

Special Initiatives
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Volume II

**National Health
Accounts and
Health Sector
Finance Reform
Model: Framework,
Model Specification
and Calibration
Exercises**

May 2000

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Partnerships
for Health
Reform



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Partnerships
for Health
Reform

Mission

The Partnerships for Health Reform (PHR) Project seeks to improve people's health in low- and middle-income countries by supporting health sector reforms that ensure equitable access to efficient, sustainable, quality health care services. In partnership with local stakeholders, PHR promotes an integrated approach to health reform and builds capacity in the following key areas:

- > *Better informed and more participatory policy processes in health sector reform;*
- > *More equitable and sustainable health financing systems;*
- > *Improved incentives within health systems to encourage agents to use and deliver efficient and quality health services; and*
- > *Enhanced organization and management of health care systems and institutions to support specific health sector reforms.*

PHR advances knowledge and methodologies to develop, implement, and monitor health reforms and their impact, and promotes the exchange of information on critical health reform issues.

May 2000

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Abstract

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Table of Contents

Abstract.....	v
Table of Contents	vii
Acronyms	ix
Acknowledgments	xi
Executive Summary.....	1
1. Introduction.....	1
1.1.1 Purpose of collaboration.....	2
1.1.2 Purpose of this paper.....	2
1.1.3 Overview of the report	2
2. Concepts and Definitions	5
2.1 Introduction.....	5
2.2 Differences between NHA and HSFRM.....	5
2.3 Definitions to support a NHA and Health Financing Reform Analysis	6
2.4 Extended National Health Accounts Definitions	10
2.5 Flow of Funds	12
3. Specification of the Health Sector Finance Reform Model.....	15
3.1 Structure and Functions of the Model.....	15
3.1.1 Functionality of the Model.....	15
3.1.2 Description of the Model.....	16
3.1.3 Entities in the Service Use Module	18
3.1.4 Entities in the Finance Module	21
3.2 Operations of the Health Sector Finance Reform Model.....	26
3.1.4.1 3.2.1 Forecasting Operations of the Service Use Module	28
3.1.4.2 3.2.2 Operations of the Finance Module	30
3.1.4.3 3.2.3 Interactions between the Service Use Module and the Finance Module	30
3.1.4.4 3.2.4 Specifying Policy Options in the Model.....	31
4. A Framework linking NHA and the HSFRM.....	33
4.1 Identities that link the NHA and HSFRM.....	33
4.2 Deriving NHA from the Health Sector Finance Reform Model.....	36
4.1.1.1 4.2.1 Data issues	36
4.1.1.2 4.2.2 Health System 1 – a fully private system.....	37

4.1.1.3	4.2.3 Health System 2: Insurance with private providers.	38
4.1.1.4	4.2.4 Health System 3 – multiple insurance options and public and private providers	40
5.	5. Calibration of exercises using Egyptian Data.....	44
5.1	Calibration Exercise 1 – deriving the 1995 National Health Accounts	44
5.2	Calibration Exercise 2 – School Health Insurance Program – Backcasting to 1991 ...	44
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Acronyms

PHR	Partnerships for Health Reform Project (USAID)
USAID	United States Agency for International Development

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Acknowledgments

I wish to thank my HIC colleagues, Afsar Akal and Katherine Burchfield, for their contributions in preparing this paper and acknowledge the contributions of Dr Peter Berman of the International Health Systems Group and Dr Nandakumar of Abt Associates Inc. in finalising the conceptual framework on which this paper is based.

Executive Summary

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on the work synthesized in this report.

Introduction

National Health Accounts provide a detailed overview of the sources and uses of funds within the health sector of individual countries. They have been used to describe the changes in both sources and uses of funds that have occurred over time and have been used by policy makers and researchers to aid decision making in the health sector. Comparisons of National Health Accounts for different countries have been carried out by researchers to describe and analyse the different rates of growth in health expenditure and different health outcomes experienced by these countries.

To develop a set of National Health Accounts (NHA) generally requires collecting a large amount of administrative by-product data, analysing survey data, cross comparisons of survey and administrative data, one-off studies, and synthesis of available data sources to estimate data that is not otherwise available. The NHA software developed by the International Health Systems Group (IHSG) of the Department of Population and International Health, Harvard School of Public Health under the Data for Decision Making Project can be used to assist in this process. However, often only a small amount of the data collected in this manner is eventually used in standard National Health Accounts tables.

In many of the countries undergoing health sector reform, National Health Accounts studies have been carried out, formally or informally, in the period when alternative reform models are being considered. In these countries the emphasis is not so much on understanding the dynamics of the old system, as being able to predict the likely consequences of alternative models of funding and organising their systems.

While working on health sector reform issues in several developing countries, the Health Insurance Commission (HIC) has developed the Health Sector Finance Reform Model (HSFRM) to assist in modelling the consequences of introducing alternative financing and organisation arrangements. In Romania the HIC undertook a formal National Health Accounts study as part of the data collection activities required to develop the HEROM (the Romanian health financing model, which was developed to model the consequences of the Health Insurance Law legislated in 1997). HEROM was based on the Generic Health Financing Model (GHFM), which was a generic model developed by the HIC following work on health sector reform in Turkey.

It was apparent to the Harvard School of Public Health and the HIC that there would be benefit to both parties to jointly explore the integration of a National Health Accounts approach and the Health Sector Finance Reform Model. Both activities are carried out to inform policy makers of the consequences of undertaking different health policies.

One of the key benefits of this Collaboration is expected to be the definition of an **Extended National Health Accounts Minimum Dataset**, which can be used to both develop the National Health Accounts and to drive the Health Sector Finance Reform Model. The definition of this Minimum Dataset will allow the maximum value to be obtained from the National Health Accounts studies, by indicating how information collected to generate a set of National Health Accounts can be organised or augmented to support the operation of the Health Sector Finance Reform Model. In many cases, data needed for the development of National Health Accounts will be accompanied by data of great value for modelling purposes. Data sources that hold health expenditure data can also contain information on utilisation of services and sometimes on the characteristics of users of these

services. For example, health insurance organisations can often provide data on costs, service use and characteristics of users.

- **Purpose of collaboration**

Potential exists to enhance the usefulness of National Health Accounts data by linking it to an analytical model such as the Health Sector Finance Reform Model. Similarly, the usefulness of the HSFRM will be enhanced if it can be adapted to use data that are routinely collected in the compilation of National Health Accounts.

This collaborative project provides an opportunity to explore the types of policy analyses that can be carried out using existing NHA data and to identify the value to be gained by routinely collecting additional data items in an Extended National Health Accounts data set.

- **Purpose of this paper**

The purpose of this paper is to:

- > develop a common set of definitions and terms that can be used to describe the relationship between the National Health Accounts and the Health Sector Finance Reform Model;
- > describe the conceptual and mathematical relationships between the NHA and Health Sector Finance Reform Model;
- > identify the additional policy analyses that could be conducted by defining an Extended National Health Accounts Minimum Data Set.

- **Overview of the report**

The remainder of the report consists of four sections.

Section 2 reviews the concepts that underpin both the National Health Accounts and the Health Sector Finance Reform Model, an explanation of some of the key differences between NHA and the model, and definitions of key entities that are common to both.

Section 3 describes the specification of the Health Sector Finance Reform Model. A detailed specification of the functionality of the model and a description of the entities and relationships in the two main modules that comprise the model is provided in Section 3.1. Section 3.2 describes the operations of the Service Use Module and the Finance Module and the interactions between them.

In Section 4, the framework that links the National Health Accounts and the Health Sector Finance Reform Model is outlined. The identities that underpin the two, and how the National Health Accounts can be evidence-based derived from the basic inputs to the Health Sector Finance Reform Model are explored, along with related data issues.

Section 5 describes the Calibration exercises that could be undertaken to demonstrate the capacity of the Health Sector Finance Reform Model. The first Calibration exercise uses the inputs to the Model to generate National Health Accounts data for the base year, 1995. The second exercise

would seek to 'backcast' the data to generate the Egyptian National Health Accounts in 1993, before the introduction of the School Health Insurance Program, by starting with the 1995 National Health Accounts (generated after the School Health Insurance Program was introduced).¹

¹ In retrospect, it was not possible to undertake the second Calibration exercise, as the data and methods used to generate the published 1993 Egyptian NHA matrices were not comparable with the 1995 matrices.

Concepts and Definitions

Introduction

The purpose of National Health Accounts (NHA) is to:

- > measure *expenditure* on ‘health’ (discretionary health services, personal health services, personal and population promotion and prevention programs, and health related activities such research and administration) in any year; and,
- > show the *uses* of these funds: who the funds are spent on, for what purposes, and how much goes for recurrent and capital purposes.

Analysis of National Health Accounts over time allows the changes in health expenditure to functions and users to be analysed and compared with desired policy directions.

The purpose of the Health Sector Finance Reform Model (HSFRM) is to *project health expenditure, service use and resource use*, by health care providers and by functions, by user groups and by regions. The projections are based on defined policy options, explicit behavioural assumptions, and assumptions about rates of change of key parameters.

Outputs from the HSFRM allow comparisons of the impact of alternative policies and production of a separate set of National Health Accounts for each policy option.

Differences between NHA and HSFRM

There is not a one-to-one relationship between elements of the National Health Accounts (or Extended National Health Accounts) and the Health Sector Finance Reform Model.

The NHA are generated from historical data and are used to describe an equilibrium situation where service use is known (and hence supply and demand are balanced) at the point where the costs of services provided are equal to the funds available to pay for them. The balance of funds may be achieved through changes in financial reserves held within the health system (such as increases or decreases in health insurance reserves) or through changes in the level of bank balances of health sector organisations.

National Health Accounts do not directly consider issues of physical resource availability, and are generally not concerned with distribution of resources either geographically or across population groups.

The Health Sector Finance Reform Model is designed to balance supply and demand both for physical resources and financial resources and examine issues concerned with the distribution of costs and resources across geographic and population groups. It projects future demand for services and the costs of providing these services. Policy options that provide different sections of the population with specific entitlements to services or to health financing can be modelled. The model also projects the

supply of services that can be produced to meet this demand from the physical resources available, and the amount of financial resources available to pay for these services.

The generic model has several algorithms that allow a balance to be found between supply and demand in each year and a range of policy options can be modelled to examine the consequences of balancing supply and demand in different ways.

Definitions to support a NHA and Health Financing Reform Analysis

There is no internationally accepted set of definitions of the entities that make up National Health Accounts, although work has been undertaken through the OECD, WHO, the Health Care Financing Agency and the Harvard School of Public Health in the USA on developing a common set of definitions. Many countries have NHA frameworks that suit their particular national policy and analytical requirements.

Table 2 outlines the set of definitions to be used in National Health Accounts and for the Health Sector Finance Reform Model, based on four levels. The first two levels of definitions are generic, and can be applied in all countries; whilst the third level is robust enough to be used in most countries. Definition of the fourth level is incomplete, as some of the classification issues raised at that level have not been finalised in any country.

The definitions seek to clarify the roles of different entities in the financing and provision of health services. In some cases an entity may carry out a number of different roles and hence may appear at several levels of the classification system.

This system of definitions seeks to extend the work on definitions for NHA already undertaken by HSPH, and to formalize the definitions required for the Health Sector Finance Reform Model. The classification of Sources of Funds and Uses (and Users) of funds is not proposed as a definitive classification. However, the HIC's experience working on National Health Accounts development and health sector reform analysis in a number of countries suggests that the entities defined in Table 2 can be identified in the majority of countries. In practice, data limitations usually require that compromises are made in both the presentation of National Health Accounts and in the type of health sector reform modeling that can be undertaken.

Both National Health Accounts and health finance reform analysis are concerned with the flow of funds and resources from initial sources of funds to end users within the health sector. Funds generally flow from:

Primary Sources—households, employers, Government (own sources), Aid and Loans, changes in reserves; through

Financing Agents (Secondary Sources)—health insurance organisations (public and private), Ministries of Health etc.; then to

Providers of services (Intermediate Uses)—hospitals, clinics, pharmacies etc; and finally to

Final Uses (Users of services, factors of production etc).

