Projection Methods for Integrating Population Variables into Development Planning

Volume I
Methods for Comprehensive Planning

Module Three
Techniques for preparing projections of household and other incomes, household consumption and savings and government consumption and investment

United Nations

ST/ESA/SER.R/90/Add.2

Department of Economic and Social Development

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EXPLANATORY NOTES

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The terms "country" and "area" as used in the text of this report also refer, as appropriate, to territories, cities or areas.

The present study has been edited and consolidated in accordance with United Nations practice and requirements.

The following symbols have been used in the tables throughout the report:

A blank in a table indicates that the item is not applicable.

A minus sign (—) indicates a deficit or decrease, except as indicated.

A full stop (.) is used to indicate decimals.

Details and percentages in tables do not necessarily add up to totals, because of rounding.

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PREFACE

This is the third and final module of the first volume of the manual on projection methods for integrating population concerns into development planning, which has been prepared by the Population Division of the Department of International Economic and Social Affairs of the United Nations Secretariat. The first module dealt with conceptual issues and methods for preparing demographic projections. The second module presented methods for preparing school enrolment, labour force and employment projections. This module describes techniques for preparing projections of household and other incomes, household consumption and savings and government consumption and investment. These techniques can be used to make a series of interrelated projections of demographic and socio-economic variables for comprehensive planning that take into account key linkages between population and socio-economic change.

The third module is the result of a collaborative effort of the Population Division, two consultants and the Latin American Demographic Centre of the Economic Commission for Latin America and the Caribbean. Draft materials describing methods for projecting incomes were prepared by James C. Knowles. Drafts of materials for projecting consumption and savings were prepared by Robert Kleinbaum. A description of the technique for projecting government expenditures was contributed by Michael Vlassoff of the Latin American Demographic Centre. These drafts were revised and put in their present form by Miroslav Macura, then a staff member of the Population Division. The Population Division is grateful to Messrs. Knowles, Kleinbaum, Vlassoff and Macura for their respective contributions to this module.

The preparation of this manual was made possible by the generous support of the United Nations Population Fund. This support included not only financial support but also helpful suggestions concerning the substance and presentation of the topics contained within the three modules. This assistance from the United Nations Population Fund is gratefully acknowledged by the Population Division.

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IX. PROJECTING INCOME USING A SOCIAL ACCOUNTING MATRIX

A. Introduction

This chapter discusses a method that can be used to project the amount of disposable income (see box 1)* received by the various institutions that make up the economy, namely, households, businesses and the government. The method can also be used to obtain various indicators of disposable household income, examples of which are levels and rates of change of per capita and per household disposable household incomes. Projections of disposable incomes of the various institutions and their various indicators can be prepared for the entire country or for its urban and rural areas. These projections can be used as indicators of the standard of living or as inputs into projections of household consumption and household savings (see chaps X and XI).

This method is based on the social accounting matrix (SAM), described in annex I, which is an accounting device for presenting income and product flows in an economy (Pyatt and Thorbecke, 1976). Using accounting relationships underlying this matrix, the method can be used to project levels of disposable income received by various types of institutions, given the levels of value added by industry and several other inputs.[1] The projection involves transforming value added by sector into incomes of factors of production (see box 2) (e.g., wages, profits, rent) and further transforming those factor incomes into incomes of institutions, namely, into disposable incomes of households, corporations, government.

Since SAM is merely a descriptive device and the relationships underlying it are accounting relationships, it is necessary for this method to use among its inputs assumptions on a variety of proportions and ratios which are used in the transformations referred to above. Those assumptions may postulate that the proportions and ratios remain fixed or undergo specified changes over time.

This method of making income projections has several advantages over using econometric models. The SAM-based method does not require time series data and does not depend on complicated estimation techniques. The SAM-based method is also relatively easy to apply from a computational standpoint.[2] Furthermore, owing to the double-entry accounting nature of SAM, all projections based on it will be consistent with other sets of economic projections and with the national accounts in general.

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* Terms defined in glossary boxes are underlined where they appear for the first time.

Box 1

Glossary

<u>Disposable income</u>
The income of a particular type of institution, such as households, corporations or government, after taxes or transfers, whichever is appropriate, which is available for consumption or savings.

<u>Household consumption</u>
The value of "final" goods and services consumed by households over a specified time period.

<u>Household savings</u>
The portion of household disposable income that is not spent on consumption over a specified time period.

<u>Social accounting matrix</u>
The tabular presentation of the income and product flows in an economy during a specified time period. It consists of a set of accounts, such as those for factors of production (labour and capital) or institutions (households, corporations and government) along with the economy's input-output table.

<u>Value added</u>
For a firm or farm, the difference between its total revenue and the cost of raw materials, services and components used in production, over a specified time period. For the economy as a whole or any of its industries, the aggregate of value added of different firms or farms of which the economy or industry is composed.

While the SAM-based method has certain advantages over econometric models, it also has some disadvantages. First, it may employ fairly rigid assumptions inasmuch as the relationships between the various income flows are generally kept fixed at the base-year levels throughout the projection. Although such relationships may change relatively little in the short run, they are likely to change over longer periods of time. The parameters in an econometric model may reflect such changes if they are estimated with data covering several periods. Thus, SAM, which is based on observations at one point in time, may not be well-suited to project incomes over the long run.

Box 2

Glossary

(Items indicated by an asterisk come from the glossary of Module One and should not be modified)

Econometric models
Mathematical models expressing economic theories in terms of empirically estimated coefficients of model relationships. The model coefficients are obtained by applying statistical estimation methods to suitable data. The models may be used to forecast future values of selected model variables.

Electronic spreadsheet program
A type of microcomputer software used in making spreadsheet type calculations electronically.

Factor incomes
The income accruing to a particular factor of production in return for services rendered by that factor. Examples of factor incomes are capital income and labour income.

Factors of production
Resources or inputs required to produce a good or service. Basic categories of factors of production are land, labour, and capital.

National accounts
A system of accounts that provide for a systematic and integrated recording of transaction flows in an economy. It brings into a coherent system data ranging in degree of aggregation from consolidated accounts of the country to detailed input-output and flow-of-funds tables. They include production and goods and services accounts, along with outlay and capital finance accounts for institutions such as households and government.

Profits
Income accruing to capital in return for services rendered by it. It can be computed as the difference between the market value of output and the market value of inputs which were employed to produce that output.

Rent
Income accruing to a durable good, such as land or buildings, in return for services rendered by the good.

Wages
Income accruing to labour in return for services rendered by it.

Since the SAM method has no behavioural content, it cannot be used to forecast changes in the functional distribution of income (see box 3), which might result from rapid inflation or changes in factor prices. Similarly, it cannot be employed to forecast shifts in the institutional distribution of income which may be the consequences of changes in the distribution of ownership of assets, such as capital. However, in making income projections with the SAM-based method, one can take into account anticipated effects of selected government policies on institutional incomes. This can be done by assuming shifts in the values of selected proportions and/or ratios over the projection period which would be in accordance with expectations on the likely outcomes of such policies. Alternatively, the values of the proportions and ratios may remain fixed over the projection period, as in the examples presented later in the chapter.

B. The technique

1. Overview

This overview lists inputs required by the method and indicates the types of results it can generate. It also outlines the computational steps involved in making an income projection with this method.

(a) Inputs

To project incomes with this method the following inputs are required:

(i) Projected levels of value added by industry;
(ii) Projected population size;
(iii) Projected number of households;
(iv) Assumed values for various proportions and ratios (see below);
(v) Assumed values for different types of transfers (see below).

The proportions and ratios for which values need to be assumed include:

(i) Proportions of value added going to wages by industry;
(ii) Ratios of net indirect taxes (indirect taxes less subsidies) to value added by industry;
(iii) Proportion of profits received by households;
(iv) Proportion of gross income of corporations (gross business income) paid to households as dividends (see box 4);
(v) Proportion of gross income of households paid as household income taxes;
(vi) Proportion of gross income of corporations paid as corporate income taxes.

Box 3

Glossary

(Items indicated by an asterisk come from the glossary of Module One and should not be modified)

<u>Factor prices</u>
The prices of factors of production, which normally reflect their scarcity value (or competitive market prices) unless distorted by institutional arrangements.

<u>Functional distribution of income</u>
The distribution of income to factors of production without regard to ownership of those factors.

<u>Indirect taxes</u>
Taxes levied on goods and services purchased by consumers and exported by producers, for which the taxpayer's liability varies in proportion to the quantity of particular goods purchased or sold. Examples of indirect taxes are customs duties (tariffs), excise duties, sales taxes and export duties.

<u>Inflation</u>
A process of above normal general price increase as reflected in, for example, the consumer and wholesale price indices. More generally, the phenomenon of rising prices.

<u>Institutional distribution of income</u>
The distribution of income to different types of institutions, such as households, corporations and government, which is influenced, among other things, by the ownership of the factors of production by the institutions.

<u>Subsidies</u>
A special type of transfer payment to a corporation to prevent it from experiencing losses or to prevent an increase in its price.

Box 4

Glossary

Corporate income taxes
Taxes levied on the profits of companies.

Dividends
Payments to shareholders of a company, usually in the form of cash or shares.

Government transfers to corporations
Payments made by the Government to corporations, which do not entail exchange of goods and services.

Government transfers to households
Payments made by the Government to households, which do not form part of exchange of goods and services. Examples of such payments are social security benefits or student grants.

Household income taxes
Taxes levied on the income accruing to members of households.

Net foreign transfers to households
The difference between the amounts of income that households received from and pay to the various institutions abroad. The receipts and payments may be in connection with the remuneration of the factors of production and/or transactions involving no exchange of goods and services.

Values for the following types of transfers should to be specified:

(i) Government transfers to households;
(ii) Government transfers to corporations;
(iii) Net foreign transfers to households.

For a national projection, the inputs should refer to the entire country. For an urban-rural projection, some of them should refer to urban and rural areas, while the others may be for the country as a whole. The inputs are listed in box 5.

Since this method is described as a procedure for making quinquennial projections, projections of value added, population size and the number of households and all other inputs would be for dates five years apart, starting with the initial year of projection. Given the appropriate annual inputs, however, the method could, of course, also be used to make annualized projections of income.

Box 5

Inputs for making income projections using the social accounting matrix

1. Value added by industry (national or urban and rural).

2. Population size (national or urban and rural).

3. Number of households (national or urban and rural).

4. Assumptions on various proportions and ratios (national or urban and rural):

   (a) Proportions of value added going to wages by industry;
   (b) Ratios of net indirect taxes (indirect taxes less subsidies) to value added by industry;
   (c) Proportions of profits received by households;
   (d) Proportions of gross income of corporations paid to households as dividends;
   (e) Proportions of gross income of households paid as household income taxes;
   (f) Proportions of gross income of corporations paid as corporate income taxes.

5. Assumptions on value of transfers (national or urban and rural):

   (a) Government transfers to households;
   (b) Government transfers to corporations;
   (c) Net foreign transfers to households.

