes related to all three hospital levels. The policy changes are the following :

(i) an increase in admissions :the number of admissions to a hospital is set as a percentage of the population in the reference zone. This percentage increases as follows:
· District hospital: from 1.5% of the population in 1995 to 2% in 2005;
· Regional hospital: from 0.5% of the population in 1995 to 0.8% in 2005;
· National hospital: from 0.2% of the population in 1995 to 0.5% in 2005.

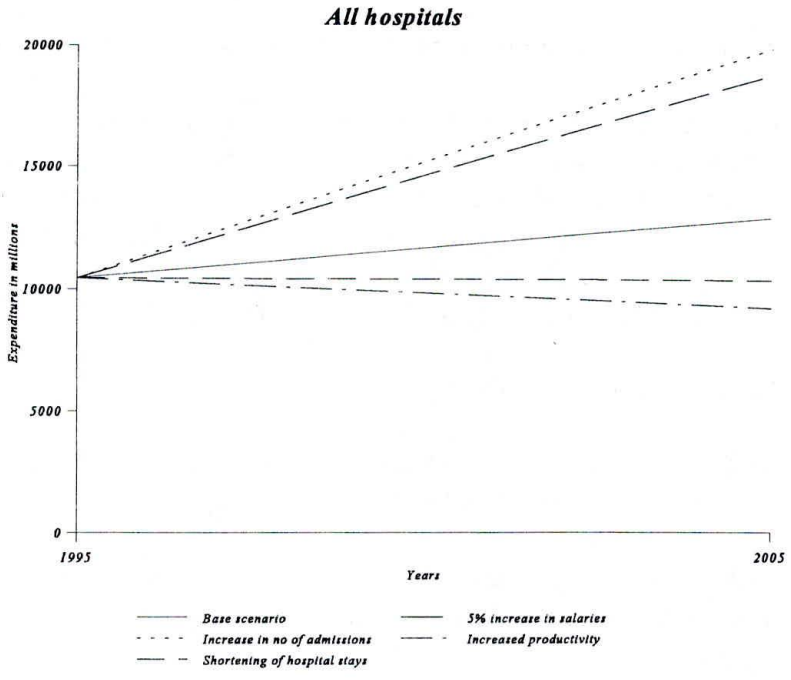
(ii) a change in staff productivity (number of staff per bed). We will assume an increase in staff productivity of 50% at all qualification levels by the end of the period.

(iii) a change in the length of hospital stay. The average length of stay is assumed to be 8 days at the beginning of the period regardless of the type of hospital. We will assume that this length gradually shortens to 6 days by the end of the period.

(iv) an annual increase in salaries. Again, we will assume an annual increase of 5% in salaries.

The following diagram presents the results of the simulation :

[14] Additional trial-and-error operations and hypotheses would be required to make the adjustment comply with the budget for each of the simulation period.



Note that in the base scenario hospital expenditure grew by 23% in expenditure over the simulation period. The simulations give the following results :

(i) a 5% increase in salaries leads to a growth of 80% by 2005;

(ii) an increase in the number of admissions leads to growth of 90 % in expenditure by 2005;

(iii) shorter hospital stays lead to reduction of 23% by 2005;

(iv) an increase of 50% in staff productivity leads to a 12% drop in expenditure by 2005.

Policies can also be combined, of course. For example, we could combine greater productivity with an increase in the number of admissions. Total expenditure at the end of the simulation period would be 14 337 million, compared to a "base case" value of 12 907 million. The latter demonstrates that the effects of the different variables do not automatically compensate for each other. As outlined in the previous section, one could set the current budgets for the simulation period and then try out various policy combinations that respect the budget constraint. For instance, if one were to respect a budget constraint of 12 907 million at the end of the simulation period, one would allow for an annual (real) growth rate of 5% in salaries provided staff productivity rises by 50 % by the year 2005[15].

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15 Additional trial-and-error operations and hypotheses would be required in order to make the adjustment comply with the budget limit for each of the simulation period.

7.3.2.4 Policy regarding administration

In the base case scenario, expenditure on administration is 2180 million and remains unchanged throughout the simulation period.

We have simulated a policy change regarding supervision at district and regional level. Supervisory checks increase from 12 per year to 24. According to this hypothesis, administrative expenditure reaches 2378 million at the end of the simulation period, i.e., an increase of 9% with respect to the base case scenario.