While there may be some variations to this flow of funds and resources, it is sufficiently general to be used as the basis for defining the entities in NHA and health finance reform analysis.

The definition of National Health Accounts is the classification of health *expenditure* by *sources* and *uses* of funds. The **generic format** for presenting National Health Accounts is as a matrix, which depicts Expenditure (money units), classified by Sources and Uses, for a specific country for a specific year.

Table 1. Health Expenditure Classified by Sources and Uses for Country A, Year.

		Sources			
Uses					

National Health Accounts Tables can present Health Expenditure (in money units) using **any combination** of Sources by Uses, although in practice it may not be possible to show data for every combination as it may not be possible to trace the links between every source and use defined. Sources and Uses are defined below and summarised in Table 2.

Sources of Funds: A *source of funds* is an entity whose primary role is the raising and/or distribution of funds for the provision of health services. A distinction is made between Primary Sources and Secondary Sources.

Primary sources: entities that raise the funds that are distributed to secondary sources (Financing Agents) or to *users* of funds.

Primary sources are:

- > Government sources (Ministry of Finance, Social Security);
- > Employers (public and private);
- > Households;
- > Loans and Aid.

Secondary sources (Financing Agents): entities that receive funds from a primary source and distribute funds to the *users* of funds (or *providers* of services).

Secondary sources are:

- > Ministry of Health;
- > Other Government including Social Insurance;
- > Private Insurance;
- > Non-government health service agencies;
- > Households

Uses of funds: The uses to which funds are put in *providing services* directly to individuals or population. Uses of funds are classified according to:

Provider Organizations:

- > Hospitals (government, private not-for-profit, private for-profit, community etc);
- > Clinics (government, private etc);
- > Private practice providers (doctors, dentists, other professionals);
- > Nursing homes (may be included or excluded);
- > Pharmacies;
- > Administration;
- > Research.

Functions:

- > Population based preventive and promotive care
- > Personal preventive and promotive care²
- > Ambulatory care *
- > Ambulatory (outpatient) *
- > Inpatient (acute, rehabilitation, palliative) *
- > Administration
- > Research

Resources:

- > Labour (Doctors, Nurses; Dentists; Pharmacists; Allied health workers, Technical and Other health workers);
- > Drugs;
- > Medical and Other Supplies;
- > Equipment;

Users of service (this is different to the above *uses* classifications, since each one of the categories below needs its own classification system):

- > Socio-economic status (eg. households by income quintile);

² These functions are also referred to as Services

- > Demography (M/F; age by group, or by specific age intervals <1, 1-4,5-14 etc; ethnicity);
- > Region (Rural/Urban)
- > Health status/disease class/health program (Diabetes, Cardiovascular, etc).

Some of the entities defined above may need to appear more than once in the Flow of Funds hierarchy. An entity may be both a primary and second source of funds, or both a source of funds and a use of funds, if very little is known about the health sector. For example it could be possible to have the Ministry of Health appearing as both a source of funds and the provider of services, but this should be avoided wherever possible.

Table 2. Proposed generic classification of Sources and Uses of funds

Level 1	Level 2	Level 3	Level 4
Sources	Sources – Primary	Government Households Employers (public and private) Loans, AID	Country specific classifications
	Sources – Secondary Financing Agents/ Financial Intermediaries	Ministry of Health Other Government (Incl. Social Security) Private Insurance Non-Government health service agencies Households	
Uses	Providers	Hospitals Clinics Private practice providers Pharmacies Administration Research	e.g. Hospitals – Govt; Private-for-profit, Private-not-for-profit; etc Private providers - GPs, specialists, diagnostic services etc.
	Functions (Functions marked with * can also be referred to as Services (or Personal Services).	Ambulatory care * Personal preventive and promotive care * Population based preventive and promotive care Inpatient care * Research Administration	e.g. Acute inpatient care, acute, rehabilitation, palliative. Acute inpatient care may be further classified by DRG, ICD etc.
	Resources	Labour Drugs Medical Supplies Other Supplies Equipment Other	Labour: Doctors, nurses, pharmacists etc.
	Users	Demography – Age/sex Socio-economic Geographic/Regional Health program.	

Note: 'Level' refers to the level of classification of data within the framework. The full range of possible National Health Accounts matrices is shown in Table 3.

The most commonly used National Health Accounts tables are Sources to Financing Agents and Financing Agents to Providers, since these involve direct transfers of resources. In general, Financing Agents do not directly fund the Service elements of Functions. Some of the Providers that Financing Agents fund may provide only Administration or Research functions, but it is unusual that the health service providers that the Financing Agents fund will provide only inpatient services or only ambulatory services. It is possible to **derive** Financing Agents to Functions but this will often require significant assumptions to be made to associate specific Functions (especially services) with specific Financing Agents.

Table 3. Possible representations of National Health Accounts

Expenditure	
Sources	by Uses
Sources	by Financing Agents
	by Providers
	by Functions
	by Resources
	by Users
Financing Agents	by Providers
	by Functions
	by Resources
	by Users

In practice, some of these possible NHA matrices shown in Table 3 may not be obtainable. For example, in the case of Sources by Users it is often impossible or impractical to allocate funds from primary sources to Users, as the funds may flow through several intermediate levels.

Extended National Health Accounts Definitions

Extended National Health Accounts (ENHA) are defined as the classification by Source and Uses OR Uses and Use of:

- > *Expenditure* in money units; or,
- > *Quantities of services*; or,
- > *Quantities of resources*.

The generic form of ENHA is a matrix format (see Table 4), the elements of which are Expenditure (money units), Services (Units of service) or Quantities of Resources (units of resources), classified by either Sources and Uses or Uses and Uses, for a specific country for a specific year. NHA are a subset of ENHAs as they relate only the Expenditure classified by Sources and Uses.

Table 4. Health Expenditure OR Services OR Quantities of Resources classified by Sources and

Sources/Uses				
Uses				

In practice, the form of ENHA may be as 'n' dimensional arrays, as the Uses to which expenditure is applied may have more than one dimension. For example, an ENHA matrix could present expenditure by sources to health services by age, sex and region – thus requiring a four-dimensional array (source by age by sex by region). Table 5 provides a list of the most likely ENHA arrays that could be generated in the course of preparing a set of National Health Accounts and undertaking analysis of health finance reform.

Table 5. Main presentations of Extended National Health Accounts Data

Sources/Uses	Uses/users	Elements of ENHA matrix
Financing Agents	by Providers	E, QS, QR
	by Functions	E, QS, QR
	by Resources	E, QR
	by Users	E, QS
Providers	by Functions	E, QS, QR
	by Resources	E, QR
	by Users	E, QS
Functions	Resources	E, QR
	by Users	E, QS
Expenditure (E), quantity of services (QS) or quantity resources (QR)		

The main ENHA datasets that will be used in the Health Sector Finance Reform Model will be:

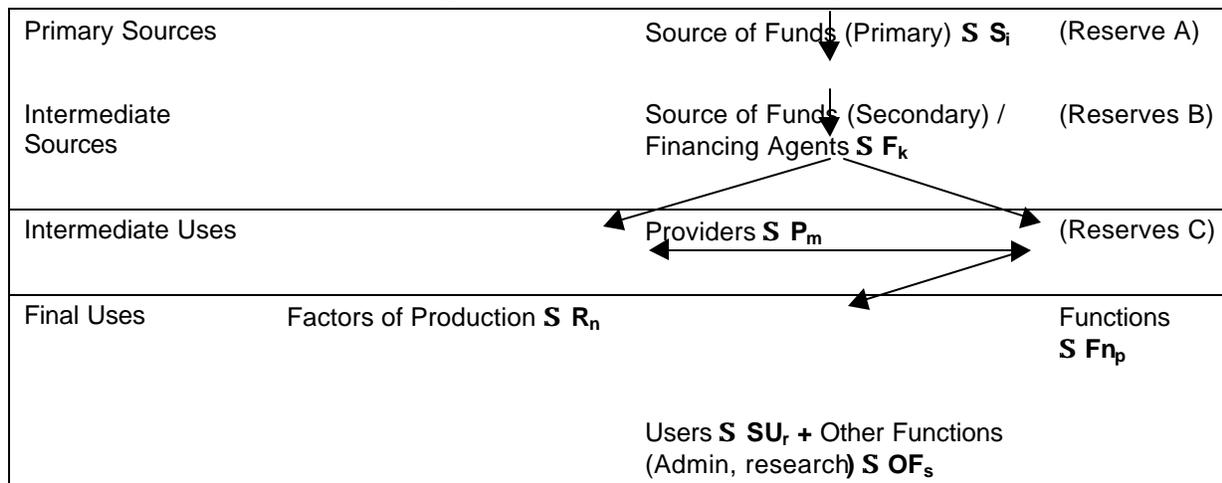
- > Sources * Financing Agents (\$)
- > Financing Agents * Providers (\$)
- > Financing Agents * Functions (\$)
- > Providers * Functions (\$)
- > Providers * Functions (Units of service)
- > Providers * Resources (\$)
- > Providers * Resources (Units of resources).

While it is possible to define many possible Extended National Health Accounts tables (such as Providers to Users), it is not always possible to directly measure the necessary expenditures or services.

Flow of Funds

The “Flow of Funds” hierarchy is used to describe how funds flow through the health sector from the primary sources to final uses. In any one year, the amount of funds flowing from sources to providers and to final users is constant, once allowances are made for changes in ‘reserves’ held by different stakeholders in the system. The ‘reserves’ in the system may be formal reserves such as those held by health insurance organisations, or in accounts held by provider organisations. The changes in reserves in any one year may be planned or unplanned changes. National Health Accounts include both Recurrent and Capital expenditure, and Depreciation of Capital Assets.

Figure 1. Flow of Funds Hierarchy



In the following discussion for simplicity three factors will be ignored that in practice must be incorporated into any analysis. These factors are:

- > changes in reserves held by different entities in the hierarchy;
- > flows of expenditure for Capital; and,
- > Depreciation allowances.

Recurrent Health Expenditure can be calculated by summing expenditure for any of the entities in the Flow of Funds Hierarchy. For National Health Accounts purposes these are Identities and are always equal since National Health Accounts deal with historical data.

$$\begin{aligned}
\text{Recurrent Health Expenditure} &= \text{Sum of Expenditure by All Sources } (S_i) \\
&= \Sigma S_i \\
&= \text{Sum of Expenditures by all Financing Agents } (F_k) \\
&= \Sigma F_k \\
&= \text{Sum of Expenditures by all Providers } (P_m) \\
&= \Sigma P_m \\
&= \text{Sum of payments to Resources } (R_n) \\
&= \Sigma R_n \\
&= \text{Sum of costs of Functions (mainly Services) at factor prices} \\
&\quad (Fn_p) \\
&= \Sigma Fn_p \\
&= \text{Sum of cost of Services to Users (at factor prices) } (SU_r) + \text{Sum} \\
&\quad \text{of Other Functions } (OF_s)(\text{Admin+Research}) \\
&= \Sigma SU_r + \Sigma OF_s
\end{aligned}$$

Specification of the Health Sector Finance Reform Model

The Health Insurance Commission has developed a conceptual framework that forms the basis of country specific computer models developed to assist in the analysis of Health Sector Finance Reforms. Section 3.1 describes the functionality of the computer models, whilst Section 3.2 describes the conceptual framework behind them.

Structure and Functions of the Model

- **Functionality of the Model**

The model:

- > is a computational tool that projects the use and costs of services, and the sources of revenue for defined policy options;
- > provides for projections for each policy option under differing sets of assumptions about changes in exogenous variables;
- > provides a set of tools to balance demand and supply where demand for services exceeds resource availability;
- > provides a set of tools to balance expenditure and revenue when these are not in balance;
- > provides standard reports on the performance of individual policy options and of comparisons of policy options using recognised performance criteria (such as equity of access and funding, sustainability of funding and resourcing) and it produces standard National Health Accounts as part of this output.
- > will estimate the trend values of the key variables that drive health expenditure, if time series data is available, and make Status Quo projections based on continuation of these trends.