(b) Outputs

In making a national projection, the method can be used to generate the following outputs relating to disposable incomes:

(i) Different types of incomes: factor incomes, gross incomes and disposable incomes;

(ii) Various disposable income aggregates, such as total disposable income and disposable incomes of institutions;

(iii) Indicators of the distribution of disposable incomes, such as the proportions of total disposable income received by various institutions;

(iv) Rates of change in total disposable income and disposable incomes of institutions;

(v) Levels and rates of change in per capita and per household disposable household incomes.

If the method is used to prepare an urban-rural projection, the results would include all those listed under (i) through (v) for urban and rural areas, as well as for the entire country. In addition, they would include indicators of the urban-rural distribution of disposable household incomes and indicators of the urban-rural differentials of those incomes.

The types of outputs that the technique can generate as part of the projection are shown in box 6.

(c) Computational steps

The disposable incomes of institutions are obtained as an outcome of successive transformations of different types of income. Initially, levels of value added by industry are converted into incomes of factors of production, such as wages and profits, classified by industry. Then, these factor incomes by industry are transformed into factor incomes received by institutions. Factor incomes of institutions are further converted into gross incomes of institutions which are, in turn, transformed into disposable incomes of institutions. Those disposable incomes are then used to derive various income aggregates, indicators of income distribution and rates of change in disposable incomes. In addition, projected total disposable household income is also used to derive levels and rates of change in the disposable household income per capita and per household.

2. National level

This section initially describes a technique for projecting the levels of disposable incomes of the various institutions at the national level. It then describes the steps needed to derive other results. The procedure, which is summarized in box 7, is based on the structure of the social accounting matrices presented in table 1 of section C and discussed in annex I. Some of the steps of that procedure are also presented in figure I. If a different structure of SAM is used, procedures will, of course, differ accordingly.

(a) Incomes of factors of production

The first step in making an income projection using relationships embodied in SAM is to derive the functional distribution of income by industry (i.e., wages and profits) from the projected levels of value added by industry. [1]

(i) Wages

Wage income by industry for the end of any given projection interval (t to t+5) can be obtained as follows:

Box 6

Types of outputs obtained by projecting incomes using the social accounting matrix

1. Different types of incomes (national or urban, rural and national)

   Factor incomes
   Gross incomes
   Disposable incomes

2. Disposable income aggregates (national or urban, rural and national)

   Total disposable income and disposable incomes of institutions

   Growth in total disposable income and disposable incomes of institutions

3. Indicators of the distribution of the total disposable income by institutions (national or urban, rural and national)

   Proportions of total disposable income received by the various institutions

4. Indicators of the urban-rural distribution of disposable household income (national only; if urban and rural incomes are being projected)

   Proportions of disposable household income in different locations

5. Rates of growth of disposable incomes (national or urban, rural and national)

   Rates of growth of total disposable income and disposable incomes of institutions

6. Indicators of per capita and per household disposable household incomes (national or urban, rural and national)

   Levels and rates of growth of per capita and per household disposable household income

7. Indicators of urban-rural differentials in disposable household incomes (national only; if urban and rural incomes are being projected)

   Percentage differences between levels of urban and rural per capita and per household disposable household income

Box 7

Computational steps needed to project incomes at the national level

The steps used to project disposable incomes at the national level at the end of the five-year projection interval are:

1. Estimate the amount of wages generated in each industry by multiplying the projected levels of value added (at factor prices) by the corresponding proportions of value added going to labour as wages. In addition, sum the wage bills by industry to obtain the total wage bill.

2. Calculate profits in each industry as the difference between the value added and the wage bill for the industry. Add up profits across industries to arrive at total profits.

3. Derive the amount of profits received by households by multiplying total profits by the proportion of total profits received by households.

4. Add the total wage bill and profits received by households to obtain the factor income of households.

5. Derive the factor income of corporations as the difference between total profits and the amount of profits received by households.

6. Calculate the gross income of corporations as the sum of their factor income and government transfers to corporations.

7. Obtain dividends received by households by multiplying the gross income of corporations by the proportion of that income paid to households as dividends. Then calculate the gross income of households as the sum of the factor income, government transfers, dividends and net foreign transfers received by households.

8. Compute household and corporate income taxes as products of gross incomes of household and corporations and respective proportions of those incomes paid as household and corporate income taxes. Compute net indirect taxes by multiplying the levels of value added by industry by the ratios of net indirect taxes to value added, followed by summing up the products. Then derive the gross income of government as the sum of household and corporate income taxes, and net indirect taxes.

9. Calculate the disposable income of households as the difference between the gross income of households and household income taxes. Derive the disposable income of corporations as the difference between gross income of corporations and corporate income taxes. Compute the disposable income of government as the difference between gross income of government and government transfers to households and corporations.

(continued)

Box 7 (continued)

10. Calculate various other disposable incomes aggregates, such as the total disposable income.
11. Derive indicators of the distribution of the total disposable incomes among institutions.
12. Compute rates of growth of disposable incomes.
13. Calculate indicators of the level and growth of per capita and per household disposable income of households.

$$WAGE(i,t+5) = PRVAWG(i,t+5) \cdot VA(i,t+5); \qquad (1)$$

$$i = 1,\ldots,I,$$

where:

$i = 1,\ldots,I$	are industries of the country's economy,
I	is the number of industries,
t	is the year of the projection period,
WAGE(i,t+5)	is the wage bill in industry i
PRVAWG(i,t+5)	is the proportion of value added going to wages in industry i, and
VA(i,t+5)	is the value added at factor prices in industry i.

The wage bill for the entire economy can be obtained by aggregating industry-specific wage bills. For the end of the projection interval (t to t+5), the total wage bill is:

$$WAGE(t+5) = \sum_{i=1}^{I} WAGE(i,t+5), \qquad (2)$$

where:

WAGE(t+5)	is the total wages.

(ii) Profits

If labour and capital are the only two factors of production, as assumed in this discussion, profits for each industry can be projected as the difference between value added and wages. At the end of a given projection interval, profits by industry are:

$$PROF(i,t+5) = VA(i,t+5) - WAGE(i,t+5); \quad i = 1,\dots,I, \qquad (3)$$

where:

PROF(i,t+5) is the amount of profits in industry i.

Given the projected profits in each industry, the total profits for the entire economy can be obtained by aggregating industry-specific profits across industries. For the end of the projection interval (t to t+5), the total profits are obtained as:

$$PROF(t+5) = \sum_{i=1}^{I} PROF(i,t+5), \qquad (4)$$

where:

PROF(t+5) is the total profits.

(b) Factor incomes of institutions

Once incomes of factors of production have been calculated, it is possible to project factor incomes received by the various institutions -- households and corporations. [1]

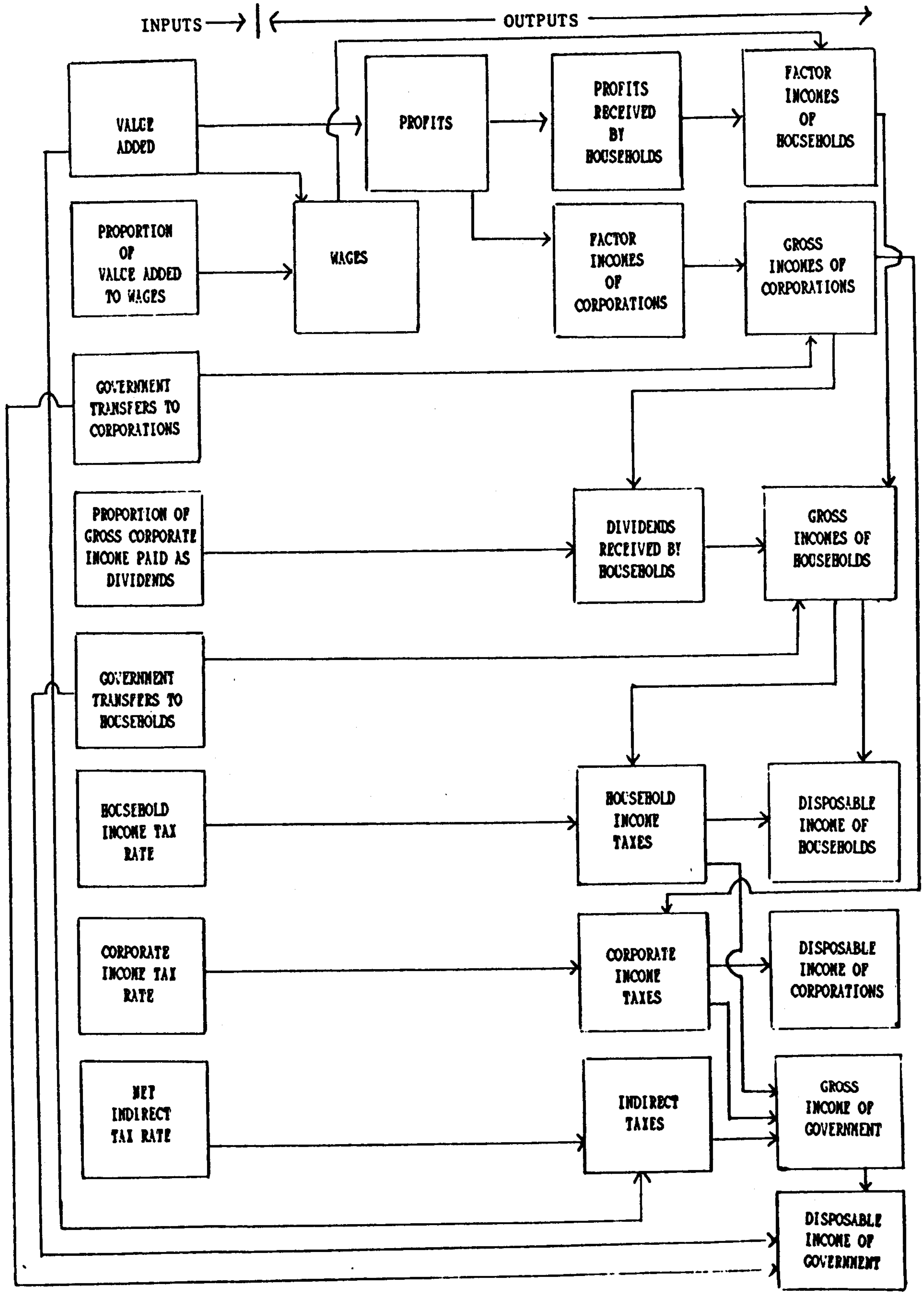
(i) Factor income of households

The factor income received by households includes total wages and that part of total profits that accrues to households.

The part of total profits that accrues to households can be found as the product of the proportion of profits going to households and total profits:

$$PROFH(t+5) = PRPROFH(t+5) \cdot PROF(t+5), \qquad (5)$$

Figure I. Steps to project incomes at the national level



where:

PROFH(t+5) is the amount of profits accruing to households, and

PRPROFH(t+5) is the proportion of profits received by households.