7.3.2.5 Policies regarding the structure of health expenditure

The base case simulation produced the following results:

	1995		2005	
	Value	Share	Value	Share
Health centres	3 105	19.7%	3 594	19.2%
Hospitals of level II and III	9 384	59.6%	11 573	61.9%
National hospital	1 085	6.9%	1 334	7.1%
Administration	2 180	13.8%	2 180	11.7%
Total	15 754	100%	18 681	100%

It can be seen that there is little change in the structure of expenditure at the different levels. In previous simulations, we also reasoned within a given structure of the health system. Obviously, the decision-maker may wish to change the structure of health expenditure. Let us assume for example that he or she adopts a health policy favouring primary health care. Such a policy would result in a greater share of the health budget being allocated to health centres and a decrease in allocations to other levels. We perform a simulation, taking account of the following hypotheses :

(i) the current health budget develops as in the base scenario, i.e., the budget increases from 15 754 million in 1995 to 18 681 million in 2005;

(ii) the new allocation to the different levels is as follows:

Health centres	30%
Hospitals of levels II and III	55%
National Hospital	5%
Administration	10%

According to these two hypotheses, budgetary constraints for the final year of the simulation period are as follows:

Health centres	5 604	million
Hospitals of levels II and III	10 274	million
National Hospitals	934	million
Administration	1 868	million

We can now examine which policy scenarios would respect each of the above constraints. Obviously, there are quite a number of solutions. For expository's sake, we have selected onlyoneper category of health facility and for the administration : the following table presents those combinations of hypotheses which allow each constraint to be respected. Of course, the user is free to choose the alternative combinations of policies which at the same time respect the predetermined constraints.

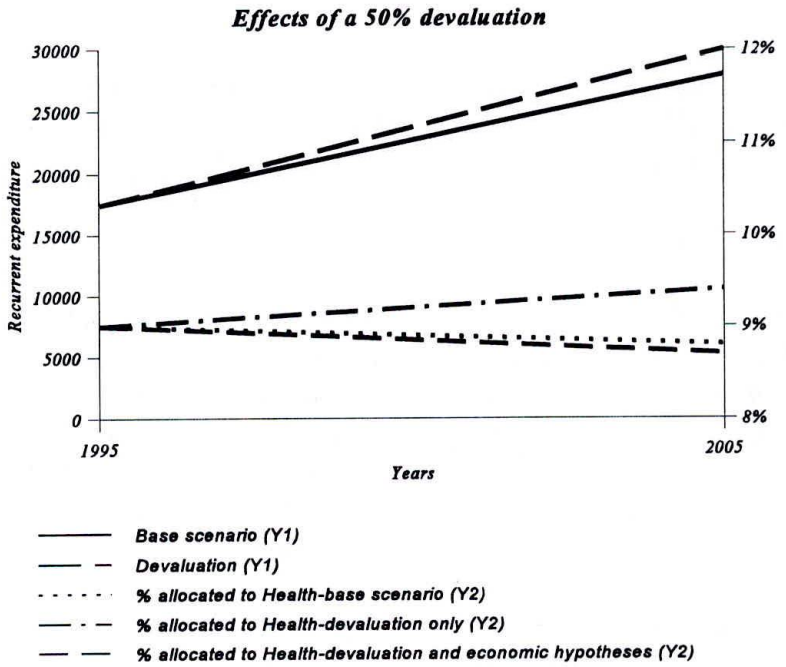
Combinations of changes in policy	Health centres	Hospitals Level II and	National Hospitals	Administration
Increase in salaries	1%	1%	1%	1%
Staff productivity	decrease in time spent on each intervention: - curative care: 30' - MCH: 15' - delivery 120'	increase in productivity of 20% (measured via the number of staff per bed)	increase in productivity of 20% (measured as the number of staff per bed)	no change
Rate of admission		no change	0,00015	
Length of hospital stay		7.5 days	7.5 days	
Number of facilities	800 small health centres and 250 large health centres			
Drug expenditure per intervention	200			
Other operating expenditure per intervention	100			
Number of jobs				- Central: decrease of 50% - District and regional: decrease of 20% for intermediate and lower categories

On the whole this scenario demonstrates that is possible to increase salaries if there is a simultaneous increase in staff productivity. Similarly, devoting a greater proportion of the budget to health centres makes it possible to increase the number of health centres and to improve quality as measured by drug and recurrent expenditure per intervention.