The model does not:

- > generate the key behavioural assumptions, or the key economic change variables that drive changes in health expenditure. Assumptions about changes in behaviour and economic factors are *inputs* to the model.
- > provide a market clearing mechanism whereby prices for resources and services are simultaneously adjusted to provide balance in the markets for resources and services.

The outputs from the model are determined by the data (real or hypothesised) available to the model. If data is available on insurance status and income distribution within the population, then it is possible to undertake analyses related to these variables. If no income distribution data is available it is not possible to report on vertical equity issues associated with different policy options.

The model can also be to analyse the impact of alternative policy options given a range of assumptions about key, but unknown variables (either parametric analysis and/or sensitivity analysis).

- **Description of the Model**

Figure 2 shows the Health Sector Finance Reform Model. This model is derived from the Conceptual Framework developed for the Generic Health Financing Model. The GHFM included a Health Outcomes Module and a General Economy Module, but these are not included in the Health Sector Finance Reform Model as they do not relate to National Health Accounts data. The definitions and Terminology introduced to date are not sufficient to describe the Health Sector Finance Reform Model.

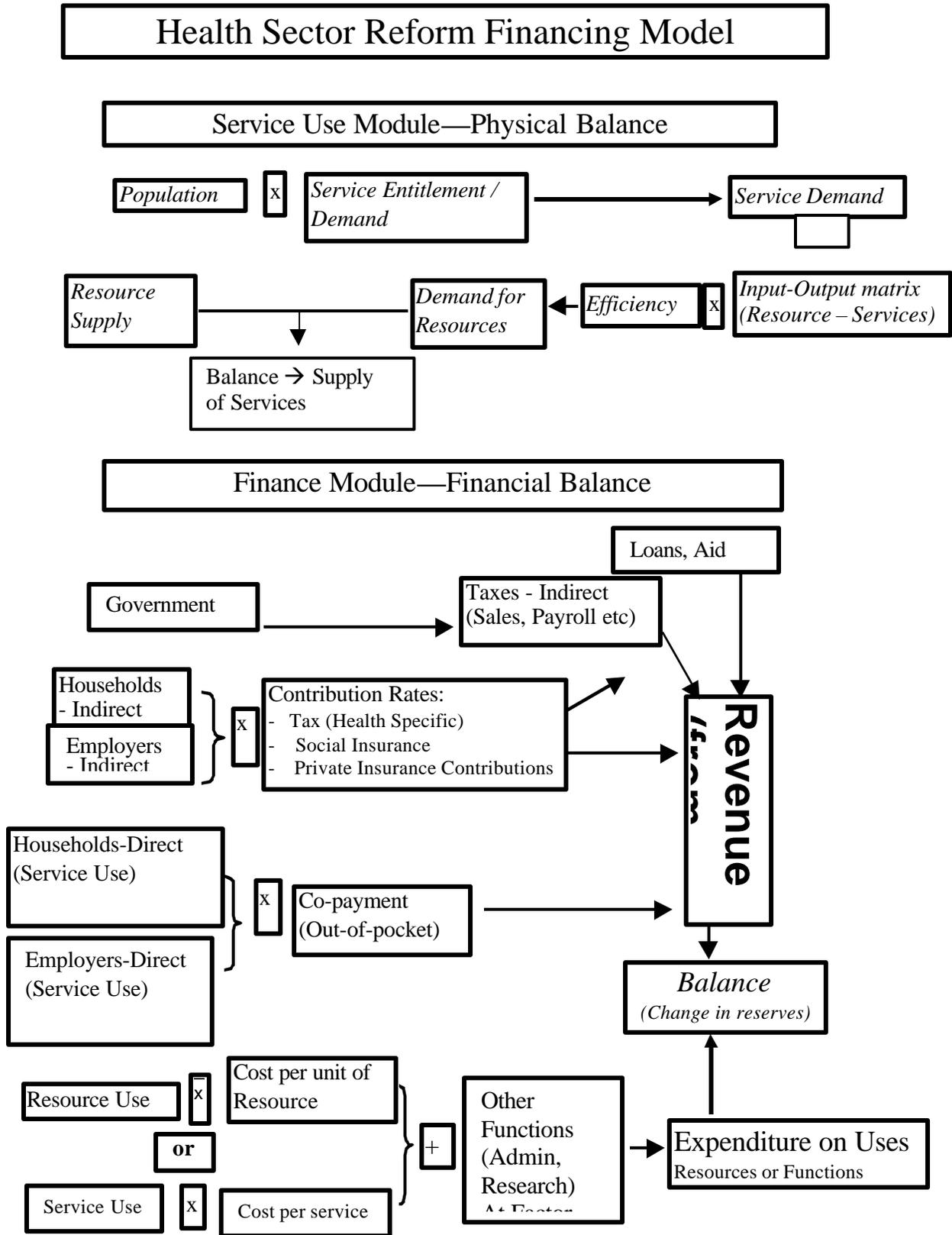
The Health Sector Finance Reform Model contains two modules – a Service Use Module and a Finance Module. The Service Use Module focuses on the capacity of the health sector to supply sufficient services to meet the demands placed on it in **future** years. It is concerned with achieving a Physical Balance – between the supply of services and the resources available to the system.

The Finance Module is more directly related to National Health Accounts since it deals with flow of funds from *sources* to *uses*. Its focus is on Financial Balance - how *balance* is achieved between the funds available from *sources* and the funds required to meet the *uses* for specific funders and providers (i.e., private sources of funds must meet the costs of private services, health insurance funds must pay for services used by insured persons, and government sources must pay for government provided services).

The two modules are linked by several key entities: *population* drives both modules; *resource use* limits supply of services in the Service Use Module and drives expenditure in the Finance Module; *service use* is determined by the interaction between supply and demand in the Service Use Module and both contributes to revenue as well as being a determinant of expenditure.

The following section will describe both the conceptual elements of the model and the data requirement issues. The level of analysis that can be carried out is determined by the data availability. If policy decision makers want to be able to answer questions relating to “access to services” and “equity of funding” under different policy options then information may be required on the age, sex, region and income groups in the population – depending on what level of analysis is required for policy purposes.

Figure 2. Health Sector Reform Financing Model



Notation: Most arrays in the Health Sector Finance Reform Model will be expressed in the form $\mathbf{aB(x)}_t$ or $\mathbf{AB(x)}_t$ where

The first ‘alpha’ character denotes generic operations:

* ‘demand for’ = **D** ‘supply of’ = **S** ‘use of’ = **U**

* ‘cost of’ = **C** ‘expenditure on’ = **E** ‘price of’ = **P**

The second ‘alpha’ character refers to specific entities:

* services = **S** resources = **R**

Upper and lower cases are used to distinguish between totals and rates. A lower case ‘alpha’ character indicates a rate (for example demand per person, units of resource per unit of service), whilst an upper case character represents a total (for example total demand for services, total resources used).

The character in brackets (x) indicates the policy option being considered. If (x) is omitted, the notation relates to the Status Quo – continuation of the current policy option.

The ‘t’ subscript refers to the time period to which the data refers. The time period $t = 0$ refers to the latest time period for which (comprehensive) data is available.

So $\mathbf{DS(1)}_3$ is Total Demand (denoted by the upper case first alpha) for Services (second alpha) under Policy Option 1 (in brackets) for time period 3 (subscript 3), while $\mathbf{dS(1)}_3$ is the demand per person (denoted by the lower case second alpha) for services under Policy Option 1 in time period 3.

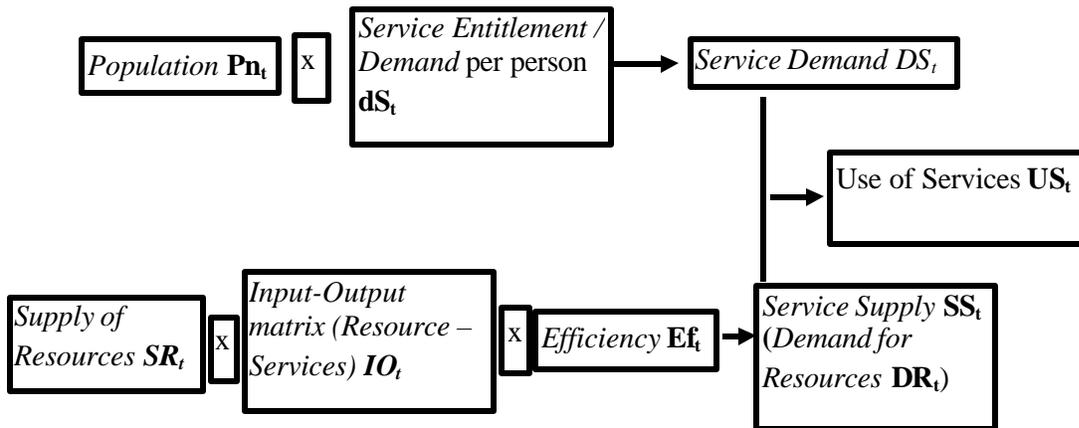
Most of the entities in the HSFRM are multidimensional and each entity should be followed by a dimension specification. For example, demand for services per person in year three of a Status Quo projection \mathbf{dS}_3 would probably be specified by service type*(provider)*age*sex*insurance status*income*region.

There are three exceptions to this notation: Population is denoted as **Pn**, the Input-Output array is represented as **IO**, and Efficiency is **Ef**.

- **Entities in the Service Use Module**

There are two alternative representations of the Services Module: the computational form shown in top half of Figure 2, or the descriptive representation shown here. The key entities in the module are defined in Figure 3, whilst Table 6 describes the entities in the model, the concepts behind the entities, and the data and calculation required to carry out the modelling. The following paragraphs describe the data dimensions (age, sex, income, region, insurance status etc.) that are generally relevant to most countries undertaking health sector reforms. The model can be ‘folded down’ to operate with a much-reduced data set – hence limiting the range of policy options that can be modelled – or it can be expanded to cover additional country specific issues.

Figure 3. Service Use Module



Population Pn_t estimates are required for each year of the projection, providing numbers of people by age, sex and insurance status, and by region and income.

Population Array = Pn_t (age*sex*insurance status*income* region) for each of the ‘p’ years of the projection ‘t=1..p’. [Note: Population does not follow the naming convention entirely since Population is represented by Pn – to distinguish it from Price = P].

Demographic data on population projections can be either input directly to the model from projections from national statistical agencies or generated within the model (assuming that base year data on population and mortality and fertility rates are available). If projections of population by income distribution and region are available they can be input to the model. Otherwise they can be input on a parametric basis and comparisons of the outcomes of different health policy options can be compared on the different assumptions about changes in income distribution over time.

Service Demand/Entitlement (per person) Ds_t . Service Demand per person in year ‘t’ is the combination of:

- > demand for services that is largely determined by the income of the persons and prices that they face for those services (allowing for insurance rebates etc); and,
- > entitlements, referring mainly to preventive and promotive services, and essential clinical services, which may be provided free as part of a public health program or as part of a basic package of services. The quantity of ‘entitlements’ can usually be specified by reference to the age, sex and health status of individuals in the population and are generally not subject to discretionary use by patients or overservicing by providers.