Therefore, the factor income of households at the end of the projection interval is calculated as follows:

$$FIH(t+5) = WAGE(t+5) + PROFH(t+5), \tag{6}$$

where:

FIH(t+5) is the factor income of households.

(ii) Factor income of corporations

The factor income received by corporations equals that part of the total profits that does not go to households. Thus, the factor income of corporations at the end of a projection interval is:

$$FIC(t+5) = PROF(t+5) - PROFH(t+5), \tag{7}$$

where:

FIC(t+5) is the factor income of corporations.

(c) Gross incomes of institutions

The gross incomes of all three types of institutions -- households, corporations and government -- can be derived from factor incomes received by households and corporations. The gross income of corporations must be projected first since it provides the basis for projecting dividends paid to households.

(i) Gross income of corporations

The gross income of corporations can be obtained as the sum of the factor income of corporations and the government transfers to corporations. For the end of the projection interval (t to t+5), the gross income of corporations is thus:

$$GCI(t+5) = FIC(t+5) + GTC(t+5), \tag{8}$$

where:

GCI(t+5) is the gross corporate income, and

GTC(t+5) is the government transfers to corporations.

(ii) Gross income of households

The gross income of households is obtained as the sum of several income components, including dividends paid to households by corporations, which must be derived before computing the gross income of households.

Dividends paid to households can be obtained as a proportion of gross income of corporations. Therefore, for the end of the projection interval (t to t+5) dividends are:

$$DIVH(t+5) = PRCIH(t+5) \cdot GCI(t+5), \tag{9}$$

where:

DIVH(t+5)	is the dividends paid to households, and
PRCIH(t+5)	is the proportion of gross income of corporations paid to households as dividends.

The gross household income can be obtained as the sum of the factor income received by households, dividends, government transfers to households and net foreign transfers to households:

$$GHI(t+5) = FIH(t+5) + DIVH(t+5) + GTH(t+5) + NFTH(t+5), \tag{10}$$

where:

GHI(t+5)	is the gross household income,
GTH(t+5)	is the government transfers to households, and
NFTH(t+5)	is the net foreign transfers to households.

(iii) Gross income of government

The gross income of government equals the sum of various taxes levied by the Government. This includes household income taxes, corporate income taxes and net indirect taxes. To compute the gross income of government, it is initially necessary to project the size of these various taxes aggregates.

a. Household income taxes

Household income taxes can be computed as the product of the gross household income and the proportion of that income paid as taxes:

$$HIT(t+5) = PRHIT(t+5) \cdot GHI(t+5), \tag{11}$$

where:

HIT(t+5)	is the household income taxes, and
PRHIT(t+5)	is the proportion of gross household income paid as household income taxes.

b. Corporate income taxes

Corporate income taxes can be computed as the product of the gross corporate income and the proportion of that income paid as taxes:

$$CIT(t+5) = PRCIT(t+5) \cdot GCI(t+5), \tag{12}$$

where:

CIT(t+5)	is the corporate income taxes, and
PRCIT(t+5)	is the proportion of gross corporate income paid as corporate income taxes.

c. Net indirect taxes

Net indirect taxes (indirect taxes less subsidies) in each industry can be obtained as a product of value added of the industry and the ratio of net indirect taxes to value added. For the end of the projection interval (t to t+5) net indirect taxes by industry can therefore be obtained as:

$$NIT(i,t+5) = RITVA(i,t+5) \cdot VA(i,t+5); \quad i = 1,\ldots,I, \tag{13}$$

where:

NIT(i,t+5)	is the net amount of indirect taxes (indirect taxes less subsidies) in industry i, and
RITVA(i,t+5)	is the ratio of net indirect taxes to value added in industry i.

Total net indirect taxes are obtained by summing up the net indirect taxes across industries. Thus, for the end of the projection interval (t to t+5) the total net indirect taxes are:

$$NIT(t+5) = \sum_{i=1}^{I} NIT(i,t+5), \tag{14}$$

where:

NIT(t+5)	is the total net indirect taxes.

The gross income of government can be obtained as the sum of revenues received by the government in the form of different taxes:

$$GGI(t+5) = HIT(t+5) + CIT(t+5) + NIT(t+5), \tag{15}$$

where:

GGI(t+5)	is the gross government income.

(d) Disposable incomes of institutions

After deriving the gross incomes of institutions, it is possible to obtain the disposable incomes of institutions, namely, households, corporations and government.

(i) Disposable household income

The disposable household income can be calculated as the gross income of households less household income taxes. For the end of the projection interval (t to t+5), the disposable household income is:

$$DHI(t+5) = GHI(t+5) - HIT(t+5), \tag{16}$$

where:

DHI(t+5) is the disposable household income.

(ii) Disposable corporate income

Disposable corporate income (i.e., gross business savings) can be obtained for the end of the projection interval as the gross income of corporations less dividends and corporate income taxes at that date:

$$DCI(t+5) = GCI(t+5) - [\ DIVH(t+5) + CIT(t+5)\ ], \tag{17}$$

where:

DCI(t+5) is the disposable corporate income.

(iii) Disposable government income

The disposable government income can be found as the gross income of government less government transfers to households and corporations. For the end of the projection interval this income is:

$$DGI(t+5) = GGI(t+5) - [\ GTH(t+5) + GTC(t+5)\ ], \tag{18}$$

where:

DGI(t+5) is the disposable government income.

(e) Other results

Once disposable incomes of the various institutions are derived for the end of a given projection interval, several useful indicators can be calculated. These indicators include disposable income aggregates and indicators of the distribution and rates of change of disposable incomes. They also include indicators of the levels and rates of change of per capita and per household disposable incomes of households.

(i) Aggregates of disposable income

A key aggregate that can be calculated from the projected disposable incomes of institutions, which are part of disposable income aggregates is the total disposable income. Increases in the total disposable income over the intervening five-year projection intervals can also be calculated, as well as increases in disposable incomes of institutions over those intervals.

a. Total disposable income

Total disposable income can be obtained by summing up the disposable incomes of households, corporations and government. For the end of a projection interval the total disposable income is:

$$TDI(t+5) = DHI(t+5) + DCI(t+5) + DGI(t+5), \tag{19}$$

where:

TDI(t+5) is the total disposable income.

b. Growth in total disposable income

The growth in total disposable income over the projection interval (t to t+5) equals the difference between the total disposable income at the end of the interval and the total disposable income at its beginning:

$$TDIG = TDI(t+5) - TDI(t), \tag{20}$$

where:

TDIG is the growth in the total disposable income during the interval.

c. Growth in disposable incomes of institutions

The increases in the disposable incomes of households, corporations and government over the projection interval are obtained as follows:

The growth of disposable household income is calculated as:

$$DHIG = DHI(t+5) - DHI(t), \tag{21}$$

The growth of disposable corporate income is obtained as:

$$DCIG = DCI(t+5) - DCI(t), \tag{22}$$

The growth of disposable government income is computed as:

$$DGIG = DGI(t+5) - DGI(t), \tag{23}$$

where:

DHIG is the growth of disposable household income during the interval,

DCIG is the growth of disposable corporate income during the interval, and

DGIG	is the growth of disposable government income during the interval.

(ii) Indicators of the distribution of total disposable income

After calculating the total disposable income, it is possible to derive the proportion of this income received by each type of institution.

Proportions by institutions

The distribution of total disposable income among the various institutions can be obtained as follows:

The proportion of the total disposable income received by households is calculated as:

$$PRDHI(t+5) = DHI(t+5) \; / \; TDI(t+5), \tag{24}$$

The proportion of the total disposable income received by corporations is obtained as:

$$PRDCI(t+5) = DCI(t+5) \; / \; TDI(t+5), \tag{25}$$

The proportion of the total disposable income received by government is calculated as:

$$PRDGI(t+5) = DGI(t+5) \; / \; TDI(t+5), \tag{26}$$

where:

PRDHI(t+5)	is the proportion of total disposable income received by households,
PRDCI(t+5)	is the proportion of total disposable income received by corporations, and
PRDGI(t+5)	is the proportion of total disposable income received by government.

(iii) Rates of growth of disposable incomes

It is also possible to compute average annual growth rates of total disposable income and disposable incomes of households, corporations and government.

a. The rate of growth of total disposable income

The average annual rate of growth of the total disposable income can be computed from the total disposable income at the beginning and at the end of the projection interval.

i. Geometric growth rates

If it is assumed that growth occurs over discrete intervals, then the percentage growth rate can be obtained using the geometric growth rate formula:

$$GGRTDI = [(TDI(t+5)/TDI(t))^{1/5} - 1] \cdot 100, \tag{27}$$

where:

GGRTDI — is the average annual geometric growth rate of the total disposable income for the interval.

ii. Exponential growth rates

Alternatively, if growth is assumed to be continuous, the percentage growth rate of total disposable income can be calculated using the exponential growth rate formula:

$$EGRTDI = [(\ln (TDI(t+5)/TDI(t))) / 5] \cdot 100 \tag{28}$$

where:

EGRTDI — is the average annual exponential growth rate of the total disposable income for the interval, and

ln — is the natural logarithm.

b. Rates of growth of disposable incomes of institutions

Average annual rates of growth of disposable incomes of institutions can be derived from the levels of those incomes at the beginning and the end of the interval.

i. Geometric growth rates

Assuming discrete growth, the geometric growth rate of the disposable household income is calculated as:

$$GGRDHI = [(DHI(t+5)/DHI(t))^{1/5} - 1] \cdot 100, \tag{29}$$

The geometric growth rate of the disposable corporate income is calculated as:

$$GGRDCI = [(DCI(t+5)/DIC(t))^{1/5} - 1] \cdot 100, \tag{30}$$

The geometric growth rate of the disposable government income is calculated as:

$$GGRDGI = [(DGI(t+5)/DIG(t))^{1/5} - 1] \cdot 100, \tag{31}$$

where:

GGRDHI is the average annual geometric growth rate of the disposable household income for the interval,

GGRDCI is the average annual geometric growth rate of the disposable corporate income for the interval, and

GGRDGI is the average annual geometric growth rate of the disposable government income for the interval.

ii. Exponential growth rates

If the projections were based on the assumption of continuous growth, then the exponential growth rate of the disposable household income is calculated as:

$$EGRDHI = [\ (\ \ln\ (\ DHI(t+5)/DHI(t)\ )\ )\ /\ 5\ ] \cdot 100, \tag{32}$$

The exponential growth rate of the disposable corporate income is calculated as:

$$EGRDCI = [\ (\ \ln\ (\ DCI(t+5)/DCI(t)\ )\ )\ /\ 5\ ] \cdot 100, \tag{33}$$

The exponential growth rate of the disposable government income is calculated as:

$$EGRDGI = [\ (\ \ln\ (\ DGI(t+5)/DGI(t)\ )\ )\ /\ 5\ ] \cdot 100, \tag{34}$$

where:

EGRDHI is the average annual exponential growth rate of the disposable household income for the interval,

EGRDCI is the average annual exponential growth rate of the disposable corporate income for the interval, and

EGRDGI is the average annual exponential growth rate of the disposable government income for the interval.