7.3.3 Health policy simulations linking MacroFin and MicroFin

7.3.3.1 Taking account of the macro-economic environment : impact of a currency devaluation

We will consider an example in which we simulate the impact of a currency devaluation. The exchange rate, which was 500 to the US dollar in the base case scenario changes to 1000 per US dollar, representing a devaluation of 50% of the monetary unit against the dollar. The simulation results obtained are presented in the following diagram.



The diagram shows how devaluation affects expenditure (in local currency) on imported drugs. We assume that no other element of current expenditure involves imports. This simulation can also be used to examine the effect of devaluation on external aid (in US dollars). The amount of external aid (in local currency) planned in the budget will have to be adjusted in order to maintain the real quantity of aid.[16]

The simulation model does not consider the effects of a devaluation on the economy and its structure, however. One might argue that a devaluation could result in an improved balance of trade and an increase in government revenue. The user could study the implications of the latter effects, by modifying the appropriate coefficients, especially the ones related to the shares of international trade in GDP.

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[16] For more information on this point see J. Perrot, L'aide extérieure pour les secteurs sociaux au lendemain de la dévaluation du franc CFA, WHO/ICO, Geneva, 21-24 February 1995.

7.3.3.2 Needs versus budgetary constraints

With the above simulations, we have linked the results of the two sub-models. But we have not yet analyzed financial requirements versus constraints of public finance as set out in the macro-economic sub-model.

The question is how to use the sub-models most productively? Of course, we should be as close to reality as possible. For example, one sequence of simulations could be as follows :

(i) the Ministry of Health makes an initial estimate (using MicroFin);

(ii) the Ministry of Finance then examines the estimate. It could reply that the figure requested is too high and suggests a health budget which is feasible taking account of macroeconomic and political considerations;

(iii) the Ministry of Health accepts this budget as a constraint and, using MicroFin, the policy package that respects this constraint and best corresponds to a previously adopted health policy.

Let us take an example to illustrate this:

We assume that the procedure begins with the Ministry of Finance requesting that the Ministry of Health draw up a budget plan over the next 10 years, based on the requirements of the health system as identified by the MoH. For the sake of simplicity, we will consider only one measure here, i.e. a substantial real increase of 5% per annum in the salaries of staff. MicroFin can be used to assess the impact of such a measure at each level (health centres, hospitals, administration) and thus on the entire system. Whereas in the base scenario total expenditure is 18 682 in the year 2005, it is 27 752 if there is to be a 5% increase in salaries.

We now import these results via the MacroFin "LINK" option[17]. We see that the proportion of the government budget allocated to health increases from 9% in 1995 to 12.9% in the year 2005.

Assuming the same procedure has been repeated for all ministries, the Ministry of Finance now has the necessary information to mediate between various ministerial requests. Les us assume that it informs the MoH that 12.9% is much too high a figure and imposes a limit of 9%. Now, MacroFin could be used to calculate the total sum available to the MoH for each of the following 10 years. This estimate then becomes the Ministry's budgetary constraint.

Once the MoH knows its overall budgetary constraint, it can use MicroFin again to :

(i) share out the total budget among the different levels, and
(ii) find the policy package which respects this new financial constraint, (thereby allowing for a different functioning of the health system).

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17 See Annex II : "User's Guide to SimFin software".

7.3.4 Rapid estimates with MacroFin

It is also possible to use MacroFin ("DIRECT" option) [18] to make certain rapid estimates regarding health expenditure based on simple hypotheses.

For instance, one could start from baseline data for the MoH budget (based on published budget data). The user does not necessarily have to link with MicroFin, should he be pressed to compute some future budget estimates rapidly. Different growth rates can be given for the different budget items.

Note that there is also a feature whereby the user can make all MoH expenditure grow like GDP (he does this by simply using a specially designed parameter[19].

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[18] Op. cit.