Table 6. Entities in Service Use Module

Entity (Array)	Concept	Dimensions
Population <i>Pn</i>	Population [Drives demand for services].	No persons *Age*sex*income*insurance status*region
Demand for Services / entitlement (per person) <i>Ds</i>	Demand – can be specified as demand for services determined by age, sex, income and insurance status. Entitlement – mainly specified for public health type programs where people ‘should’ use services – e.g. vaccinations, screening etc.	Service type*provider *Age*sex*income*insurance status*region
Demand for Service (Total) <i>DS</i>	Total demand for each class of service, and for each sector (public, private etc).	“ “ “
Supply of Resources (availability) <i>SR</i>	Total number of units of resources. [Resources can constrain the availability of services, by provider and by region].	Resource type* provider type*region
Input-output matrix <i>IO</i>	The quantity of resources (inputs) necessary to produce one unit of output (services), for a given organisational arrangement and level of efficiency.	Resource type * Service type* service provider* region (* policy option).
Efficiency <i>Ef</i>	A parameter that can be set (on the basis of comparisons with other systems) that indicates the level of efficiency at which each service and provider operates given the organisational arrangement and incentives that operate. [Health sector reform is often undertaken to improve efficiency. The reform can involve changes in incentives. Increased output may be produced from same combination of factors.]	Resource type * Service type*provider*region
Supply of Services <i>SS</i>	Conceptually, this is the total quantity of services that can be produced at defined levels of efficiency given the available resources – see Data Requirements..	Total services* service type* provider* region.
Use of Services <i>US</i>	Determined by the interaction of supply and demand, pricing of services, changes in organisation (I-O) and changes in efficiency.	Total services* service type*provider*age*sex *income*insurance status*region

This array has to be specified for each type of service (ambulatory, inpatient, personal preventive etc), for each provider or services (hospital, clinic etc), for each income group (since demand is determined by income), for each insurance status, and for age*sex groups (since many public health services are generally targeted to age groups) and for each year of the projection. Variation can also be allowed for demand and entitlements between regions. In general, the dimensions for demand for services per person in year ‘t’ are service type, provider, age, sex, insurance status and income.

Data on Service Use per Person in the Base Year ‘0’ Us_0 must be obtained from administrative source (for example, service use by insured people could be obtained from insurance organisations) or from household surveys. Public Health Authorities may specify entitlements to services, eg. vaccination schedules, recommended screening schedules for breast or cervical cancer.

Service Demand (total demand) in any projection year is a product of Population and Demand per person by service type. For the Status Quo, demand in year t is

$DS_t = Pn_t * Ds_t$ where DS_t is the total number of services demanded by service type* provider* age*sex*insurance status*income*region.

Service Supply – SS_t – is the total supply of services that can be produced from the available resources, which is part of the conceptual framework. As shown in Figure 2, SS_t is not calculated directly. Instead, the Demand for Resources is determined once Demand for Services has been calculated. Demand for Resources in year ‘t’ (DR_t) is calculated by dividing total demand for services in year ‘t’ by the Input-Output Matrix for ‘t’ (IO_t).

$$DR_t = DS_t / IO_t$$

If the supply of resources in ‘t’ SR_t is greater than or equal to DR_t , the demand for resources to satisfy demand in ‘t’, then the quantity of services demanded in year ‘t’ DS_t can be provided, and the use of services in year ‘t’ is US_t . If SR_t is less than DR_t , then mechanisms to reduce demand, or to increase productivity of existing resources, must be implemented, until $SR_t = DR_t$. Various mechanisms to balance supply and demand are included in the model.

US_t is total number of services use by service type, provider, age, sex, insurance status, income and region.

The resources and I-O Matrix can be either calculated from administrative data sources, from surveys or one-off studies. If no data is available on resources availability and on I-O relationships, the model can still run without having resources as a constraint. The Module can generate projections on the effect of aging, changes in insurance coverage, internal migration on demand for services.

- **Entities in the Finance Module**

The main entities and relationships in the Finance Module are shown in

Figure . Table 7 lists the entities and definitions in the module. The entities can be mapped fairly directly to National Health Accounts entities.

The National Health Accounts definitions include two levels of sources of funds: *primary sources* (Government, Households, Employers, and Loans and Aid); and *secondary sources* or Financing Agents (Ministry of Health, Social Insurance, Private insurance and so on). In the Finance Module, the four primary sources can be identified: Government, Household (Direct and Indirect), Employers (Direct and Indirect) and Loans and Aid. Financing Agents are not shown directly, but their existence is recognised, in part, by splitting the payments of Households and Employers into indirect payments (contributions to Social Insurance, Private Insurance etc) which would go to some of the Financing Agents, and direct (out-of-pocket) payments for health services. The indirect payments go to Financing Agents and would be included in country specific models.

Figure 4. Finance Module

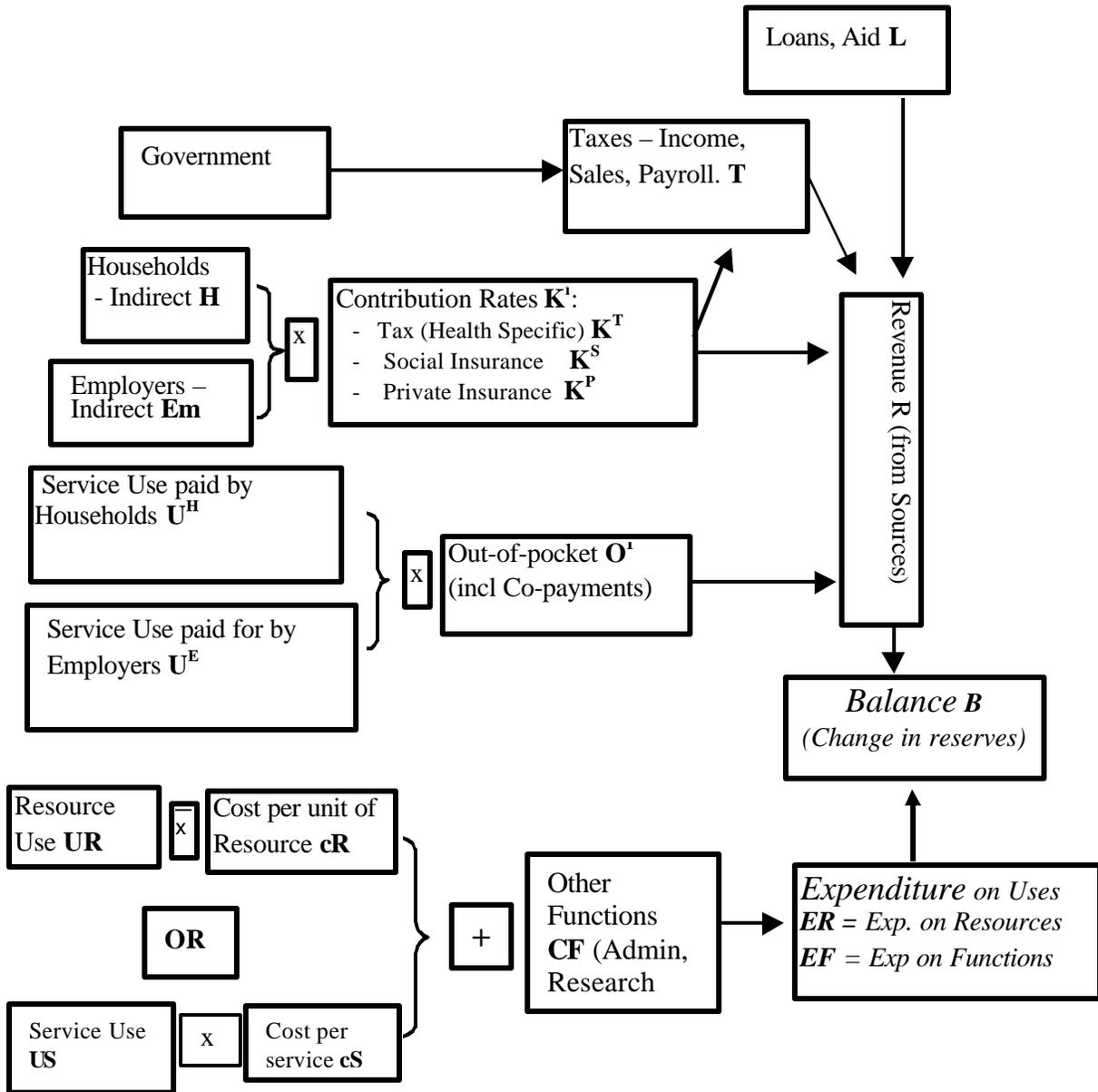


Table 7. Entities and Definitions in the Finance Module

Entity (Array)	Concept	Dimensions
Primary Sources	Defines the primary sources of funds to pay for health services and functions.	
Government T = taxes	Total contributions to Financing Agents from consolidated revenue (and not from health specific taxes and levies.)	Financing Agents *Direct and Indirect * individual/household income*region.
Households (Indirect) H Employers (Indirect) Em	The number of individuals/ households or employers that make health specific payments to tax, social security or insurance.	(Households/Individuals or Employers) * income* indirect source (private insurance, social insurance etc) * region.
Contribution Rates K^I where superscript I = Financing Agents - Health Specific Tax (T), Social Insurance S etc.	The contribution rates to health specific taxes, social insurance, private insurance.	Contribution rates* household/individual or Employers) * income* social insurance * insurance status. Financing Agents could be a dimension.
Use of services paid for by Household (Direct) U^H and Employers (Direct) U^E	Number of services for which Households/ individuals or employers make direct out-of-pocket payments.	Service type*provider type* social insurance status* insurance status* sources (Household/Employer).
Co-Payments (Out-of-pocket) O^I where superscript I denotes payments by H and E	The direct payment (Co-payments, out-of-pocket) per service for services may by households, individuals or employers.	Service type* provider type* social insurance status* insurance status
Loans, Aid L	Revenue provided through foreign Loans and Aid	Revenue * provider (*function* region).
Revenue R	Total revenues from all sources	Source*Financing Agents *Service type*provider type
Uses of Funds	Defines the uses of health funds	
Resource Use UR	The number of resources used in the provision of services and functions	Service type*provider type * region
Cost per Unit of Resource cR	Cost per unit of resource used.	Provider type*region
Expenditure on Uses – ER Exp on resources, - EF Exp. On Functions	Total Expenditure on Resources and Functions	Expenditure* resource type*provider* region Expenditure * function* provider* region
Service Use US	Total services used	Service type*provider type*region (* insurance etc if relevant)
Cost per Unit of Service Cs	Cost per Unit of service at factor costs.	Cost*service type*provider*region
Functions CF	Expenditure on non- service health related functions at factor costs.	Cost* non-service health related function*provider* region.
Balance B	Difference between revenue raised and expenditure on services or resources in year.	+/- expenditure*provider (and Financing Agent if modelled).

- **Primary Sources of Revenue**

Government T_t : Government is defined as a Primary Source of revenue in the National Health Accounts. Government contribution to the health sector from consolidated revenue (symbol T_t for Tax in year ‘t’) can be defined as an exogenous variable or can be modelled as a balancing item. T_t could be specified as an array with dimensions of Financing Agents, income, insurance status and region but this information is often difficult to obtain. This incidence of tax on households by income level is of value in determining the true distribution of the burden of health care costs on households.

Loans, Aid L_t : Revenue from Loans and Aid is generally determined externally to the health sector. It is treated as an exogenous variable also. It may be specified as an array having dimensions of service type, income, region, and health status characteristics.

Households and Employers are also defined as a primary source of revenue for the health sector. Both entities can contribute to funding health systems either indirectly, through Social Insurance, Mandated Health Insurance, Private Insurance and so on; or directly by paying for individual health services. Some of the indirect contributions will be to Financing Agents defined in the National Health Accounts definitions. It should be noted that the definition of Households in this context includes Individuals. The “Households” category may refer to either Households or Individuals depending on the institutional arrangements of specific countries. For most purposes H_t is equal to Population Pn_t .

Households Indirect H_t^I and Employers Indirect Em_t^I . This refers to the number of Households and Employers who contribute to indirect health funding arrangements. The dimensions of H will be by the criteria set by the Financing Agents and may relate to household income, employment status, region and age.

Contribution rates K^I : are the contribution rates of Households and Employers to specific Financing Agents: K^I_t defines the contribution to health specific taxes (such as the Medicare Levy in Australia) and the dimensions of K^I_t will be determined country specific. In Australia the contribution is determined by Household income, but it could include region, employment status or a number of other variables. K^S_t would be a Social Security contribution rate..