(iv) Levels of per capita and per household disposable incomes of households

In addition to the above indicators, one may also compute levels and rates of change of the per capita and per household disposable household incomes.

Per capita disposable household income can be obtained by dividing the disposable household income by the population size. Thus, for the end of a given projection interval (t to t+5), per capita disposable household income is:

$$PCDHI(t+5) = DHI(t+5)\ /\ POP(t+5), \tag{35}$$

where:

PCDHI(t+5) is the per capita disposable household income, and

POP(t+5) is the population size.

Per household disposable household income, which will be often referred to as average disposable household income can be obtained by dividing the disposable household income by the total number of households. Thus, for the end of a given projection interval, average disposable household income is:

$$ADHI(t+5) = DHI(t+5) \;/\; NH(t+5), \tag{36}$$

where:

ADHI(t+5) is the average (per household) disposable household income, and

NH(t+5) is the total number of households.

(v) Rates of change of per capita and per household disposable incomes of households

Once the levels of per capita and per household disposable household incomes are computed, their average rates of change over time can be derived either as geometric or as exponential rates.

a. Geometric growth rates

If it is assumed that growth occurs in discrete time intervals, percentage rates of growth of per capita and per household disposable household incomes can be obtained as follows:

The geometric growth rate of per capita disposable household income is calculated as:

$$GGRPCDHI = [\ (\ PCDHI(t+5)/PCDHI(t)\ )^{1/5} - 1\ ] \cdot 100, \tag{37}$$

where:

GGRPCDHI is the average annual geometric growth rate of the per capita disposable household income for the interval.

The geometric growth rate of per household disposable income is calculated as:

$$GGRADHI = [\ (\ ADHI(t+5)/ADHI(t)\ )^{1/5} - 1\ ] \cdot 100, \tag{38}$$

where:

GGRADHI is the average annual geometric growth rate of the average (per household) disposable household income for the interval.

b. Exponential growth rates

If the projections assume continuous growth, the percentage rates of growth of per capita and per household disposable household incomes would be calculated as follows:

The exponential growth rate of per capita disposable household income is calculated as:

$$EGRPCDHI = [(\ln (PCDHI(t+5)/PCDHI(t))) / 5] \cdot 100, \tag{39}$$

where:

EGRPCDHI is the average annual exponential growth rate of per capita disposable household income for the interval.

The exponential growth rate of per household disposable income is calculated as:

$$EGRADHI = [(\ln (ADHI(t+5)/ADHI(t))) / 5] \cdot 100, \tag{40}$$

where:

EGRADHI is the average annual exponential growth rate of average (per household) disposable household income for the interval.

3. Urban-rural level

A major policy objective in many countries is to reduce income differences between urban and rural areas. To project urban and rural incomes along with those differences it is necessary to apply this method at the urban-rural level. This section describes a procedure for projecting urban and rural disposable incomes that is similar to that employed in making a national projection. Like its national counterpart, the procedure can be used to project levels of incomes of different types, and to calculate other results, such as levels and growth rates of per capita and per household disposable incomes of households.

(a) Different categories of incomes

The procedure for making urban-rural income projections derives incomes of factors of production (wages and profits) using steps that are urban-rural equivalents of the steps described in equations (1) through (4). Factor incomes and gross incomes of institutions are derived with urban-rural counterparts ofthe steps explained, respectively, by equations (5) through (7) and by equations (8) through (15). Lastly, disposable incomes of households, corporations and government are projected employing urban-rural equivalents of the steps described in equations (16) through (18).

(b) Other results

The indicators discussed in connection with the national projection can also be computed as part of an urban-rural projection. Those indicators are, however, calculated for urban and rural areas separately, as well as for the entire country, using steps analogous to those indicated by equations (19) through (40). In addition, indicators of the distribution of disposable household income by location -- proportions of disposable household income urban and rural -- can be calculated. [a] Moreover, indicators of the urban-rural differentials of per capita and per household disposable incomes of households can be calculated.

(i) Proportions of disposable household income that are urban and rural

The proportion of disposable household income that is urban (k=1) at the end of the projection interval can be obtained by dividing the disposable household income in urban areas by the disposable household income for the entire country:

$$PRDHIURB(t+5) = DHI(1,t+5) \; / \; DHI(t+5), \qquad (41)$$

where:

k = 1,2	are urban and rural locations,
PRDHIURB(t+5)	is the proportion of disposable household income that is urban,
DHI(k,t+5)	is the disposable household income in location k.

The proportion of disposable household income that is rural (k=2) can be found as a compliment of the proportion urban:

$$PRDHIRUR(t+5) = 1 - PRDHIURB(t+5), \qquad (42)$$

where:

PRDHIRUR(t+5)	is the proportion of disposable household income that is rural.

(ii) Urban-rural differentials in per capita and per household disposable household incomes

Given the levels of per capita and per household disposable household incomes in urban (k=1) and rural (k=2) areas, it is possible to calculate differences between urban and rural incomes as a per cent of rural incomes. In particular, for the end of a given projection interval (t to t+5), the percentage difference between urban and rural per capita disposable household incomes is:

$$DPCDHI(t+5) = [(PCDHI(1,t+5) - PCDHI(2,t+5)) / PCDHI(2,t+5)] \cdot 100, \qquad (43)$$

where:

DPCDHI(t+5) is the difference between urban and rural per capita disposable household incomes expressed as per cent of the rural per capita disposable household income, and

PCDHI(k,t+5) is the per capita disposable household income in location k.

For the end of a given projection interval, the percentage urban-rural difference of per household disposable income is:

$$DADHI(t+5) = [(ADHI(1,t+5) - ADHI(2,t+5)) / ADHI(2,t+5)] \cdot 100, \qquad (44)$$

where:

DADHI(t+5) is the difference between urban and rural average (per household) disposable household incomes expressed as per cent of the rural average (per household) disposable household income, and

ADHI(k,t+5) is the average (per household) disposable household income in location k.

This completes the description of the technique for making income projections using the social accounting matrix.

C. The inputs

This section lists the inputs that are employed to project incomes using the social accounting matrix. It then describes the way those inputs can be prepared.

1. Types of inputs required

The following categories of inputs are needed to project incomes using a social accounting matrix:

(a) Projected levels of value added by industry;
(b) Projected population size;
(c) Projected number of households;
(d) Assumed values of various proportions and ratios;
(e) Assumed values of various types of transfers.

Items (d) and (e) above require further amplification.

Various proportions and ratios used by the method are as follows:

(a) Proportions of value added going to wages by industry;
(b) Ratios of net indirect taxes (indirect taxes less subsidies) to value added by industry;
(c) Proportion of profits received by households;
(d) Proportion of gross corporate income paid to households as dividends;
(e) Proportion of gross household income paid as household income taxes;
(f) Proportion of gross corporate income paid as corporate income taxes.

Three types of transfers for which values also need to be assumed are as follows:

(a) Government transfers to households;
(b) Government transfers to corporations;
(c) Net foreign transfers to households.

These categories of inputs should be prepared for the entire country or for urban and rural areas, depending on the type of projection to be made.

2. Preparation of the inputs

Where suitable projections of value added, population and the number of households are already not available, the preparation of the requisite inputs may begin by making those projections.

(a) Projections of value added, population size and the number of households

Projections of value added, which are often prepared in the course of drafting a development plan, can be derived using a procedure based on an input-output table. Such a procedure was outlined in box 17 of Module Two. Projections of the population size can be prepared by means of the cohort component method and those of the number of households can be made by the headship rate method. These techniques were respectively described in chapters II and III of Module One.

Projected value added must be calculated at factor prices rather than at market prices (see box 8). The difference between the two is equal to net indirect taxes (indirect taxes less subsidies), which are excluded from value added at factor prices. If the available projection of value added is calculated at market prices, this projection will have to be adjusted using information on net indirect tax, which is provided in SAM to obtain a projection of value added at factor prices.

(b) Assumptions on the various proportions and ratios

To prepare assumptions on the initial and future values of the various proportions and ratios, observations on those proportions and ratios for a recent date or a few such dates are needed.

Box 8

Glossary

(Items indicated by an asterisk come from the glossary of Module One and should not be modified)

Capital income
Income in the form of profits, dividends and interest, accruing to physical capital and financial claims in return for services rendered by those forms of capital.

Labour income
Income, primarily in the form of wages and salaries, accruing to labour in return for services rendered by it.

Market prices
The amounts of money or money equivalents needed to be given up in order to obtain goods and services through exchange.

(i) Observations on proportions and ratios

Observations on the relevant proportions and ratios can be derived from a recent SAM. If an appropriate SAM is not available, it can be derived using the types of data that are briefly discussed in annex I.

a. Procedures to derive observations on proportions and ratios

The steps that must be taken to obtain observations on proportions and ratios needed in preparing income projections at the national or urban-rural level described in this section. Annex II shows how those steps can be used to obtain observations on the proportions and ratios employing illustrative SAMs shown in tables 1 and 2.

i. National level

The following discussion of the steps that can be used to derive observations on the relevant proportions and ratios needed to make a national projection are based on the structure of a SAM such as that shown in table 1.

Value added. To calculate proportions of value added going to wages for each industry, it is initially necessary to derive the level of value added at factor cost for every industry. Where the factors of production include only labour and capital, the value added at factor cost for each industry in a given year to which

Table 1. An illustrative social accounting matrix

(Thousands of LCUs)a/

Expenditures

			1a	1b	2a	2b	2c	2d	3	4a	4b	4c	4d	4e	4f	4g	4h	5	6 Totals
	1a.	Income to labour (wages)								19 142	1 021	22 176	1 845	9 070	15 766	18 353	66 043		153 417
	1b.	Income to capital (profits)								113 836	896	18 416	3 903	19 265	20 367	11 262	23 969		211 914
	2a.	Household current account	153 417	151 326		23 773	6 625												335 141
R	2b.	Corporate current account		60 588			7 853												68 441
e	2c.	Government current account			31 336	13 881		13 313											58 530
c	2d.	Indirect taxes								-965	18	10 849	3	13	947	710	1 737		13 313
e	3.	Combined capital account			33 481	30 788	-11 952											20 983	73 300
i	4a.	Agriculture			93 820				2 671	1 635		34 680		479		7	752	15 699	149 744
p	4b.	Mining			35					81	395	13 496	23	1 292			170	1 867	17 360
t	4c.	Manufacturing			51 652				3 519	7 363	740	36 643	726	12 963	5 174	10 806	16 214	52 884	198 685
s	4d.	Utilities			2 309					264	52	1 726	910	346	405	777	1 695	258	8 742
	4e.	Construction			12 496				34 798		13	464		1 674		135	410	78	50 070
	4f.	Trade			19 708				3 973	2 272	151	9 036	186	2 525	1 789	2 225	2 281	12 415	56 563
	4g.	Transport			18 208					1 080	311	3 326	108	832	6 080	8 401	3 927	16 717	58 990
	4h.	Services			31 836		56 002			1 669	136	4 860	539	1 609	5 149	4 100	14 709	12 862	133 471
	5.	Rest of the world account			40 260				28 338	3 366	13 625	43 012	498		886	2 215	1 563		133 762
	6.	Totals	153 417	211 914	335 141	68 441	58 530	13 313	73 300	149 743	17 360	198 685	8 742	50 070	56 563	58 990	133 471	133 763	

a/ Local currency units.