[19] See Annex II, p 129

ANNEX I
ADDITIONAL INDICATORS

1. Table of results: HEALTH EXPENDITURE AT CONSTANT PRICES

Ministry of Health expenditure

Rate of growth of total expenditure

$$he_{t,mi} = \frac{(he_{t,mi})}{(he_{t-1,mi})} - 1 \qquad (143)$$

Ministry of Health expenditure per capita

Per capita expenditure

$$hec_{t,mi} = \frac{hec_{t,mi}}{POP_t} \qquad (144)$$

Per capita expenditure (domestically financed)

$$hed_{t,mi} = \frac{hedc_{t,mi}}{POP_t} \qquad (145)$$

Per capita expenditure in US$

$$hec\$_{t,mi} = \frac{hec_{t,mi}}{TXCH_t * POP_t} \qquad (146)$$

Rate of growth of per capita health expenditure

$$rhec_{t,mi} = \frac{hec_{t,mi}}{hec_{t-1,mi}} \qquad (147)$$

National health expenditure

Total

$$nhe_t = he_{t,mi} + he_{t,oth} + he_{t,pr} \qquad (148)$$

Rate of growth of total national health expenditure

$$rnhe_t = \frac{nhe_t}{nhe_{t-1}} \quad \textbf{(149)}$$

Total per capita expenditure

$$hnec = \frac{hne_t}{POP_t} \quad \textbf{(150)}$$

Rate of growth of total per capita expenditure

$$rnhec_t = \frac{nhec_t}{nhec_{t-1}} - 1 \quad \textbf{(151)}$$

Reminder: growth of gross domestic product

Rate of growth of GDP

$$rgdpf_t = \frac{gdpf_t}{gdpf_{t-1}} - 1 \quad \textbf{(152)}$$

Per capita gdp

$$gdpfc_t = \frac{gdpf_t}{POP_t} \quad \textbf{(153)}$$

Rate of growth of per capita gdp

$$rgdpfc_t = \frac{gdpfc_t}{gdpfc_{t-1}} - 1 \quad \textbf{(154)}$$

2. Table of results: HEALTH EXPENDITURE AT CURRENT PRICES

Ministry of Health expenditure

Current expenditure on health as a proportion of total Government recurrent expenditure

$$PHRE_{t,mi} = \frac{HRE_{t,mi}}{GRE_t} \quad (155)$$

Capital expenditure on health as a proportion of total Government capital expenditure

$$PHCE_{t,mi} = \frac{HCE_{t,mi}}{GCE_t} \quad (156)$$

Total Ministry of Health expenditure as a proportion of total Government expenditure

$$PHE_{t,mi} = \frac{HE_{t,mi}}{GE_t} \quad (157)$$

National expenditure on health

Total

$$NHE_t = HE_{t,mi} + HE_{t,oth} + HE_{t,pr} \quad (158)$$

Total per capita

$$NHEC_t = \frac{NHE_t}{POP_t} \quad (159)$$

Total per capita in US$

$$NHEC\$ = \frac{NHEC_t}{RXCH_t} \quad (160)$$

Total as a percentage of GDP (factor cost)

$$PNHE_t = \frac{NHE_t}{GDPF_t} \quad (161)$$

Total government expenditure on health as a percentage of total government expenditure

$$PTGHE_t = \frac{(HE_{t,mi} + HE_{t,oth})}{GE_t} \quad (162)$$

3. Table of results: STRUCTURE OF HEALTH EXPENDITURE

Ministry of Health

Structure of expenditure (percentages)

Current expenditure

$$PHRE_{t,mi,} = \frac{HRE_{t,mi,}}{HE_{t,mi}} \quad (163)$$

Capital expenditure

$$PHCE_{t,mi} = \frac{HCE_{t,mi}}{HE_{t,mi}} \quad (164)$$

Structure of current expenditure (percentages)

Personnel

$$PHRE_{t,mi,1} = \frac{HRE_{t,mi,1}}{HRE_{t,mi}} \quad (165)$$

Drug expenditures

$$PHREDR_{t,mi} = \frac{(HRE_{t,mi,t,5} + HRE_{t,mi,6})}{HRE_{t,mi}} \quad (166)$$

of which imports

$$PHRE_{t,mi,5} = \frac{HRE_{t,mi,5}}{HRE_{t,mi}} \quad (167)$$

Other expenditure

$$POTHHE_t = \frac{(\sum_{jml,\ldots,4} HRE_{t,mi,j} + \sum_{jm7,\ldots,10} HRE_{t,mi,j})}{HRE_{t,mi}} \quad (168)$$

Structure of financing

Current expenditure (percentages)

DOMESTIC FINANCING

$$PHRED_{t,mi} = \frac{HRED_{t,mi}}{HRE_{t,mi}} \quad (169)$$

EXTERNAL FINANCING

$$PHREX_{t,mi} = 1 - PHRED_{t,mi} \quad (170)$$

Capital expenditure (percentages)