Households Direct H^U_t and Employers Direct E^U_t represent the number of services for which Households or Employers made payments directly for health services. The dimensions of H^U_t and E^U_t are service type, provider, age, sex, income and region.

Out-of-Pocket O^I : represents cash payments associated with the use of health services by individuals and made on their behalf either by themselves or by their employers. The O^I rates of payment may be determined by their insurance status, service type, service provider, and income.

Note that the amount of direct contributions is likely to be inversely related to the level of Government contribution and to the level of the indirect contributions to revenue

Revenue R : is the sum of revenues from all of the Primary Sources and $= \sum S_i$ (see Figure). Revenue should include source and provider (and service type) dimensions.

- **Uses of Funds**

The *Uses of Funds* in the Extended National Health Accounts definitions are Providers, Functions, Resources and Users. In the Finance Module, Resource Use **UR** and Service Use **US** are

incorporated in the model explicitly, whilst Users are incorporated indirectly through the use of services in the Household Direct H^U entity. Providers are not shown in the conceptual model in Figure 4, but would be modelled explicitly in a country specific model by partitioning the Resource array to reflect resources used by each provider type.

Resource Use UR_t : is quantity of resources used to produce the services used and is calculated by dividing Use of Services US_t derived in the Service Use Module by the final IO_t .

$$UR_t = US_t / IO_t$$

The dimensions of UR_t should be provider and factor of production (region optional).

Cost per unit of Resource cR_t : Cost per unit of Resource must be specified, or can be estimated if trend data on cost of resources is available. cR_t is likely to vary by factor of production and provider (and region).

Service Use US_t : is derived from the Service Use Module.

Cost per unit of Service cS_t : is calculated by multiplying the Input-Output Matrix IO_t which gives the number of units of resources necessary to produce one unit of service, by the cost per unit of resources cR_t . The dimensions of cS_t are likely to be service type, provider and region.

$$cS_t = cR_t * IO_t. \text{ (Note: total cost of services is } CS_t = US_t * cS_t)$$

Cost of Other Functions CF_t : Administrative costs unrelated to service delivery and research costs are subject to control by policy makers. These are inputs to the model. If time series data are available, it would be possible to make trend estimates of these amounts.

Expenditure on Resources ER_t : is the sum of the expenditure on resources to provide the services US_t and Other Functions CF_t . Note that ER_t is equal to the Sum of Payments to Resources ΣR_n in Figure 1. The dimensions of this array should be factor of production by provider by region.

Expenditure on Functions EF_t : is the sum of expenditure on all Functions – health services and other functions. $EF_t = CS_t + CF_t$ and EF_t is equal to the Sum of Expenditure on Functions $\Sigma SU_t + \Sigma OF_s$. The dimensions of EF_t are service type* provider (*region).

Balance B_t : The balance is the difference between the amount of revenue provided by all sources and the expenditure on services and functions in the same year. The balance may appear as a result of increases or decreases in formal reserves of insurance organisations (Social or private), or changes in bank accounts of individual provider organisations. The significance of the balance will depend on the operation of the health system. B_t has the dimensions of source (and possibly provider and region).

Operations of the Health Sector Finance Reform Model

As stated earlier, the purpose of the Health Sector Finance Reform Model is:

- > to *project* expenditure on health, use and types of services, and resources use, by providers and by functions, and by user groups and by regions;

- > based on defined policy options, explicit behavioural assumptions, and assumptions about rates of change of key parameters.

The outputs from the Health Sector Finance Reform Model allow comparisons of the impact of alternative policies and for the productions of National Health Accounts for each policy option.

The model consists of two interacting Modules:

- > the Service Use Module which is concerned with achieving a ‘physical balance’ between the demand for services, and hence a demand for resources and the physical resources available to the health sector; and,
- > the Finance Module which is concerned with achieving a ‘financial balance’ between the supply of funds (from *primary sources* and *secondary sources*) to meet the expenditure on services (the *uses of funds*);

The Modules have several key entities in common. The Population array \mathbf{Pn}_t in the Service Use Module and the Household array \mathbf{H}_t in the Finance Module are the same data set displayed differently. The Use of Services \mathbf{US}_t dataset in the Service Use Module is the same as the Household Service Use array \mathbf{H}^U in the Finance Module. Finally, the out-of-pocket payments array \mathbf{O}^I in the Finance Module is used in the calculation of the amount of services that people of different ages and income groups are expected to use – the Service Entitlement/Demand array \mathbf{sD}_t - in the Service Use Module.

If the Service Use Module finds that an initial policy option demands more services and hence resources than available resources can supply, the policy analyst can change the policy option to change the performance of the systems – either by reducing demand, or increasing productivity. Alternately, the optimising function of the model may be invoked to allocate resources to priority areas set by the analyst. The model indicates the unmet demand in such circumstances. Once a physical balance is obtained in the Service Use Module it is then necessary to test if the policy option is financially viable. By a series of iterations between the modules it is possible to find policy options that result in both physical and financial balance.

The model is designed to enable comparisons to be made on projections of the effects of policy options on important aspects of health systems performance, such as equity, efficiency and sustainability. Time-series results can vary according to the selected base year during model construction. The base year is generally chosen on the completeness of data grounds. The effects of health policy on health flows and other key variable can be observed by running reports that project to any year after the base year. For the purposes of this software, elapsed years could also be in a projection report if base year is different than today. For instance, a base year of 1995 would render a projection report including the years 1996,1997 although they refer to past years.

The model can also be used to analyse effects of health policy in the past. To do so, it is necessary to calculate values for years prior to the base year. This is referred as backcasting.

The mathematical construct of backcasting is as simple as reversing the sign of assumptional variables or varying the indices from their base year value of one to less or greater than one depending on the direction of growth. Growth rate parameters then need to be interpreted as a rate of decline so as to reach values that may have happened in the past. If the projected value of a parameter after a base year is declining, then the interpretation of this parameter gets reversed.

The model produces a set of standard reports which highlight a number of key indicators for each policy option. A list of these standard reports is provided in Table 8 above. The reports include projections of National Health Accounts, measures of equity of access to services and equity of paying for services between difference income groups and regions and measures of sustainability of the policy options. The model can compare reports for several policy options on the key issues of sustainability and equity.

Table 8. List of Standard Reports

Population Projections
Resource Projections
Service Demand/Use Projections
National Health Accounts Projections <ul style="list-style-type: none"> > From Primary Sources to Financing Agents > From Financing Agents to Providers > From Providers to Functions > From Providers to Line Items
Health Expenditure (recurrent, capital, total) by <ul style="list-style-type: none"> > Hospital > Ambulatory Medical > Preventive and Promotive (Public Health)
Revenue Projections <ul style="list-style-type: none"> > By cover type > By type of contribution (tax, premium, user payment etc)
Service Demand/Use by Income <ul style="list-style-type: none"> > Hospital > Medical > Preventive and Promotive (Public Health) > Total
Policy Scenario Reports <ul style="list-style-type: none"> > Project Status Quo > Extensions of Health Insurance to all of the population or other defined segment > Compare Revenue and Expenditure > Examine resource availability > Model Alternative payments to Doctors > Access and Equity issues

The computer model software is a high-end output production tool. Most computer-based models are tiered towards production of informative data to help decision-making. The outputs allow policy analysts access data of various dimensions and in various forms such as time series, cross-tabulation and graphics.

- **Forecasting Operations of the Service Use Module**

The Service Use Module includes variables that relate most directly to health sector reform. It is concerned with the ‘real’ production and distribution within the health sector. On the other hand, the Financial Module deals with the ‘enabling’ elements of finance to facilitate the production and distribution of services.

The Service Entitlement/Demand Array specifies the expected demand for services and entitlement to public health and essential clinical services by each age, sex and income group, (and region) and for each type of insurance or funding arrangement specified in the policy option. The specification of this array requires that:

- > the structure of the insurance and subsidy arrangements for each policy option (and Status Quo) be considered for each age, sex and income group since it is the out-of-pocket payments that will largely determine the capacity of different income groups to use services;
- > the providers who are expected to produce the services also need to be considered if specific types of insurance require individuals to obtain services from specific providers (for example, if patients can only receive insurance benefits if they use hospitals and clinics owned by, or contracted by, their insurance organisations).

$dS(i)_t$ must specify, for the i^{th} policy option, the expected use of services by service type and provider and age, sex, income, insurance status and region.

Resource availability is relatively fixed in the short term, and movements between regions, and sometimes between providers, can be slow.

By specifying the quantity of services that can be produced from fixed inputs of resources, the Input -Output Matrix defines the production function for services at or about the current rate of output (and sometimes for each provider). The IO_t matrix reflects the organisational and work practices in any type of organisation at time 't'. The IO matrix may be varied over time to reflect either changes in methods of producing service or changes expected to result from incentives included in specific policy options. Changes in organisation of services or of financing incentives can be expected to change the IO_t matrix over time.

The Efficiency array is included separately from the IO_t matrix, since it is possible to increase the numbers of units of services produce using a constant mix of resources as input. So Ef_t can be changed over time to reflect the increased productivity that could be expected if an appropriate set of incentives were provided. The effects of improved efficiency could be included in the IO_t array, but it is included since it is sometimes useful to consider the effects of incentives separate from organisational issues.

As described earlier, the Service Use Module operates by defining values for Ds_t (number of services per person) for specific policy options and then calculating the total demand for services DS_t that would result. By dividing the demand for services by IO_t the total demand for resources, DR_t , is estimated. If total demand for resources DR_t is expected to be less than supply of resources SR_t then the demand can be met. If demand DR_t exceeds supply SR_t in the whole health system, or in a major part of it, then the policy analyst has a number of options including:

- > changing the policy settings in the Service Entitlement/Demand Array Ds_t by, for example, increasing charges for some or all services, or reducing the level of entitlements (for example, offering screening programs every 3 years to the target population instead of every 2 years);
- > examining methods for changing the organisation and production of services to obtain greater output from the existing resources – change IO_t .

- > use the optimising feature of the model to allocate resources to ‘priority’ services and accept that there will be unmet demand for services in some sectors.

If the shortage of resources is confined to a few sections of the health system, then the analyst has the same options as before, but can also consider transferring resources across sections to achieve a more acceptable balance of services across regions of target populations.

While it is easy to change the numbers in the model and produce a physical balance, the real skill of the policy analyst is to be able to define what administrative activities must be taken that will produce the actual changes represented by changing the numbers.

Once the process described above is completed, the model will have produced a ‘solution’ for each policy option defined which ensures that demand for services and entitlements is met, given the resources available. It is then necessary to ‘test’ this solution in the Finance Module to see if there is a financial balance as well.

- **Operations of the Finance Module**

The Finance Module seeks to balance the revenue provided by *sources* of funds and the expenditure incurred in *uses* of funds. Balance is sought at both the aggregate level, and for each sub-system (that is, revenues from Social Insurance must balance the costs of services provided to Social Insurance beneficiaries; revenues from private insurance must balance the insurer paid costs of services provided to the private insured and so on). This fiscal balance may be achieved by increasing or decreasing formal reserves for health by these Financing Agents or by changes in the level of bank accounts held by providers, but in the short to medium term, revenues from the sources of funds must equal the expenditures on uses of funds. The contribution of government to the health sector may be set as the balancing item (unconstrained budget transfers), however few governments give open ended support to the health sector.

The variables, and hence the policy options, that can be directly controlled within the Finance Module are those influencing the revenue side of the revenue-expenditure balance. Revenue can be increased or decreased by changing contribution rates \mathbf{K}^I to Social Insurance, Private Insurance, health specific taxes, by increasing out-of-pocket payments \mathbf{O}^I , or by changing the government contribution \mathbf{T}_t or loans and aid \mathbf{L}_t .

- **Interactions between the Service Use Module and the Finance Module**

The design of policy options requires that consideration be given balancing supply of and demand for both financial and physical resources.