Table 2. An illustrative social accounting matrix involving some urban-rural disaggregation

(Thousands of LCUs) a/

Expenditures

Receipts	1a Urban	1a Rural	1b Urban	1b Rural	2a Urban	2a Rural	2b	2c	2d	3	4a	4b	4c	4d	4e	4f	4g	4h	5	6 Totals
1a. Income to labour (wages) Urban											1 210	681	19 374	1 600	7 834	13 831	15 403	40 642		100 576
Rural											17 932	340	2 802	245	1 237	1 935	2 949	25 401		52 841
1b. Income to capital (profits) Urban											6 856	611	16 076	3 362	2 158	13 814	9 469	14 749		67 096
Rural											106 979	285	2 340	541	17 107	6 553	1 793	9 220		144 818
2a. Household current account Urban	100 576		37 660				23 148	6 189												167 574
Rural		52 841		113 665			625	436												167 567
2b. Corporations current account			29 435	31 153				7 853												68 441
2c. Government current account					26 221	5 116	13 881		13 313											58 530
2d. Indirect taxes											-965	18	10 849	3	13	947	710	1 737		13 313
3. Combined capital account					29 998	3 485	30 787	-11 952											20983	73 300
4a. Agriculture					7 303	86 517				2 671	1 635		34 680		479		7	752	15 699	149 743
4b. Mining					35						81	395	13 496	23	1 292			170	1 867	17 360
4c. Manufacturing					31 705	19 947				3 519	7 363	740	36 643	726	12 963	5 174	10 806	16 214	52 884	198 685
4d. Utilities					2 309						264	52	1 726	910	346	405	777	1 695	258	8 742
4e. Construction					616	11 880				34 798		13	464		1 674		135	410	78	50 070
4f. Trade					14 795	4 913				3 973	2 272	151	9 036	186	2 525	1 789	2 225	2 281	12 415	56 563
4g. Transportation					1 758	16 450					1 080	311	3 326	108	832	6 080	8 401	3 927	16 717	58 990
4h. Services					18 614	13 222		56 002			1 669	136	4 860	539	1 610	5 149	4 100	14 709	12 862	133 471
5. Rest of the world account					34 221	6 038				28 338	3 366	13 625	43 012	498		886	2 215	1 563		133 762
6. Totals	100 576	52 841	67 096	144 818	167 574	167 567	68 441	58 530	13 313	73 300	149 743	17 360	198 685	8 742	50 070	56 563	58 990	133 471	133 762	

a/ Local currency units.

SAM refers can be obtained as the sum of labour income (wages) and capital income (profits) in that year:

$$VA(i,t') = WAGE(i,t') + PROF(i,t'); \qquad (45)$$

$$i = 1,\ldots,I,$$

where:

t' is the given calendar year. [6/]

Proportions of value added going to wages. Given the levels of value added at factor cost, the proportion of value added going to wages in each industry can be obtained as the amount of wages paid by the industry divided by the industry's value added:

$$PRVAWG(i,t') = WAGE(i,t') / VA(i,t'); \qquad (46)$$

$$i = 1,\ldots,I.$$

Ratios of net indirect taxes to value added. For each industry the ratios of value added going to net indirect taxes can be obtained by dividing net indirect taxes (indirect taxes less subsidies) by the value added:

$$RITVA(i,t') = NIT(i,t') / VA(i,t'); \qquad (47)$$

$$i = 1,\ldots,I.$$

Proportion of profits received by households. The proportion of profits going to households can be calculated as the amount of profits accruing to households, divided by the total profits:

$$PRPROFH(t') = PROFH(t') / PROF(t'). \qquad (48)$$

Proportion of gross corporate income paid to households as dividends. The proportion of gross income of corporations going to households as dividends can be obtained as the amount of income received by households as dividends, divided by the amount of gross income of corporations:

$$PRCIH(t') = DIVH(t') / GCI(t'). \qquad (49)$$

Proportion of gross household income paid as household income taxes. The proportion of gross income of households reserved by the government as household income taxes can be calculated as the ratio of household income taxes to gross household income:

$$PRHIT(t') = HIT(t') / GHI(t'). \qquad (50)$$

Proportion of gross corporate income paid as corporate income taxes. The proportion of gross income of corporations that is paid to government as corporate income taxes can be calculated as the corporate income taxes divided by gross income of corporations:

$$PRCIT(t') = CIT(t') \ / \ GCI(t'). \tag{51}$$

ii. Urban-rural level

The description of steps that would be used to derive observations on proportions and ratios needed to make an income projection at the urban-rural level will assume that the structure of the SAM is such as that shown in table 2.

Value added. To derive observations on proportions of value added going to wages by industry in both urban and rural areas, it is initially necessary to derive levels of value added at factor cost generated in the two areas by industry using an urban-rural equivalent of equation (45):

$$VA(i,k,t') = WAGE(i,k,t') + PROF(i,k,t'); \tag{52}$$

$$i = 1,\ldots,I;$$

$$k = 1,2.$$

Proportions of value added going to wages. Proportions of value added going to wages can be calculated from total wages by industry in urban and rural areas and the levels of value added in the two locations, employing an urban-rural counterpart of equation (46):

$$PRVAWG(i,k,t') = WAGE(i,k,t') \ / \ VA(i,k,t'); \tag{53}$$

$$i = 1,\ldots,I;$$

$$k = 1,2.$$

Ratios of net indirect taxes to value added. If it is assumed that ratios of net indirect taxes to value added by industry do not vary between urban and rural locations, those ratios can be derived by dividing net indirect taxes for each industry by the sum of industry's value added levels generated in urban and rural locations:

$$RITVA(i,k,t') = NIT(i,k,t') / \sum_{k'=1}^{2} VA(i,k',t'); \tag{54}$$

$$i = 1,\ldots,I;$$

$$k = 1,2.$$

Proportions of profits received by households. The proportions of profits going to households in urban and rural areas can be calculated using an urban-rural equivalent of equation (48):

$$PRPROFH(k,t') = PROFH(k,t') \ / \ PROF(k,t'); \quad k = 1,2. \qquad (55)$$

Proportions of gross corporate income paid to households as dividends. The proportions of gross corporate income received by households in urban or rural areas as dividends can be calculated as dividends received by households in those areas divided by the total gross corporate income:

$$PRCIH(k,t') = DIVH(k,t') \ / \ GCI(t'); \quad k = 1,2. \qquad (56)$$

Proportions of gross household income paid as household income taxes. The proportions of gross household income paid as household income taxes in urban and rural areas can be calculated using an urban-rural equivalent of equation (50):

$$PRHIT(k,t') = HIT(k,t') \ / \ GHI(k,t'); \quad k = 1,2. \qquad (57)$$

Proportions of gross corporate income paid as corporate income taxes. If it is assumed that proportions of gross corporate income paid as corporate income taxes do not vary between urban and rural areas, those proportions can be obtained by dividing corporate income taxes by gross corporate income, both of which are for the entire country:

$$PRCIT(k,t') = CIT(t') \ / \ GCI(t'); \quad k = 1,2. \qquad (58)$$

b. Illustrating the derivation of observations on proportions and ratios

The calculation of the relevant proportions and ratios is illustrated in annex II, first for the country as a whole and then for urban and rural areas, using SAMs shown in tables 1 and 2, respectively.

(ii) Assumptions on future values of proportions and ratios

The observations of the relevant proportions and ratios, which can be derived from a given SAM, would always refer to a date that precedes the initial year of the projection. They would provide the basis for selecting the assumed future values of the proportions and ratios to be included among projection inputs.

For the initial year of projection, the assumed values can be selected by approximating trends in the values of the proportions and ratios over the time period between the year to which SAM refers and the initial year. Information needed to approximate those trends may not be readily available, particularly where SAM refers to a date close to the initial year. In such a situation, specifying the initial year values of the proportions and ratios may entail personal estimates of the changes in their values. If there is no strong reason to do otherwise, one may assume that the values of the proportions and ratios remained fixed prior to the initial year and use the observations on the proportions and ratios derived from SAM as estimates of the initial year values.

Assumptions on future values of the relevant proportions and ratios should be based on the considerations regarding possible future shifts in those proportions and ratios, which may arise in the absence of government interventions or as a result of government policy. Thus, proportions of value added going to wages, for example, may be assumed to remain constant at the level observed in SAM if net effects of various forces influencing those proportions can be expected to cancel out. Alternatively, they may be allowed to change over time to reflect possible changes such as a wage freeze (see box 9).

The proportion of profits received by households can be anticipated, for example, to increase over the projection period if the share of the country's capital stock which is owned by households operating it as unincorporated businesses is expected to grow over time. Similarly, the proportion of gross corporate income going to households as dividends may be assumed to increase if the household ownership of corporate securities is expected to expand over the projection period.

Assumptions regarding the future ratios of net indirect taxes to value added and the future proportions of the gross incomes of households and corporations paid as household and corporate income taxes can be formulated by taking into account the future fiscal policy of the government. Since tax rates are used as instruments of fiscal policy, these proportions can be treated as policy instruments in the income projection exercise.

Box 9

Glossary

Fiscal policy
Government taxation and expenditure policy designed to regulate the aggregate level of economic activity.

Gross domestic product
The total monetary value of all final goods and services produced in an economy over a given period of time, typically one year, calculated at market or factor prices.

Wage freeze
The fixing of wages at their existing level for a specified or indefinite period.

(c) Assumptions on transfers

To prepare assumptions on future values of transfers -- government transfers to households and corporations and net foreign transfers to households from abroad - observations on those variables for a recent date or a few such dates are needed. The observations may be derived from a recent SAM.

Assumptions on transfers can be formulated by selecting values for those transfers for the relevant future years that would take into account the observations on them for a recent year or years. Formulating assumptions in this way would, however, require that projected values of certain other variables be taken into account. This would ensure that the transfers are given realistic values which do not lead to absurd projection results. For example, this procedure should ensure that government transfers to households and corporations would not add up to an excessive proportion of the projected gross government income, out of which they are paid.

To avoid unrealistic assumptions on future values of transfers, they can be selected using a two-stage procedure, which initially entails making assumptions on future ratios of transfers to, say, gross domestic product (GDP), and then multiplying those ratios by the projected GDP. This procedure requires that recent observations on the relevant ratios be obtained, that assumptions on the ratios be formulated using those observations and that the projected GDP be multiplied by the assumed ratios.

(i) Observations on the relevant ratios

Ratios of the transfers to GDP can be derived from a recent SAM.

a. Procedures to derive observations on ratios

Procedures to derive the relevant ratios are described in this section, first for the country as a whole and, then, for urban and rural areas. They are illustrated in part in annex III using the social accounting matrix presented in table 1.

i. National level

The discussion of the steps to derive ratios of the various transfers to GDP for the country as a whole assumes a structure of SAM such as that shown in table 1.