DOMESTIC FINANCING

$$PHCED_{t,mi} = \frac{HCED_{t,mi}}{HCE_{t,mi}} \quad (171)$$

EXTERNAL FINANCING

$$PHCEX_{t,mi} = 1 - PHCED_{t,mi} \quad (172)$$

total expenditure (percentages)

DOMESTIC FINANCING

$$PHED_{t,mi} = \frac{HRED_{t,mi} + HCED_{t,mi}}{HE_{t,mi}} \quad (173)$$

EXTERNAL FINANCING

$$PHEX_{t,mi} = 1 - PHED_{t,mi} \quad (174)$$

NATIONAL EXPENDITURE

Structure by sector (percentages)

Ministry of Health

$$PHE_{t,mi} = \frac{HE_{t,mi}}{NHE_t} \quad (175)$$

Other ministries

$$PHE_{t,oth} = \frac{HE_{t,oth}}{NHE_t} \quad (176)$$

Private sector

$$PHE_{t,pr} = \frac{HE_{t,pr}}{NHE_t} \quad (177)$$

ANNEX II
USER'S GUIDE TO SimFin

1. HOW TO INSTALL SimFin

1.1 Create a sub-directory in the directory where you installed Lotus 123[20] before. You could call this sub-directory **SIMUL**, for instance.

1.2 Copy the files from the SimFin diskette in this sub-directory with the following instruction :

A:> COPY *.* C:\LOTUS\SIMUL

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20 We suppose that Lotus (versions 3.1 or 4) is installed in a directory called **LOTUS.**

2. HOW TO START MicroFin

2.1 Go to the **LOTUS** directory:

C:\LOTUS

2.2 Start Lotus

C:\LOTUS\123

then hit the **ENTER** key

2.3 Once you are in Lotus, call the Menu by typing

/ or <

2.4 When you get the Lotus menu on the screen, select

DIRECTORY

2.5 Enter the name of the sub-directory where you copied the **SimFin** diskette by typing :

C:\LOTUS\SIMUL

2.6 Start first MicroFin. To do so, go back to the Lotus menu, then choose :

FILE then **RETRIEVE**

and select

MODELE.WK3

You will see the WHO logo while the simulation programme is downloaded.

2.7. From MicroFin's main menu, you may then choose between :

a) **INPUTS**

to enter, modify or consult data,

b) **RESULTS**

to consult results,

c) **SAVE**

to save your work or

d) **EXIT**

to exit the programme.

To choose one instruction from the menu, it is sufficient to type the initial of the selected instruction only. For instance, one can simply type **I** if one wants to go to the INPUTS section.

3. HOW TO USE MicroFin

The programme allows the user to analyze the functioning of health services at different levels including their administration. Different menus lead the user to these different components.

3.1 General principles of MicroFin

a) The model allows the user to make projections over a 10-year period.

b) A first step is to enter the base year data. Select a baseline year for which there is a sufficient amount of information available.

c) Secondly, objectives to be reached by the end of the 10-year period have to be set by the user.

3.2 Data input

3.2.1 Health services categories and administration

a) MicroFin distinguishes four main components: health services at health centres, at district and/or regional hospitals[21], at national hospitals[22] and the administration. In turn, the latter is composed of administrative services at the level of the district, the region, and the centre.

For each of these categories, base year data and the objectives to be reached at the end of the period have to be entered.

REMINDER

Base year information includes data applicable at the national level, as well as data specifically related to various categories of health facilities. For each of these categories, we consider only the "average" facility.

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21 In MicroFin, we call these "Hospitals of level II and III".

22 In MicroFin, these are also referred to as "Hospitals of level IV".

3.2.2 Order of data entry

a) As far as baseline data are concerned, the user may choose to start working on any component.

REMINDER
Objectives need to be entered as the last step of the user's input (i.e. after having entered national data and "average" data related to health facilities.

b) Depending on the configuration of the Lotus software you are using, decimal numbers must be separated by either :

(i) a full stop, for instance : 0.10 or 123.5
or
(ii) a coma, for instance : 0,10 or 123,5

To enter a percentage, only type the number followed by the % sign.
For instance, 15 percent is typed in as : **15 %**

c) All monetary values must be entered in national currency units.