If equity of funding of health services is a policy consideration, a policy option must explicitly consider how much different income groups and regions contribute. This means that contribution rates for social insurance \mathbf{K}^S or to health specific taxes \mathbf{K}^T will need to be income- and possibly age-related. So the dimensions of \mathbf{K}^I could be income, age and region. Similarly out-of-pocket payments \mathbf{O}^I could also be made income, age and region specific. In Australia, low-income people are entitled to a Concessional Benefits Card, which entitles them to low priced services and drugs.

Therefore, the design of a single policy option requires specification of the tax rates \mathbf{T}_t and indirect contribution rates \mathbf{K}^I , and the prices for specific services \mathbf{O}^I to be charged to different income

and 'health priority' groups. It also requires that the expected demand for services dS_t , is determined taking into account both impact on income and prices of revenue measures. Physical access to services also needs to be factored in, so dS_t may have a regional as well as income, insurance status dimensions. While T_t and K^I may be income specific, therefore, O^I and dS_t may be service type, provider, and region specific, as well as income specific.

Changing variables in the Finance Module – that is, changing policy instruments - can have direct effects on the Service Use Module. Changing out-of-pocket payments O^I in the Finance Module will alter the values of demand for services that must be input to the Service Use Module. Increases in out-of-pocket payments can be expected to decrease demand for services dS_t . Similarly, increasing contribution rates K^I can be expected to decrease disposable household income, and again reduce demand dS_t .

There is therefore a feedback loop between the two modules: changing T_t , K^I and O^I in the Finance Module; these change dS_t in the Service Use Module and thus to Use of Services US_t ; changes in US_t are reflected in changes in indirect use of services by households, H^H , in the Finance Module.

- **Specifying Policy Options in the Model**

The amount of detail necessary to specify Policy Options that can be analysed in the Health Sector Finance Reform Model will depend on the specific objectives of the health sector reforms being modelled. The extent to which Policy Options can be modelled will also be heavily influenced by the availability of data.

Health sector reform can often result in changes to almost all of the entities shown in Figure 2 , and the analyst must consider the most effective ways of modelling the policy options being considered. The effects of the changes are generally incorporated in several places within the Model. Alternatively, the Model can be developed so that it automatically links relevant entities. Some of the methods of incorporating Policy Options are described briefly here. :

Changes in Insurance coverage: Many reforms result in changes in contributions to health insurance or taxes (K^I_t). The out-of-pocket payments for services are often changed (O^I_t) for sub-populations (for example, co-payments may be set at zero for low-income groups). The demand for services (dS_t) for different sub-populations may change due to changes in out-of-pocket payments, and hence total demand (DS_t) and total usage (US_t) for services may change. All of these changes are linked and theoretically predictable. However, few countries have sufficient data to allow the empirical analyses of income and price elasticities of demand to be undertaken to incorporate into a model, and even fewer have undertaken such analyses even where data is available.

Changes in Organisation of Services and Payments for Providers: Many reforms will change the organisation of health services, the methods of paying providers, and may change significantly the resources available. These changes may be made by excluding many existing providers from practice, or by introducing training programs to increase supply, or by using aid or loan money to buy additional capital equipment. Changes in supply therefore require SR_t to be modified accordingly. The reform may change the organisation of health service providers (e.g. from polyclinic to individual practice) requiring changes to IO_t , and new payment methods may influence the rate of work by providers - changing efficiency of operations Ef_t .

It has been the experience of the HIC that the specification of policy options, and the use of data to represent these options, is generally not just the concern of policy analysts. Stakeholders, especially providers, generally have a keen interest in what assumptions are being made about the way in which they will respond to different policy options. In the absence of good local research on behavioural responses of providers and users of health services, most groups are reluctant to see 'foreign' data imported into the model without having the opportunity to scrutinise this data.

Therefore, while it would be possible to build a highly interactive model incorporating the responses of providers and patients to different policy options, the absence of local data generally precludes this option, and the local political circumstances generally limit the usefulness of such a model. The process of talking through with local stakeholders what data will be incorporated into the model often highlights elements of local practice of which the overseas consultants may be unaware, and is an essential part of model development.

Framework Linking NHA and the HSFRM

The National Health Accounts matrices are a set of static arrays which describe the *sources* of funds and *uses* of funds for health expenditure a given year for a given country.

The Health Sector Finance Reform Model is a projection and analysis tool which *projects* expenditure on health, service use, and resources use, by providers, functions, user groups and regions; based on defined policy options, explicit behavioural assumptions, and assumptions about rates of change of key parameters.

Current and projected National Health Accounts matrices can be generated by the Health Sector Finance Reform Model once the model has been specified for a particular country and the model has been ‘populated’ with data. Development of country-specific model requires that country-specific information is incorporated into the structure of the data arrays that drive the model.

Due to the differences between national organisational and funding arrangements, it is not possible to define a generic process whereby NHA matrices can be produced from the HSFRM. However, the following sections outline a general approach to developing National Health Accounts from Health Sector Finance Reform Model data by:

- > looking at the identities that underpin the NHA and HSFRM;
- > describing some of the processes that are required to develop NHA from ‘raw’ data sets that support the HSFRM;
- > examining a series of simple models of the health sector and describing the process whereby NHA may be developed from the HSFRM.

Identities that Link the NHA and HSFRM

The following section illustrates that the NHA matrices are identical to entities in the Health Sector Finance Reform Model. However, one of the main differences between the NHA arrays and the HSFRM arrays is that the NHA arrays are two dimensional (for example Sources to Financing Agents) while HSFRM arrays are multidimensional (for example, Sources might be 5 sources by 5 income quintiles by 4 insurance status and Financing Agents might be 5 Financing Agents by 7 provider systems). The HSFRM arrays can always be ‘folded down’ to the dimensions appropriate to the NHA tables. If the data sources are not rich enough to generate the data necessary to provide the additional dimensions necessary to populate the model, then the HSFRM can not be operated at its full potential. If the data is available with at least one dimension more than is necessary to describe the National Health Accounts matrices, then the model can provide analyses over and above that which is possible with the National Health Accounts tables.

It is possible to develop a country-specific Health Sector Finance Reform Model without having data to populate it – but no analysis or projections can be carried out without data. The capacity to develop National Health Accounts matrices and to operate a country specific HSFRM model is entirely determined by the data that is available.

The first NHA Matrix is Sources to Financing Agents.

Matrix 1

**National Health Expenditures
Primary Sources to Financing Agents (Secondary Sources)
Primary Sources**

Financing Agents	Government	Employers	Households	Loans/Aid	Total
Ministry of Health					
Other Gov't					
Private Insurance					
NGOs					
Households					
Total					

The elements of NHA Matrix 1 are derived from the following HSFRM entities:

= Government (Tax)+Employer (indirect and direct)+ Household (indirect and direct) + Loans and Aid

$$= T_t + (E_m * K^I + E^U * O^I) + (H * K^I + H^U * O^I) + L_t$$

where each of these ‘fold down’ to a (5x1) column vector to reflect the dimensions of Sources to Financing Agents. Each elements above can be ‘folded down’ to one of the columns in Matrix 1 (ie. T_t can be folded down to the Government* Financing Agents column, $(E_m * K^I + E^U * O^I)$ can be ‘folded down’ to the Employers*Financing Agents column etc).

In the base year (defined earlier as the year for which the latest data is available), the values of T_t (taxes), $E^U * K^I$ and $H * K^I$ (contributions by Employers and Households to public and private insurance and Financing Agents) and L_t (loans and aid) should be available from official sources. Contributions of employers and households to private insurance may not be readily available, which may be a problem for the development of both NHA and the HSFRM.

The second National Health Accounts matrix is Financing Agents to Providers.

Matrix 2

**National Health Expenditures
Financing Agents to Providers
Financing Agents**

Providers	Ministry of Health	Other Gov't	Private Insurance	Non-gov't Orgs	Employers	Households	Total
Ministry of Health							
Other Gov't							
Private Insurance							
NGOs							
Households							
Total							

Note 1: Hospitals may be subdivided into ones owned by the MOH Universities, Private for-Profit, Private Not-for-Profit

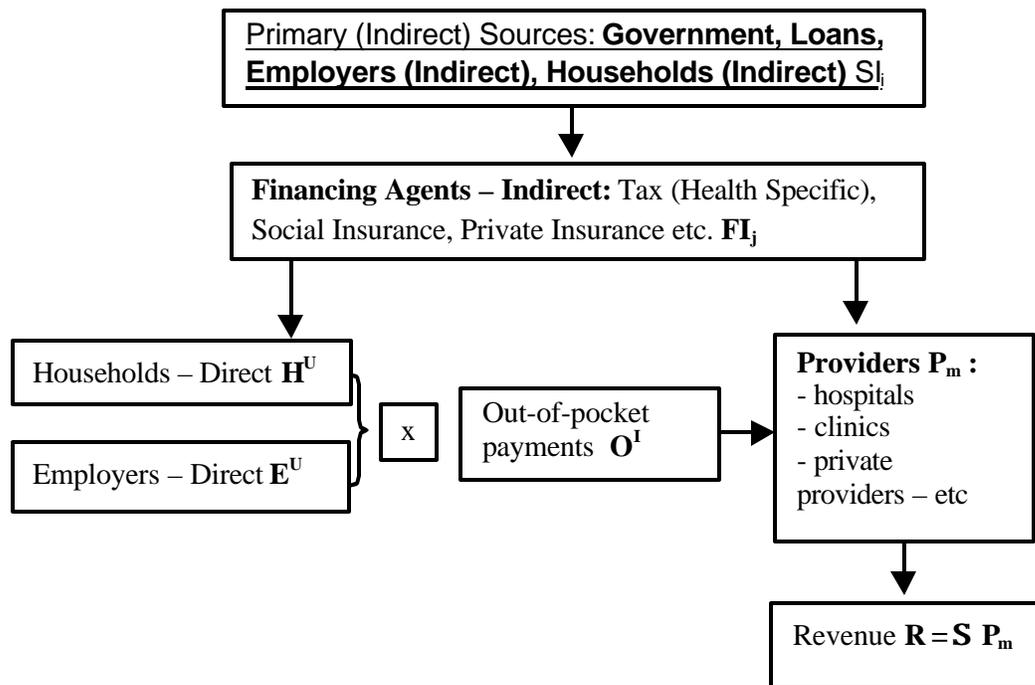
$E^U * O^I$ and $H^U * O^I$ are the out-of-pocket payments (direct payments) by employers and households for health services. The availability of this data will depend on the nature of the health system. If health services are largely provided by publicly owned institutions, it is likely that the

revenue will be recorded as income by the organisations providing the services. Out-of-pocket payments to private organisations will likely only be available from household expenditure surveys.

The transfer of funds from Financing Agents to Providers has not been described in the Health Sector Finance Reform Model presented in Figure 4 because these flows are very country specific in two ways. Financing Agents vary significantly between countries and Financing Agents can transfer funds to Providers in a number of different ways – direct budget provision, funding on a fee-for service basis, funding on a performance related block grant and so on.

Figure 4 could be modified to show the role of Financing Agents as shown in Figure 5.

Figure 4. Finance Module with Financing Agents—Revenue Side Only



In Figure 5, Financing Agents have been split into two groups: Indirect Financing Agents, which are the organisations that Employers and Households contribute money to, and Direct Financing Agents (Employers and Households, where money is paid directly to providers of health services. In this representation of the revenue side of the Finance Module, funds are transferred from the Primary sources to Indirect Financing Agents, and Indirect Financing Agents either transfer funds to Providers or to Employers and Households, which then pay for services directly. Note that payments by indirect Financing Agents to Employers and Households would correspond to situation where insurance organisations reimburse these entities for part or all of the health services that the entities have paid for.

The first four Financing Agents columns in NHA Matrix 2 are represented by $FI_j, j=1..4$, where there were four indirect Financing Agents (or the number of Financing Agents appropriate for a particular country) ‘folded down’ to a (8×4) array. The Employers and Households columns would correspond to E^U and H^U each ‘folded down’ to an (8×1) array.