Gross domestic product. To derive observations on the ratios, one should initially calculate gross domestic product at factor cost, which can be obtained by aggregating levels of value added at factor cost across the various industries:

$$GDP(t') = \sum_{i=1}^{I} VA(i,t'), \qquad (59)$$

where:

GDP(t') is the gross domestic product at factor prices.

Ratio of government transfers to households to GDP. Given the gross domestic product, the ratio of government transfers to households to GDP can be obtained as government transfers to households, divided by GDP:

$$RGTH(t') = GTH(t') \,/\, GDP(t'), \tag{60}$$

where:

RGTH(t') is the ratio of government transfers to households to the gross domestic product.

Ratio of government transfers to corporations to GDP. The ratio of government transfers to corporations to GDP can be calculated as government transfers to corporations, divided by GDP:

$$RGTC(t') = GTC(t') \,/\, GDP(t'), \tag{61}$$

where:

RGTC(t') is the ratio of government transfers to corporations to the gross domestic product.

Ratio of net foreign transfers to households to GDP. The ratio of net foreign transfers to households to GDP can be derived as net foreign transfers to households, divided by GDP:

$$RNFTH(t') = NFTH(t') \,/\, GDP(t'), \tag{62}$$

where:

RNFTH(t') is the ratio of net foreign transfers to households to the gross domestic product, and

NFTH(t') is net foreign transfers to households.

ii. Urban-rural level

The ratios of transfers to GDP for urban and rural areas can be calculated by steps analogous to those used for calculating the ratios at the national level. This discussion will assume that the structure of a SAM involved is that shown in table 2. Gross domestic product. The levels of gross domestic product at factor prices for urban and rural areas can be obtained using the urban-rural equivalent of equation (59):

$$GDP(k,t') = \sum_{i=1}^{I} VA(i,k,t'); \tag{63}$$

$$k = 1,2.$$

Ratios of government transfers to households to GDP. Ratios of government transfers to households to GDP are calculated for urban and rural areas using an urban-rural equivalent of equation (60):

$$RGTH(k,t') = GTH(k,t') \ / \ GDP(k,t'); \qquad k = 1,2. \tag{64}$$

Ratios of government transfers to corporations to GDP. If it is assumed that ratios of government transfers to GDP do not vary across locations, they can be obtained using the following modification of the step indicated in equation (61):

$$RGTC(k,t') = GTC(t') \ / \ [\sum_{k=1}^{2} GDP(k',t')]; \qquad k'=1 \qquad k = 1,2. \tag{65}$$

Ratios of net foreign transfers to households to GDP. Ratios of net foreign transfers to households to GDP are calculated for urban and rural areas using an urban-rural equivalent of equation (62):

$$RNFTH(k,t') = NFTH(k,t') \ / \ GDP(k,t'); \qquad k = 1,2. \tag{66}$$

b. Illustrative derivation of observations on ratios

The steps introduced above to derive the relevant ratios using an appropriate SAM are illustrated for the entire country and for the urban and rural areas separately in annex III.

(ii) Assumptions on future values of ratios

Once the relevant ratios are obtained from a given SAM, they can be used to prepare assumptions about the values of those ratios for the projection period. Thus, values of the ratios of government transfers to households andcorporations to GDP can be chosen by taking into account expected future government policies regarding those transfers. Values of the ratio of net foreign transfers to households to GDP can be chosen on the basis of expectations regarding future trends in foreign transfers to and from households.

(iii) Derive future values of transfers

Given assumptions on future values of the relevant ratios, future values of the corresponding transfers can be calculated as described below.

a. Procedure to derive future values of transfers

The description of the procedure is first concerned with the national level.

i. National level

To derive future values of transfers at the national level, assumptions regarding future ratios of those variables to GDP should be used in connection with projected GDP values.

Gross domestic product. To project transfers for the end of any projection interval (t to t+5), it is necessary to first project gross domestic product at factor prices for that date by summing the projected value added levels by industry:

$$GDP(t+5) = \sum_{i=1}^{I} VA(i,t+5); \tag{67}$$

where:

GDP(t+5) is the gross domestic product at factor prices.

Government transfers to households. To derive government transfers to households for the end of the projection interval, the projected gross domestic product for that date should be multiplied by the assumed value of the ratio of government transfers to households to GDP:

$$GTH(t+5) = GDP(t+5) \cdot RGTH(t+5). \tag{68}$$

Government transfers to corporations. To compute government transfers to corporations for the end of the projection interval, the projected gross domestic product should be multiplied by the assumed ratio of government transfers to households to GDP:

$$GTC(t+5) = GDP(t+5) \cdot RGTC(t+5). \tag{69}$$

Net foreign transfers to households. Net foreign transfers to households for the end of the interval can be obtained as a product of the projected gross domestic product and the assumed ratio of net foreign transfers to households to GDP:

$$NFTH(t+5) = GDP(t+5) \cdot RNFTH(t+5). \tag{70}$$

ii. Urban-rural level

The derivation of the assumed future values of transfers for urban and rural areas is identical to that for the country as a whole, except that the calculations are performed for each location. Thus, gross domestic product for urban and rural areas for the end of the given projection interval is obtained using an urban-rural equivalent of equation (67) with the projected levels of value added by industry for the two areas for that date. Government transfers to households and corporations and net foreign transfers to households for the two areas are obtained using urban-rural counterparts of equations (68) through (70) and assumed values of the relevant ratios along with the projected values of the gross domestic product for the two locations.

b. Illustrative derivation of future values of transfers

The derivation of future values of transfers at the national level are illustrated in annex III. An analogous derivation for the urban-rural level is not illustrated owing to its similarity to that for the national level.

D. Illustrative examples of projections

The examples presented in this section use the inputs described in the preceeding section to illustrate the preparation of national and urban-rural projections of incomes using the method based on the social accounting matrix. The examples show how calculations are made for the projection interval 0-5. Results for a 20-year projection period also provided.

1. National projection

This example is based on the inputs, including projected levels of value added by industry, projected population size and projected numbers of households, which are shown in table 3. The inputs also include assumptions on the relevant proportions and ratios and assumpltions on transfers, which are presented, respectively, in table 4 and 5.

These inputs are for dates five years apart, starting with the initial year of projection (denoted as year 0). They are based on the assumption that the proportions and ratios would remain unchanged over the projection period, at the levels derived from the SAM shown in table 1 (see annex II for the derivation). They are also based on the assumption that the ratios of the transfers to the gross domestic product will remain unchanged at the levels observed in that SAM (annex III).

(a) Incomes of factors of production

The initial step in projecting disposable incomes involves the projection of wages and profits.

(i) Wages

For any specific year of the projection period, the wage bill for any industry can be calculated as a product of the value added and the proportion of value added going on wages. The calculations for the end of the projection interval 0-5 (year 5) are illustrated in table 6, where wages in year 5 for each industry (column 4) are obtained by multiplying value added in that year (column 2) by the assumed proportion of value added going to wages in that year (column 3).

For example, wages in agriculture at the end of the interval 0-5, 24,656, are obtained as:

$$24,656 = (171,341)\ (0.1439). \qquad (1)$$

Table 3. Inputs for projecting incomes at the national level; projected value added by industry, population size and number of households

Variable	Year 0	5	10	15	20
Value added (thousands of LCUs) a/					
Agriculture	147 800	171 341	198 631	230 268	266 943
Mining	2 100	2 810	3 761	5 033	6 735
Manufacturing	45 100	66 267	97 368	143 065	210 209
Utilities	6 400	9 404	13 817	20 302	29 830
Construction	31 500	38 325	46 628	56 730	69 020
Trade	40 100	56 242	78 883	110 637	155 174
Transportation	32 900	41 990	53 591	68 397	87 293
Services	100 000	146 933	215 892	317 217	466 096
Population size (thousands)					
	10 000.0	11 210.4	126 19.0	14 159.4	15 675.6
Number of households (thousands)					
	1 470.7	1 638.7	1 854.7	2 138.4	2 486.2

a/ Local currency units.

where 171,341 is the value added in agriculture and 0.1439 is the proportion of value added going to wages in agriculture at that date.

The wage bill for the entire economy can be obtained as the sum of the industry-specific wage bills. The total wage bill at the end of the interval 0-5, 236,005, is the total of industry-specific wage bills, which are shown in column 4 of table 6.

(ii) Profits

Profits for each industry can be projected as a difference between value added and the wage bill, as illustrated for the end of the interval 0-5 in table 7. Thus, profits in the various industries (column 4) are obtained as the differences between the value added levels (column 2) and the wage bills (column 3) in those industries.

For example, profits in agriculture at this date, 146.685, are calculated as:

$$146{,}685 = 171{,}341 - 24.656, \qquad (3)$$

where 171,341 and 24,656 are, respectively, value added and the wage bill in agriculture in year 5.

Given the projected profits in each industry, the total profit for the entire economy can be obtained as the sum of the industry-specific profit levels. Thus, the total profits at the end of the interval 0-5, 297,306, are obtained by adding up the profit levels by industry projected for that date and shown in column 4 of table 7.

(b) Factor incomes of institutions

After projecting incomes of factors of production, one can further project factor incomes received by institutions, such as households and corporations.

(i) Factor income of households

The factor income of households consists of total wages and a part of total profits.

The amount of profits going to households can be calculated as the product of the proportion of profits paid to households and the total profits. For the end of the projection interval 0-5, this amount of profits, 212,306, is obtained as follows:

$$212.306 = (0.7141)\ (297.306), \qquad (5)$$

where 0.7141 is the proportion of profits paid to households in year 5 (table 4), while 297,306 is the total profits in that year (table 7).

Table 4. Inputs for projecting incomes at the national level; assumptions on the various proportions and ratios

Variable	Year 0	5	10	15	20
Proportions of value added going to wages					
Agriculture	0.1439	0.1439	0.1439	0.1439	0.1439
Mining	0.5326	0.5326	0.5326	0.5326	0.5326
Manufacturing	0.5463	0.5463	0.5463	0.5463	0.5463
Utilities	0.3210	0.3210	0.3210	0.3210	0.3210
Construction	0.3201	0.3201	0.3201	0.3201	0.3201
Trade	0.4363	0.4363	0.4363	0.4363	0.4363
Transportation	0.6197	0.6197	0.6197	0.6197	0.6197
Services	0.7337	0.7337	0.7337	0.7337	0.7337
Ratios of net indirect taxes to value added					
Agriculture	-0.0073	-0.0073	-0.0073	-0.0073	-0.0073
Mining	0.0094	0.0094	0.0094	0.0094	0.0094
Manufacturing	0.2673	0.2673	0.2673	0.2673	0.2673
Utilities	0.0005	0.0005	0.0005	0.0005	0.0005
Construction	0.0005	0.0005	0.0005	0.0005	0.0005
Trade	0.0262	0.0262	0.0262	0.0262	0.0262
Transportation	0.0240	0.0240	0.0240	0.0240	0.0240
Services	0.0193	0.0193	0.0193	0.0193	0.0193
Proportions of profits received by households	0.7141	0.7141	0.7141	0.7141	0.7141
Proportions of gross corporate income paid to households as dividends	0.3474	0.3474	0.3474	0.3474	0.3474
Proportions of gross household income paid as household income taxes	0.0935	0.0935	0.0935	0.0935	0.0935
Proportions of gross corporate income paid as corporate income taxes	0.2028	0.2028	0.2028	0.2028	0.2028

Table 5. Inputs for projecting incomes at the national level: assumptions relating to transfers

(Thousands of LCUs) a/

Variable	Year				
	0	5	10	15	20
Government transfers to households	7 347	9 653	12 825	17 225	23 373
Government transfers to corporations	8 727	11 466	15 234	20 460	27 763
Net foreign transfer to households	0	0	0	0	0

a/ Local currency units.