3.2.3 How to return to the main menu of MicroFin ?

When you are in a submenu of a health facility category or of administration, press

EXIT

then press **RETURN** to return to the main menu of MicroFin menu.

REMINDER
Wait until you see the main menu on the screen before inputting data or giving new instructions to MicroFin.

3.3. Results

a) The command

RESULTS

from the main menu will trigger the execution of the calculations in MicroFin. The user is requested to wait for a few moments during the calculation procedure.

REMINDER

Only launch the RESULTS command when all the baseline data and objectives have been well entered. The results are shown in a table form. You should in no way try to enter data into these tables.

b) You may go through the table with the arrows displayed on the keyboard, as well as with the **HOME** and **END** keys.

To leave the results tables, hit the **ENTER** key twice.

c) When you work with a **RESULTS** table, you may display the corresponding graph by pressing **INS**.

To leave the graph, press **INS** again. You can exit the table by hitting the **ENTER** key twice.

d) All the results are displayed in millions of national currency units and in constant prices. You may print selected results with the **PRINT** command.

e) In the case of consolidated results[23], you may consult specific graphs by selecting **OPTION**.

To leave these graphs, press the **INS** key again.

REMINDER

Before launching the **PRINT** commands, make sure that the printer's name and characteristics were properly selected when installing Lotus. Also make sure your printer is switched on.

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23 These can be found in the submenu "For all health services"

3.4 Save and exit commands in the main menu

You have to use the

SAVE

command every time you wish to keep the changes or the data you have just entered.

If you do not wish to save them, then leave your work with the command

EXIT

3.5 Switching between menus

Switching from lower-level menus (submenus) to highler-level menus can be done by pressing

EXIT

or

RETURN

depending upon the level of menu the user is currently using.

3.6 Specific elements to take into account while working with the MicroFin components

3.6.1 HEALTH CENTRES

3.6.1.1 Information for the base year

The model enables the user to consider up to four different categories of health centres.

REMINDER
The use of the first category of health centre is compulsory; the use of the other categories is optional.

When the user does not wish to use the optional categories, he/she may only have to type 0 as entry in each type of health service and 0 for the population covered. Data for each category of health service is entered into one line. Within that line, all the information has to be filled in.

Some inputs are optional, and therefore 0 could be entered as a value. In particular,

(i) *related to health services*: deliveries and IEC activities may be nil; however, values for the other activities need to be different from zero.

(ii) *related to health personnel*: the numbers of doctors, midwives, nurses and non-medical may be nil; for all other personnel, data different from zero need to be entered.

3.6.1.2 Objectives

If levels 2, 3 and 4 are not utilized, the values of the columns in the corresponding objectives show **ERR**, but the user should not worry about that as it has no effect on final results.

3.6.2 DISTRICT AND REGIONAL HOSPITALS

a) Two categories of hospitals may be considered. However, MicroFin accepts that only one category is effectively used.

b) The second category is considered inexistent if the number of admissions or covered population is nil.

c) There are four in-patient departments .

REMINDER
The user needs to input data for all four in-patient departments.

Apart from the four in-patient departments, other departments are defined. However, the user does not have to put in data for those necessarily. It is the case for the radiology department and ambulance service, and for the catering department.

Except for the radiology department, the ambulance service and the catering department,

- there must always be at least one health service item, i.e.:
  . a surgical operation (in the operating theatre)
  . a consultation (in the outpatient department)
  . a laboratory examination (in the laboratory).
- there must always be at least one bed in each of the four in-patient departments.

Note also that within any hospital department, it is possible that the total of personnel, in any of the qualification categories, is nil.

3.6.3 NATIONAL HOSPITALS

a) Up until 10 in-patient departments can be taken into account. The user should enter the data for each department one after the other.

REMINDER
Data input is required for the first 7 in-patient departments.

b) If an in-patient department does not exist, please :
- put a zero in the number of admissions and of beds for the base year;
- give 0 % as objective for the admissions if you do not want this department to exist at the end of the period.

c) Ambulance and catering services are optional: all related information can be set at zero.

d) All other hospitals departments are supposed to exist. Therefore, there must be at least one health service, in other words at least one surgical intervention, one external consultation, one laboratory test, one radiology act, one urgency intervention, and one dental exam per year.

3.6.4 ADMINISTRATION

In principle, all data need to be entered. However, in the case of district and regional administrations, one does not have to enter necessarily data for:

- senior administrative staff (except for District Medical Officer or Regional Medical Director)
- clerical staff and service personnel.