Figure 5 also facilitates description of the relationship between the HSFRM and NHA Matrix 3. As shown in the Flow of Funds Hierarchy (Figure 1), one of the measures of Total Health Expenditure can be found by summing all payments to Providers $(\sum P_m)$. Summing all the elements

in the array P_m in Figure 5 will equal total health expenditure and ‘folding down’ P_m will give NHA matrix 3.

Matrix 3

Expenditure - Providers to Functions
Providers

Functions	Hospitals	Clinics	Private Providers	Pharmacies	Nursing Homes	Research	Admin	Other	Total
Ambulatory Care									
Personal P&P									
Population P&P									
Inpatient Care									
Research									
Admin									
Other									
Total									

Note: P&P = Preventive and Promotive Services and Programs.

4.2 Deriving NHA from the Health Sector Finance Reform Model

The previous section examined the ways in which National Health Accounts and the Health Sector Finance Reform Model are logically equivalent. In this section, the process of developing National Health Accounts using disaggregated data that drives the Health Sector Finance Reform Model will be examined. This section also forms the basis for identifying an Extended National Health Accounts Minimum Dataset that, if collected, would not only produce the standard NHA matrices, but would populate the Health Sector Finance Reform Model and facilitate both projections of National Health Accounts and other analyses. The focus is on data required for the Finance Module.

• 4.2.1 Data issues

Most countries have no planned approach to collecting and tabulating the health financing and administrative information that is necessary for developing NHA or for populating the HSFRM. Information that is available has generally been collected for audit and accountability purposes and for operational requirements of the agencies concerned. Private sector activities often provide little or no publicly available information.

The process of developing National Health Accounts and for populating the HSFRM from original data sources generally requires a jigsaw-like approach to collecting and cross checking data from different sources. Most countries have a variety of sources that can be utilised, including:

- Administrative information systems of both public and private providers of health care and financing health services;
- Data from national statistical agencies: surveys and censuses of households, health-related enterprises, and other enterprises. Some of the surveys and censuses may be health specific, others may provide data that can be combined with health related data (such as surveys of earnings of employees in all enterprises that may be combined with information about industries that are required to provide health insurance to employees);
- State regulatory agencies may have data on the expenditure, staffing and health service activity of private enterprise;
- Legislation on insurance contribution rates and entitlements to benefits;
- Private enterprises their associations may collect and/or publish data on health related activity, expenditure and staffing.

- Reports and studies by government and academics.

In many cases sample data on the distribution of variables can be used in combination with administrative data sets that give reliable aggregate data on expenditure and use of services. Total expenditure on health services derived from household health expenditure and use surveys often differs from reliable aggregate data from administrative sources. The proportions of expenditure and use by different demographic or income groups derived from the sample is often applied to the aggregate data to give the distribution of total expenditure and use across these groups.

The combination of both the paucity of data sources and the conflicting values that emerge from other sources means that there is a requirement that data from several sources be compared and combined. Where necessary, best estimates from informed individuals or from groups discussions can be incorporated to fill in gaps in the data. A ‘best available’ data set can be developed which maximises the quantity and reliability of the data that are used in subsequent analyses. The use of a single data set ensures consistency across subsequent analyses.

The process of developing the ‘best available’ dataset is not described in this report. General principles of developing a ‘best available’ dataset are described above, but no detailed prescription can be given. Any report of a national study will have such a description of the process of developing the ‘best available’ dataset but that is an historical record.

The remainder of this section will describe the development of NHA from the HSFRM for three generic models of the health sector.

• 4.2.2 Health System 1 – a fully private system

One of the simplest models of the health sector that can be analysed is one in which:

- households pay the full cost of health care;
- all providers of health care are private;
- there is no insurance; and
- there is no government activity in regulation, research or administration.

In such a system, the price charged for services will closely approximate the costs of providing the services – at least in the long run.

The National Health Accounts matrices would be very simple, as there would only be one source of funds and one Financing Agent. Matrix 1 would be a single cell with the total health expenditure shown. Matrix 2 (Financing Agents to Providers) would also be very simple, with one Financing Agent and ‘n’ provider types. In matrix notation this would be a (nx1) column vector.³

In a simple health sector such as the one described above, a sufficiently large survey of household expenditure and use in base year ‘0’ would provide sufficient data to provide the National Health Accounts matrixes and to populate the HSFRM. From a good survey the following HSFRM figures could be derived:

uS₀ –number of services per person, by service type, provider, age, sex, income and region;

US₀ - total use of services, by service type, provider, age, sex, income and region;

eS₀ –expenditure per service by service type, provider, age, sex, income and region; and

ES₀ –total expenditure on services by service type, provider, age, sex, income and region.

From these items it is possible to calculate the price per unit of service

pS₀ = **ES₀/US₀** where **pS₀** is cost per unit by service type, provider and region.

In the system defined, price per unit of service **pS₀**

= **cS₀** – cost per unit of service by service type, provider, and region,

³ The conventions for naming National Health Accounts arrays are different to those for giving the dimensions of matrixes. The NHA convention is to say *Sources* to *Uses* where *Sources* relate to the **columns** of the matrix and *Uses* relate to the **rows** of the matrix. The dimensions of a matrix are given as 5*7 where there are 5 **rows** and 7 **columns**

and \mathbf{pS}_0 also equals
 $= \mathbf{O}_0^I$ – the out-of-pocket payment for services by service type, provider and region,
 since in this model out-of-pocket payments are equal to costs of services and there are
 no insurance rebates

As noted above, in this health system, NHA matrices are very simple, as there is only one source of funds (Households) and there is no distinction between Primary Sources and Financing Agents.

NHA Matrix 1, *Sources to Financing Agents*, is only a single cell, as there is only one Source and one Financing Agent.

NHA Matrix 2, *Financing Agents to Providers*, can be derived directly from the survey by ‘folding down’ \mathbf{ES}_0 to the Provider dimension.

NHA Matrix 3, *Providers to Functions*, can also be derived by ‘folding down’ \mathbf{ES}_0 Provider by Service Type Functions.

NHA Matrix 5A and 5B: Expenditure and Use of Services by Provider and Service Type (Similar to Table 9:Matrix 5A – ENHA MDS, but without the dimension of insurance status).

• 4.2.3 Health System 2: Insurance with private providers.

The assumptions that apply in this system are:

- some employed people and their dependants have insurance which is funded by employers and employees;
- the reserves levels of the insurer are held constant and ignored for the purposes of discussion;
- insurance reimburse households on a per service basis for services paid for by the household;
- health sector providers are private.

In this system, it is assumed that the prices of services are equal to the costs of services in the private sector. The system could be modelled to allow for price discrimination between insured and uninsured by providers but this will not be explored here.

As System 2 is more complex than System 1 because of the presence of health insurance, additional information is required to develop the NHA matrices. In addition to the household health expenditure and use survey, information is also required on certain aspects of the operation of the insurance system.

The data produced from the survey will be the same data as described for System 1, except that all arrays will have the additional dimensions of insurance status:

\mathbf{uS}_0 –number of services per person, by service type, provider, age, sex, income, **insurance status** and region;

\mathbf{US}_0 - total use of services, by service type, provider, age, sex, income, **insurance status** and region;

\mathbf{eS}_0 –expenditure per services by service type, provider, age, sex, income, **insurance status** and region; and

\mathbf{ES}_0 –total expenditure on services by service type, provider, age, sex, income, **insurance status** and region.

\mathbf{ES}_0 can be ‘folded down’ to expenditure by provider by service type by insurance status to produce Matrix 5A of the Extended National Health Accounts Minimum Dataset as shown in Table 9. \mathbf{US}_0 can also be ‘folded down’ to give a Matrix 5A (but with units of service instead of expenditure).

From these items it is possible to calculate \mathbf{pS}_0 , the **price** per unit of services and \mathbf{O}_0^I the out-of-pocket payments:

$\mathbf{pS}_0 = \mathbf{O}_0^I = \mathbf{ES}_0/\mathbf{US}_0$ where \mathbf{O}_0^I is out-of-pocket payments **by** service type, **insurance status**, provider and region.

As the uninsured pay the full cost of services, the cost per unit of service by service type, provider, and region \mathbf{cS}_0 is equal to the price per unit by service type, **uninsured only**, provider and region (from \mathbf{pS}_0).

It is possible to calculate \mathbf{IB}_0^j the insurance benefit for each service and provider type (where \mathbf{IB}_0^j is the insurance benefit **per service** by service type and provider for insurance provider ‘j’ in time period ‘0’ and \mathbf{IB}_0^j is the **total expenditure by insurance provider ‘j’** by service type and provider in time period

'0'.

$$iB_0^j = cS_0 - O_0^j$$

That is, the insurance benefit for each service is equal to the cost of a service less the out-of-pocket payment for that service. The total expenditure by insurers is equal to the insurance benefits (by service type* provider type) multiplied by the number of services used (by service type* provider type). (**US₀ – insured only**).

For System 2 there are two primary sources of funds (employers and households) and two Financing Agents (insurers and households), as well as the standard range of providers and services.

Table 9: Matrix 5A - Extended National Health Accounts MDS

**Expenditure by Service Type for insured and
uninsured population – by providers
Providers**

Service Type	Users	Hospitals	Clinics	Private Providers	Pharmacies	Nursing Homes	TOTAL
Ambulatory Care	Insured						
	Uninsured						
Personal P&P	Insured						
	Uninsured						
Population P&P	Insured						
	Uninsured						
Inpatient Care	Insured						
	Uninsured						
Total	Insured						
	Uninsured						
TOTAL	All	ExpH	Exp C	ExpPP	ExpP	ExpNH	Σ Exp

NHA Matrix 2 can be derived from Table 9. **Total** expenditure on each service type can be taken directly from the column totals in Table 9. Household out-of-pocket payments come directly from O_0^j (which comes from the household survey). Total payments by the insurance organisation ($\Sigma E*Ben + \Sigma H*Ben$) may be obtained by a number of methods: the insurance organisation may be able to provide it directly; the household survey may collect it directly; it may be calculated from iB_0^j by (**US₀ – insured only**) as described above. The proportions of insurance contributions from Employers and Households should be available from administrative or regulatory sources. So NHA Matrix 2 can be derived from household survey data and limited administrative/regulatory sources.

NHA Matrix 2: Financing Agents to Providers (2 by 5 matrix)

Providers	Financing Agents			T O T A L
	Insurance		Households	
	Employer	Households		
Hospitals	E*HBen	H*HBen	OOP-H	ExpH
Clinics	E*CBen	H*CBen	OOP-C	ExpC
Private Providers	E*PPBen	H*PPBen	OOP-PP	ExpPP
Pharmacies	E*PBen	H*Pben	OOP-P	ExpP
Nursing Homes	E*NHBen	H*NHBen	OOP-NH	ExpP

(where E*HBen is **E**mployer – **H**ospital – **B**enefit is the employer contribution through insurance to hospital costs of insured persons).

NHA Matrix 1 can then be filled in from elements

NHA Matrix 1 – Primary Sources to Financing Agents is a 2*2 matrix

Financing Agents	Primary Sources		
	Employers	Households	TOTAL
Insurance	ΣE^*Ben	ΣH^*Ben	Σ Insurance benefits
Households	nil	ΣOOP	ΣOOP
TOTAL	ΣE^*Ben	$\Sigma H^*Ben + \Sigma OOP$	$\Sigma IBen + \Sigma OOP$

• 4.2.4 Health System 3 – multiple insurance options and public and private providers

The assumptions that apply in this more complex model, with multiple insurance options and both private and public providers are:

- 1) Insurance:
 - a) There are multiple insurance arrangements – mandatory public insurance systems for some sections of the population, some employment based private insurance funded by employers and employees;
 - b) the reserves levels of the private insurer are held constant and ignored for the purposes of discussion;
 - c) insurance reimburse households on a per service basis for services paid for by the household;
- 2) Ownership of Provider facilities:
 - a) the state insurance organisation owns some health service providers, but their members can also use other service providers;
 - b) the Ministry of Health own a full range of facilities;
 - c) private providers own a full range of service provider types.
- 3) Taxation funding – Ministry of Health facilities are funded on a block grant basis from consolidated revenue (facilities retain user fees);
- 4) Paying for services:
 - a) Private insurance pays benefits to household members for all service types and providers - iB^P_0 benefits per service by service type and provider for persons with P insurance;

TOTAL	ΣE^*Ben	ΣH^*Ben	ΣOOP	ΣExp
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- b) Mandatory insurance provides services in their own institutions to members who pay copayments O_0^M service type*provider;
- c) In Ministry of Health owned facilities the poor do not pay for services but all others do. The prices for services in state facilities are unrelated to the cost of services are pS_0^M by service type*provider (the M indicates services in Ministry owned facilities).