Table 6. Projecting wages at the national level in year 5

Industry	Value added a/ (thousands of LCUs) d/	Proportion of value added going to wages b/	Wages c/ (thousands of LCUs) d/
(1)	(2)	(3)	(4)
Agriculture	171 341	0.1439	24 656
Mining	2 810	0.5326	1 497
Manufacturing	66 267	0.5463	36 201
Utilities	9 404	0.3210	3 019
Construction	38 325	0.3201	12 268
Trade	56 242	0.4363	24 539
Transportation	41 990	0.6197	26 021
Services	146 933	0.7337	107 805
Total			236 005

a/ From table 3.
b/ From table 4.
c/ (Col. 2) . (col. 3).
d/ Local currency units.

Table 7. Projecting profits at the national level in year 5

(Thousands of LCUs) a/

Industry	Value added b/	Wages c/	Profits d/
(1)	(2)	(3)	(4)
Agriculture	171 341	24 656	146 685
Mining	2 810	1 497	1 314
Manufacturing	66 267	36 201	30 065
Utilities	9 404	3 019	6 385
Construction	38 325	12 268	26 057
Trade	56 242	24 539	31 704
Transportation	41 990	26 021	15 969
Services	146 933	107 805	39 128
Total	533 311	236 005	297 306

a/ Local currency units.
b/ From table 3.
c/ From table 6, col. 4.
d/ (Col. 2) - (col. 3).

Therefore, the size of household factor income at the end of the interval 0-5, 448,311 (shown in table 8), can be obtained as follows:

$$448{,}311 = 236{,}005 + 212{,}306, \tag{6}$$

where 236,005 is total wages and 212,306 is profits paid to households in year 5.

(ii) Factor income of corporations

The factor income of corporations equals that part of total profits that does not go to households. Therefore, the amount of that income at the end of the interval 0-5, 85,000, which is also shown in table 8, can be calculated by subtracting profits paid to households from total profits at that date:

$$85{,}000 = 297{,}306 - 212{,}306 \tag{7}$$

where 297,306 and 212,306 are total profits and profits paid to households in year 5.

(c) Gross incomes of institutions

After projecting household and corporate factor incomes, it is possible to project the gross incomes of the various institutions -- households, corporations and government.

(i) Gross income of corporations

The gross corporate income is equal to the sum of the factor income of corporations and government transfers to corporations. Therefore, gross corporate income at the end of the interval 0-5, 96,466, which is shown in table 8, can be derived as follows:

$$96{,}466 = 85{,}000 + 11{,}466, \tag{8}$$

where 85,000 is the factor income of corporations (table 8) and 11,466 is the amount of government transfers to corporations in year 5 (table 5).

(ii) Gross household income

Gross household income consists, among other things, of dividends paid to households, which must be derived before gross household income is computed.

Dividends. Dividends paid to households can be obtained as a proportion of gross corporate income. Therefore, dividends at the end of the interval 0-5, 33,512, are calculated as:

$$33{,}512 = (0.3474)\ (96{,}466), \tag{9}$$

where 0.3474 is the proportion of gross corporate income going to households as dividends (table 4) and 96,466 is the gross corporate income in year 5 (table 8).

Table 8. Projected factor incomes, gross incomes and disposable incomes of institutions

(Thousands of LCUs) a/

Type of income	Year 0	5	10	15	20
Factor incomes of:					
Households	338 575	448 311	600 098	811 671	1 108 605
Corporations	67 325	85 000	108 472	139 977	182 696
Gross incomes of:					
Households	372 342	491 476	655 899	884 631	1 205 091
Corporations	76 052	96 466	123 706	160 437	210 459
Government	65 022	87 346	118 576	162 558	224 866
Disposable incomes of:					
Households	337 528	445 523	594 572	801 918	1 092 415
Corporations	34 208	43 390	55 643	72 165	94 665
Government	48 949	66 227	90 516	124 873	173 731

a/ Local currency units.

Gross household income. Given the amount of dividends, gross household income can be obtained as the sum of household factor income, dividends, government transfers to households and net foreign transfers to households. Thus, the gross household income at the end of the interval 0-5, 491,476, which is shown in table 8, is calculated as follows:

$$491{,}476 = 448{,}311 + 33{,}512 + 9{,}653 + 0, \tag{10}$$

where 448,311 is household factor income (table 8), 33,512 is dividends, 9,653 is government transfers to households (table 5) and 0 is net foreign transfers to households (table 5), all in year 5.

(iii) Gross income of government

To calculate gross government income, it is initially necessary to project the different sources of government revenue -- household income taxes, corporate income taxes and net indirect taxes.

a. Household income taxes

Household income taxes can be obtained as the product of the gross household income and the proportion of that income paid as household income taxes. Thus, the amount of household income taxes at the end of the interval 0-5, 45,953, is obtained as follows:

$$45{,}953 = (491{,}476)\ (0.0935), \tag{11}$$

where 491,476 is the gross household income (table 8) and 0.0935 is the proportion of gross household income paid as household income taxes in year 5 (table 4).

b. Corporate income taxes

Corporate income taxes are derived as the product of the gross corporate income and the proportion of that income paid as corporate income taxes. Therefore, the amount of corporate income taxes at the end of the interval 0-5, 19,563, is obtained as follows:

$$19{,}563 = (96{,}466)\ (0.2028), \tag{12}$$

where 96,466 is the gross income of corporations (table 8) and 0.2028 is the proportion of gross corporate income paid as corporate income taxes in year 5 (table 4).

c. Net indirect taxes

Net indirect taxes (indirect taxes less subsidies) for any industry can be calculated as the product of value added and the ratio of net indirect taxes to value added for that industry. The calculations of net indirect taxes for the end of the projection interval 0-5 are illustrated in table 9, where net indirect taxes in year 5 for each industry (column 4) are obtained by multiplying the

Table 9. Projecting net indirect taxes at the national level in year 5

Industry	Value added a/ (thousands of LCUs) d/	Ratio of net indirect taxes to value added b/	Net indirect taxes c/ (thousands of LCUs) d/
(1)	(2)	(3)	(4)
Agriculture	171 341	-0.0073	-1 251
Mining	2 810	0.0094	26
Manufacturing	66 267	0.2673	17 713
Utilities	9 404	0.0005	5
Construction	38 325	0.0005	19
Trade	56 242	0.0262	1 474
Transportation	41 990	0.0240	1 007
Services	146 933	0.0193	2 835
Total	533 311		21 829

a/ From table 3.
b/ From table 4.
c/ (Col. 2) . (col. 3).
d/ Local currency units.

value added in that year (column 2) by the assumed ratio of net indirect taxes to value added in that year (column 3).

For example, net indirect taxes in agriculture at the end of the interval 0-5, -1,251, are obtained as:

$$-1{,}251 = (171{,}341)\ (-0.0073), \tag{13}$$

where 171.341 is the value added in agriculture (column 2) and -0.0073 is the ratio of net indirect taxes to value added in agriculture (column 3) at that date.

The total net indirect taxes can be obtained as the sum of the industry-specific net indirect taxes. Thus, the net indirect taxes for the entire economy at the end of the interval 0-5 are 21,830, which are shown as the total of column 4 in table 9.

Given the projected levels of household and corporate income taxes and that of the total net indirect taxes, the gross income of government is obtained as sum of these various taxes. Thus, for the end of the interval 0-5, the gross income of government, 87,346, which is shown in table 8, is obtained as:

$$87{,}346 = 45{,}953 + 19{,}563 + 21{,}830, \tag{15}$$

where 45,953, 19,563 and 21,830 are household income taxes, corporate income taxes and total net indirect taxes, respectively, in year 5.

(d) Disposable incomes of institutions

Given the projected gross incomes of institutions, it is possible to project the disposable incomes of institutions.

(i) Disposable household income

The disposable household income equals the gross household income less household income taxes. Thus, the disposable household income at the end of the interval 0-5, 445,523, is calculated as follows:

$$445{,}523 = 491{,}476 - 45{,}953, \tag{16}$$

where 491,476 is the gross income of households (table 8) and 45,953 is household income taxes in year 5.

(ii) Disposable corporate income

Disposable corporate income (gross business savings) equals the gross corporate income less dividends and corporate income taxes. The disposable corporate income at the end of the interval 0-5, 43,390, is therefore:

$$43{,}390 = 96{,}466 - (33{,}512 + 19{,}563), \tag{17}$$

where 96,466 is the gross corporate income (table 8), 33,512 is dividends and 19,563 is corporate income taxes, all in year 5.

(iii) Disposable government income

Government disposable income equals the difference between the gross income of government and government transfers to households and corporations. The government disposable income at the end of the interval 0-5, 66,227, is therefore obtained as:

$$66{,}227 = 87{,}346 - (9{,}653 + 11{,}466), \tag{18}$$

where 87,346 is the gross government income (table 8) and 9,653 and 11,466 are respectively government transfers to households and corporations in year 5 (table 5).

(e) Other results

After projecting the disposable incomes of the various institutions for the end of the given projection interval, a number of useful indicators can be derived. Those indicators include various income aggregates, indications of the distribution of income and rates of growth of disposable incomes.

(i) Aggregates of disposable income

In addition to disposable incomes of institution, aggregates of disposable income that may be obtained by this method include, the total disposable income, the change in this income and changes in disposable incomes of institutions.

a. Total disposable income

The total disposable income is equal to the sum of the disposable incomes of the various institutions. Therefore, for the end of the interval 0-5, the total disposable income, 555,140, is calculated as follows:

$$555{,}140 = 445{,}523 + 43{,}390 + 66{,}227, \tag{19}$$

where 445,523, 43,390 and 66,227 are, respectively, the disposable incomes of households, corporations and government in year 5 (table 8).

The total disposable income in year 5 is shown in table 10 in the column corresponding to that year, together with the disposable incomes of the three institutions. Also presented in this table are the projected disposable income levels for other years of the projection period, as well as other results obtained in the course of projecting incomes.