4. HOW TO START MacroFin

4.1 Go to the **LOTUS** directory :

C:\LOTUS

4.2 Start the Lotus programme:

C:\LOTUS\123

then hit the **ENTER** key

4.3 Once you are in Lotus, call the Menu by typing

/ or <

4.4 Enter the name of the sub-directory where you have copied the **SimFin** diskette by typing:

C:\LOTUS\SIMUL

4.5 Call back the Lotus Menu, and choose :

FILE then **RETRIEVE**

and select :

EN_MACRO.WK3

to start the model.

4.6 A screen is displayed, informing the user that he has two options. Either the user presses

DIRECT

if he does not wish to establish a link with the results produced by MicroFin. In this case, he needs to enter all budget data related to the Ministry of Health himself.

Or he chooses

LINK

in which case he establishes a link with MicroFin: budgeted expenditure by the Ministry of Health (except for training, maintenance and investment) will be entered into MacroFin automatically.

REMINDER

1) Before choosing the **LINK** option, the user should make sure that:

- first, MicroFin files are kept *in the same sub-directory* as the file he is currently using;

- second, the data necessary for MicroFin have been entered before and that a simulation run has been performed.

2) Should the user wish to use again MacroFin in its **DIRECT** way, he will have to exit the current work and start a new session.

5. HOW TO USE MacroFin

5.1 The main menu

The menu commands can be invoked by typing simultaneously the **ALT** key and **the appropriate letter.** For instance, to start entering the data about population, type :

ALT A

5.2 General principles on how to use the model

a) It can be used over a ten-year period.

b) A certain number of baseline data have to be entered, as well as growth rates and parameters for the simulation period, in order for the model to produce results.

c) Select a baseline year for which there is a sufficient amount of information available.

REMINDER

If the user chooses the option **LINK,** he should be careful to use data concerning the same base year as the one used in MicroFin.

5.3 Data input

5.3.1 Entering the data

REMINDER

1. Follow all the indications displayed in the command panels or on the screens (coloured boxes).
2. Carefully read all the menus and contents of information boxes on top of the screens.
3. Wait until the main menu comes back after exiting a screen.

5.3.2 Order of entering the data

The base year (**ALT Y**) ought to be entered at the beginning of your work.

Moreover, it is necessary to enter the data concerning the utilization of GDP (**ALT R**) and the values added (**ALT V**) before working on the utilization of GDP in percentage (**ALT G**). In addition, it is necessary to enter the data concerning the values added (**ALT V**), utilization of GDP (**ALT R**) and taxations (**ALT T**) before proceeding to the taxation rates (**ALT U**).

5.3.3 Units

Baseline values are generally in form of amounts, rates or percentages.

The baseline population size is entered in millions of inhabitants.

All the monetary values must be entered in millions of units of the national currency, and at current prices of the base year. There is only one exception, namely : imports of drugs in the Ministry of Health expenditure (**ALT H**) have to be entered in million US$, and at current prices.

5.3.4 Entering percentages and decimal numbers

To enter a percentage (or a rate), the user only has to type the number followed by the % sign, for instance :

fifteen percent is typed : **15 %**

Depending on the configuration of Lotus, decimal numbers have to be separated by:

- (i) either a full stop, for instance : 0.10 or 123.5
- (ii) or a coma, for instance : 0,10 or 123,5

5.3.5 How to return to the main menu of MacroFin

To quit entering, you have to hit the **ENTER** key twice, which enables you to leave the screen on which you are working and to return to the main menu.

REMINDER

Wait until the screen with the main menu is shown before you launch a new operation.

5.4 Display and consultation of results

a) Commands in the "Results" section of the Main Menu allow you to display the various results.

b) The results are displayed in tables and graphs. Results are usually expressed in millions, in currency units per capita, in rates or percentages.

REMINDER
Do not try by any means to enter data in the results tables or in the graph.

c) Move into the tables with the arrow-keys as well as with **HOME** and **END.**

To exit the results, in the tables or in the graph, hit the **ENTER** key twice.

5.5 How to print

In the results section of the Main Menu, you may ask for a printout of the tables or graph by selecting the corresponding keys, i.e. : **ALT** simultaneously with one of the letters **F, J, K** or **N.**

WARNING
Before launching the print commands, make sure that the printer's name and characteristics were properly selected when installing Lotus. Also make sure your printer is switched on.