In this system, it is assumed that the prices of services in the private sector and in facilities in Mandatory Insurance organisations are equal to the full costs of services in the private sector, but the prices in state owned institutions are not full cost prices.

This model has three primary sources of funds (government, employers and households), four Financing Agents (Ministry of Health, mandatory insurance, private insurance and households) and the usual ranges of service types and providers of services (with three ownership options – Ministry, mandatory insurance organisation and private). This type of model approximates the complexity of the Egyptian health sector. NHA Matrix 1 will therefore be a 3 (sources) by 4 (Financing Agents) array, and NHA Matrix 2 will be a 4 (Financing Agents) by 5 (Provider) array.

The key data required for the Finance Module can be obtained from the household health expenditure and use survey. Because of the greater complexity of System 3 as compared with Systems 1 and 2, there are several additional data sources required.

The main additional sources are:

1) **insurance data:**

- a) mandatory and private insurance contribution rates by employers and households, and,
- b) the characteristics of the insured populations;

2) **tax** (government) contributions to the Ministry of Health facilities.

With this additional information it is possible to develop the National Health Accounts matrices.

From the household health expenditure and use survey, similar data is obtained as in the survey in System 2, except that the **provider** classification has to define the ownership of the service (MoH, Private etc.) as well as its service type (hospital etc.), and the **insurance status** has more categories.

uS_0 –number of services per person, by service type, provider, provider type, age, sex, income, insurance status and region;

US_0 - total use of services, by service type, provider, provider type, age, sex, income, insurance status and region;

eS_0 –expenditure per services by service type, provider, provider type, age, sex, income, insurance status and region; and

ES_0 –total expenditure on services by service type, provider, provider type, age, sex, income, insurance status and region.

ES_0 can be ‘folded down’ to expenditure by service type, provider, **provider type** and insurance status to produce a matrix similar to Matrix 5A in Table 9, except that the type of provider will also be shown. US_0 can also be ‘folded down’ to give Matrix 5A that is similar to Table 9, but has units of service instead of expenditure.

From these items it is possible to calculate pS_0 , the **price** per unit of services by provider, provider type and insurance status, and the average out-of-pocket payments O_0^I with the same dimensions.

Price per unit of service $pS_0 = O_0^I = ES_0/US_0$ where O_0^I is out-of-pocket payment by service type, **insurance status**, provider and region.

Cost per unit of service cS_0 for all non-Ministry of Health providers is equal to the price per unit by service type, **uninsured only**, provider and region (from pS_0), since in these facilities the uninsured pay the full cost of services. The cost per service by insurer type and provider type for insurer ‘k’ and provider type ‘j’ is denoted cS_0^{kj} .

Cost per Unit of Services for Ministry of Health facilities cS_0^M can not be calculated directly from survey data, since the amount of Tax subsidy to Ministry of Health facilities cannot be determined from household survey data.

Total cost on services provided by MOH facilities ES_0^M can be estimated by calculating the total out-of-pocket payments to these facilities (number of MoH services provided to the non-poor US_0^M [non-

poor] multiplied by O^M_0 the out-of-pocket payments for services in MoH facilities) and adding the tax contribution T .

$$ES^M_0 = T + (US^M_0 * O^M_0)(\text{non-poor}).$$

Total cost of insured services by insurance provider by provider type can be calculated in total and in each type of provider facility using the approach outlined in System 2. First calculate iB^{jk}_0 the Insurance Benefit for each service and provider type (iB^{jk}_0 is the insurance benefit per service by service type and provider for insurance provider ‘j’ in provider facility type ‘k’ in time period ‘0’ and IB^{jk}_0 is the total expenditure by insurance provider ‘j’, service type and provider facility type ‘k’ in time period ‘0’.

$iB^{jk}_0 = cS^{jk}_0 - O^{jk}_0$ that is insurance benefit for each service is equal to the cost of service less the out-of-pocket payment for that service.

Total expenditure by insurer is then equal to the insurance benefits (by service type and provider type) multiplied by the number of services used (by service type and provider type)

$$IB^{jk}_0 = iB^{jk}_0 * (US^{jk}_0).$$

In a system as complex as System 3, it is likely that some of the total expenditures by insurers and facilities will be recorded by administrative or regulatory bodies. It is therefore likely that the estimates for some of the values – like total benefits payments by insurers for services, IB^{jk}_0 , -can be checked against insurance records, while the estimate of revenues from patients gathered by Ministry of Health facilities, $(US^M_0 * O^M_0)(\text{non-poor})$, can be checked against Ministry sources.

Matrix 5A of the Extended NHA Minimum Dataset is ‘Expenditure by Service Type for insured and uninsured population – by providers’ and Matrix 5B is Service Use by Service Type for insured and uninsured population – by providers. For Health System 3, these matrices are greatly expanded, since each column for provider type has to be subdivided into MoH, Private, Insurance Organisation and so on. Further, the row showing ‘insured’ has to be split into Mandatory insurance, private insurance and so on. Each cell of Matrix 5B now contains the appropriate value of total service use US^{jk}_0 by service type, provider type and insurer.

However, it is not possible to completely fill Matrix 5A with expenditure data. As discussed above it is possible to calculate IB^{jk}_0 for all providers except the Ministry of Health Facilities. The method of funding Ministry of Health facilities defined in System 3 is that the facilities receive a block grant from consolidated revenue and retain user fees. Two options are available to fill in Matrix 5A. In the first, the block grants can be allocated to service types using the relativities found in the other sectors, and then the out-of-pocket payments O^M_0 can be added to this amount, Alternatively, the values of O^M_0 can be included in the array and the block grants shown in a separate column.

NHA Matrix 2 (Financing Agents to Providers) is a (4x5) matrix with Financing Agents being Ministry of Health (T), Mandatory Insurance (IB^j_0 – where ‘j’ = Mandatory), Private Insurance (IB^j_0 – where ‘j’ = Private insurance) and Households and Providers are the five groups in Matrix 2 above. The elements of each column are T^j , IB^j_0 (j= mandatory), IB^j_0 (j= private insurance), and $(O^j_0 * Us^j_0)$.

NHA Matrix 1 (Primary sources to Financing Agents) is a (3x4) matrix with the Primary sources being Government, employers and households and Financing Agents being Ministry of Health, Mandatory Insurance, Private Insurance and Households. The elements of NHA Matrix 1 are shown in the following table.

	Primary Sources			
	Government	Employers	Households	Total
Ministry of Health	T	-	O^M_0	$T + O^M_0$
Mandatory Insurance		$Emp \% * IB^j_0$	$Hh \% * IB^j_0$	$IB^j_0, j = \text{Man. I.}$
Private Insurance		$Emp \% * IB^j_0$	$Hh \% * IB^j_0$	$IB^j_0, j = \text{Pri. Ins}$
Households			O^I_0	O^I_0

Total				
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5. Calibration of exercises using Egyptian Data.

Two calibration exercises for the Egyptian model resulting from this collaboration were defined during discussions between the HIC and HSPH. These two calibration exercises were to be undertaken using data and examples relating to the Egyptian health sector reform and the School Health Insurance Program. The intention was that the HIC should develop an Egypt-specific Health Sector Finance Reform Model, based on the described framework and populate it with data collected through the Data for Decision Making Project. Once the Egyptian Model was developed, it would be calibrated (or tested) using the following exercises:

1. Calibration Exercise 1 - derive the three NHA matrices for 1995 using disaggregated Egyptian data and calibrate the results to the matrices for 1995 prepared by HSPH using the standard approach.
2. Calibration exercise 2 - a 'back projection' exercise modelling the impact of the School Health Insurance Program. This exercise will start from the detailed 1995 data, to estimate what the 1991 National Health Accounts were **before** the introduction of the School Health Program.

Following a detailed review of the data available, it was apparent that the second Calibration Exercise could not be carried out as planned, as the data available for 1993 was of poor quality and was not comparable with the 1995 results. However, the following paragraphs describe the proposed methodology for both exercises, had quality data been available.

5.1 Calibration Exercise 1 – deriving the 1995 National Health Accounts

It is proposed that the first calibration exercise be carried out using the methods described in Section 3.2. Once the Health Sector Finance Reform Model was adapted to Egyptian requirements and populated with available data, the model would then be used to generate the three NHA matrices (Primary Sources to Financing Agents, Financing Agents to Providers, and Providers to Functions). It would also entail identifying the minimum amount of data required in the Model to generate these matrices.

5.2 Calibration Exercise 2 – School Health Insurance Program – Backcasting to 1991

This exercise would be in the form of a Status Quo Projection and Policy Options analysis of the type that the Health Sector Finance Reform Model is designed to undertake. The model was designed to assist in health sector reform policy analysis by:

- projecting costs, service use, sustainability and equity under the Status Quo policy for a number of years into the future;
- defining potential reform policy options and projecting the likely impact of these reforms on costs, service use, sustainability and equity;
- comparing the outcomes of the reform policy options with the Status Quo outcomes.

This exercise requires running the model in reverse. Starting with 1995 policy, including the School Health Insurance Program, and available data the project would 'backcast' the operations of the Egyptian Health Sector to 1991 to see how it would have performed had School Health Insurance Program existed then. The policy option of 'removing SHIP' is then modelled and back cast to 1991– that is the 1995 data on use of services and costs are modelled as if SHIP did not exist, and this policy scenario is backcast to 1991. The projections of 1991 outcomes **without** SHIP are then compared with the actual data recorded

in the partial 1991 National Health Accounts data available through the Data for Decision Making Project

The backcasting would consist of:

- developing the population matrix $\mathbf{Pn}_{t=91-95}$ by age, sex, insurance status, *region and income to the extent possible;
 - developing, from the Household Expenditure and Use Survey, the use of services per person matrix \mathbf{uS}_{95} – use of services by service type, income quintile, insurance status, provider and region;
 - developing estimates of \mathbf{pS}_{95} and \mathbf{cS}_{95} - prices and costs of services in 1995, by service type, provider, insurance status and region;
 - from \mathbf{uS}_{95} develop \mathbf{uS}_{91-95} and $\mathbf{uS(1)}_{91-95}$ – where \mathbf{uS}_{91-95} are estimates of service per person use over the period 1991-1995 under the Status Quo (in this case the Non-SHIP option, assuming that the School Health Insurance Program had operated over that period) and $\mathbf{uS(1)}_{91-95}$ – estimates of service use per person assuming that School Health Insurance Program did not exist. This will require consultation between the parties on assumptions about changes in service use over time;
 - estimating total service use \mathbf{US}_{91-95} and $\mathbf{US(1)}_{91-95}$ under the Status Quo and the Non-SHIP policy options;
 - from \mathbf{pS}_{95} and \mathbf{cS}_{95} – develop \mathbf{pS}_{91-95} and \mathbf{cS}_{91-95} and $\mathbf{pS(1)}_{91-95}$ and $\mathbf{cS(1)}_{91-95}$, estimates of the prices and costs of services under the Status Quo and Non-SHIP policy options.
 - the costs of health services by provider and insurance status for 1991-1995 can be calculated for both policy options will be calculated by multiplying the appropriate price/cost and services use arrays. From these the NHA matrices can be developed.
 - the backcast estimates of the 1991 Non-SHIP policy scenario can be compared with the actual 1991 data.
-