5.6 How to save results and exit the main menu

You have to use command

ALT S

every time you wish to save the data and results obtained, or

command

ALT Q

every time you wish to exit without saving changes.

5.7 Specific elements to take into account while working with the MacroFin components

5.7.1 Information for the base year

Generally, the information is to be entered in the first column in millions of units, except for the exchange rates (**ALT X**).

You may *not* enter baseline data in the following cases :

(i) UTILIZATION OF GDP (in %) (**ALT G**)
because the baseline data are calculated automatically by the model via data entered before.

(ii) TAXATION RATE (**ALT U**)
because the baseline taxation rates are calculated automatically as well, via data on taxation revenues entered before.

(iii) PRICE INDEX (**ALT P**)
because, by default, for the base year, these indexes are equal to 100.

5.7.2. Growth rates

a) Growth rates are:

(i) either *variable* over the simulation period: in this case you enter them year by year;
(ii) or are *fixed* throughout the whole period: in this case you only enter one rate.

You may select these options by entering the parameters **1 or 0** in the appropriate column.

b) Moreover, in two cases it is possible to perform a simulation run, assuming that the future growth rates are equal to the real growth rates of GDP. They are :

(i) GOVERNMENT EXPENDITURE (**ALT E**)
(ii) MINISTRY OF HEALTH EXPENDITURE (**ALT H**)

The parameter **1** must be entered in the appropriate cell to activate this feature. In this case therefore, the user no longer has to enter variable or fixed growth rates.

c) Only baseline data may be entered in the following cases:

(i) UTILIZATION OF GDP (**ALT R**)
(ii) TAXATION (**ALT T**)

5.7.3 Cases where no data should be entered

You may not enter data for the base year or the subsequent years in the following cases:

(i) in EXCHANGE RATES **(ALT X)**

When the Purchasing Power Parity (PPP) feature is activated, the resulting exchange rates are displayed on the top of the screen in a special information box. To activated this particular feature, the value **1** needs to be entered in the appropriate cell.

(ii) in GOVERNMENT EXPENDITURE (**ALT E**)

Total operating expenses are calculated automatically by the model and displayed.

(iii) in MINISTRY OF HEALTH EXPENDITURE (**ALT H**)

Total operating expenses are calculated automatically by the model and displayed.

5.8 Link between MicroFin and MacroFin

a) If you choose the **LINK** option, you do not need to enter the majority of current Ministry of Health expenditure, since these are imported from MicroFin.

b) The MacroFin user gets access to the Ministry of Health expenditure projected via MicroFin by pressing

ALT W

The imported data are displayed in red. The user can not modify them.

6. OTHER QUESTIONS

6.1 How to get a print-out ?

When you wish to print results, you only have to check that your printer is ready. The programme automatically proceeds to the necessary print configurations in Wysiwyg. By default it selects the printer placed in first position set by the Lotus 123 configuration during installation.

If you wish to use a different printer, you will then have to launch the Lotus 123 Installation procedure and modify the configuration so that that particular printer is put in first position.

Whatever printer you choose for your print-out, it will remain valid for all the other print-outs of the model.

Using the Wysiwyg menu, you may decide which option you want to select for :

- paper size
- paper orientation (portrait or landscape)
- compression (nil, automatic or manual).
- print definition (draft or final).

Of course, you have to select these options **before** launching SimFin.

6.2 How can Lotus 123 recognize your computer equipment ?

Launch Lotus 123 by typing **LOTUS**.

The Lotus 123 access menu is displayed, choose **INSTALL**.

Choose **CHANGE SELECTED EQUIPMENT** from the main menu, then,

MODIFY CURRENT DCF, then

CHANGE SELECTED PRINTER.

Once you have selected the printer you want to rank first, choose :

RETURN TO MENU

then

SAVE CHANGES

6.3 How to use the special keys ?

a) To quit a particular screen or results :

hit the **ENTER** key twice.

b) To move within a particular screen and within the results tables,

(i) use arrows ← , → , up, down

If you are in the results tables, the arrows will allow you to move from one cell to the other only.

Generally speaking, if you want to return to the beginning of your table when you are on the last entry, press the → arrow

(ii) use **HOME** and **END**

In all cases, keys **HOME** and **END** will respectively position the cursor to the first and the last data.

c) To modify data without having to re-enter them completely, you may use the function key **F2**.