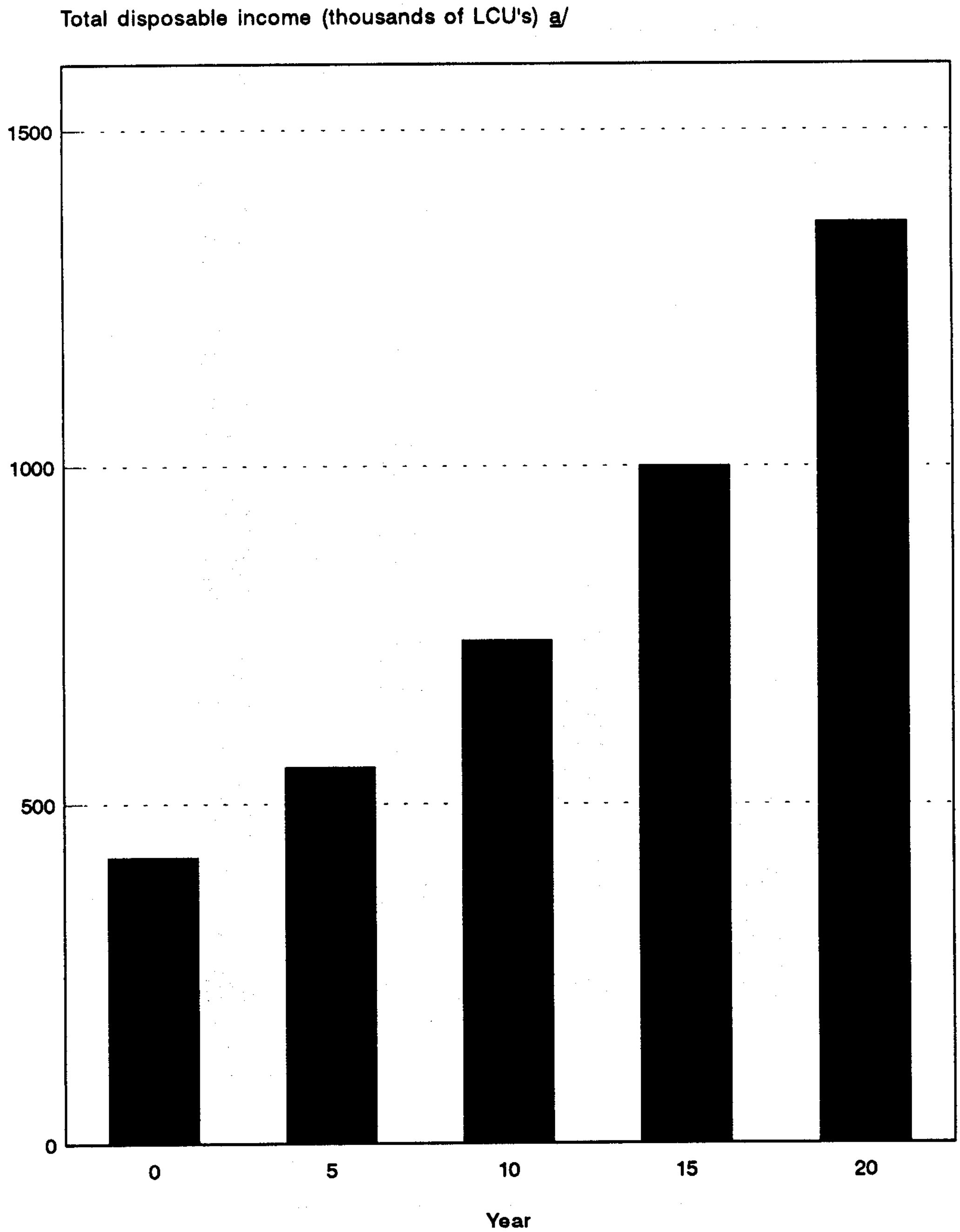
Figure II shows how the projected total disposable income increases over this period. Similarly, figure III indicates the increase in the disposable incomes of institutions over the same period.

Table 10. Disposable incomes: aggregates, indicators of the distribution and rates of growth

Indicators	Year 0	5	10	15	20
Disposable income aggregates (thousands of LCUs) a/					
Levels of income					
Total	420 685	555 140	740 731	998 956	1 360 810
Household	337 528	445 523	594 572	801 918	1 092 415
Corporate	34 208	43 390	55 643	72 165	94 665
Government	48 949	66 227	90 516	124 873	173 731
Growth in incomes					
Total		134 455	185 591	258 225	361 854
Household		107 995	149 049	207 346	290 497
Corporate		9 182	12 253	16 522	22 500
Government		17 278	24 289	34 357	48 858
Indicators of the distribution of total disposable income by institutions					
Proportions by institutions					
Total	1.00	1.00	1.00	1.00	1.00
Households	0.80	0.80	0.80	0.80	0.80
Corporations	0.08	0.08	0.08	0.07	0.07
Government	0.12	0.12	0.12	0.13	0.13
Rates of growth of disposable incomes (percentage)					
Total		5.70	5.94	6.16	6.38
Households		5.71	5.94	6.17	6.38
Corporations		4.87	5.10	5.34	5.58
Government		6.23	6.45	6.65	6.83

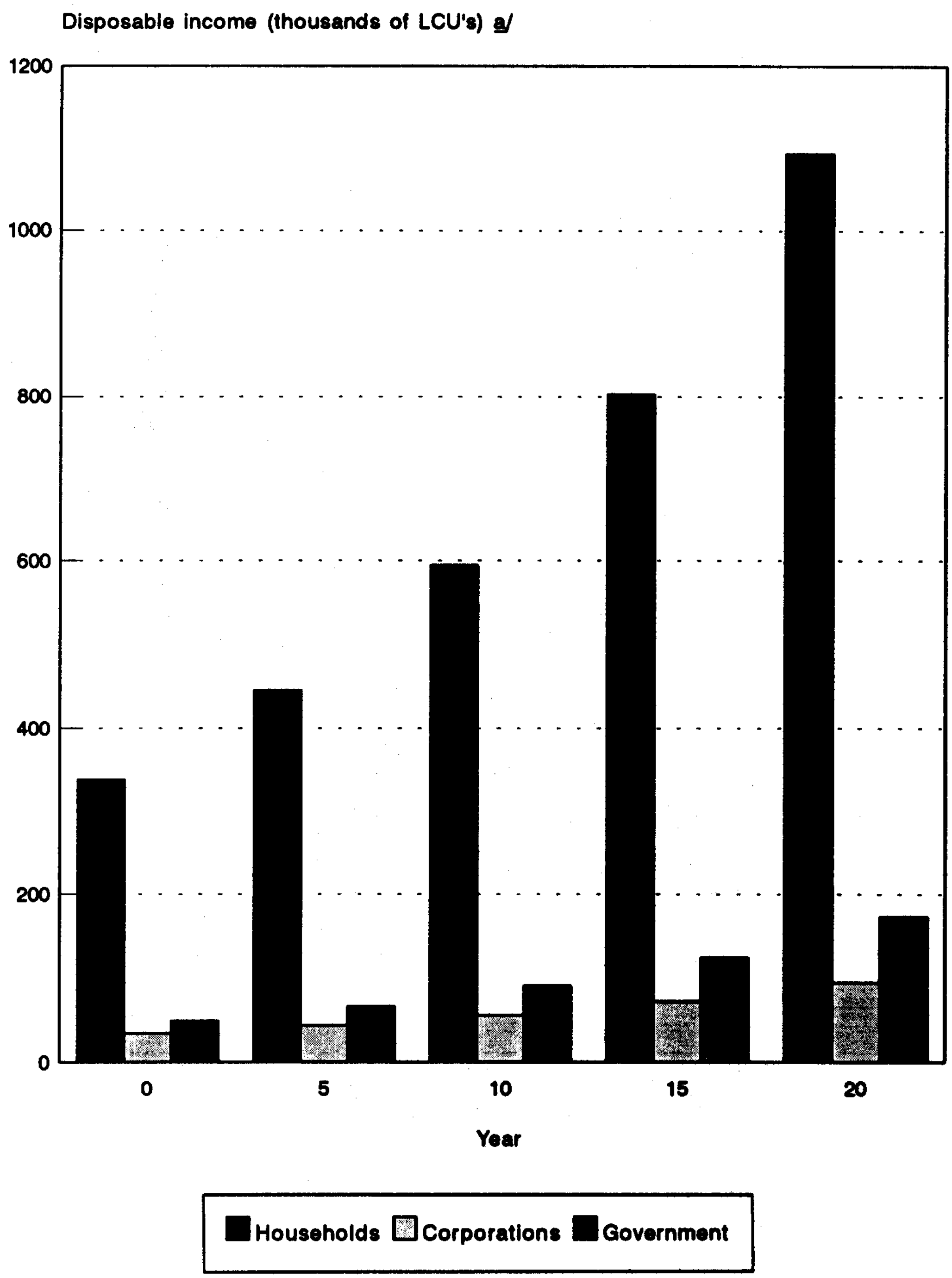
a/ Local currency units.

Figure II. Total disposable income



a/ Local currency units.

Figure III. Disposable incomes of households, corporations and government



a/ Local currency units.

b. Growth in total disposable income

The increase in the total disposable income over a given projection interval equals the difference between the levels of total disposable income at the end and at the beginning of the interval. Therefore, the growth in the total disposable income over the interval 0-5, 134,455, is obtained as follows:

$$134{,}455 = 555{,}140 - 420{,}685, \tag{20}$$

where 420,685 and 555,140 are the levels of total disposable income in years 0 and 5, respectively.

c. Growth of disposable incomes of institutions

The increases in the disposable incomes of institutions over the interval 0-5 are obtained as follows:

The growth of disposable household income, 107,995, is calculated as:

$$107{,}995 = 445{,}523 - 337{,}528, \tag{21}$$

where 337,528 and 445,523 are the levels of disposable household income in years 0 and 5.The growth of disposable corporate income, 9,182, is calculated as:

$$9{,}182 = 43{,}390 - 34{,}208, \tag{22}$$

where 34,208 and 43,390 are the levels of disposable corporate income in years 0 and 5.

The growth of disposable government income, 17,278, is calculated as:

$$17{,}278 = 66{,}227 - 48{,}949, \tag{23}$$

where 48,949 and 66,227 are levels of disposable government income in years 0 and 5.

The projected increases in the disposable incomes of institutions are presented in table 10.

(ii) Indicators of the distribution of total disposable income

After projecting the disposable incomes for the end of the given projection interval, the proportion of the total disposable income going to each institution can be derived.

Proportions by institutions

Proportions of the total disposable income received by the various institutions at the end of the interval 0-5 are calculated as follows:

The proportion of the total disposable income received by households, 0.80, is obtained as:

$$0.80 = 445{,}523 \ / \ 555{,}140, \qquad (24)$$

where 445,523 and 555,140 are the disposable household income and the total disposable income in year 5, respectively.

The proportion of the total disposable income received by corporations, 0.08, is obtained as:

$$0.08 = 43{,}390 \ / \ 555{,}140, \qquad (25)$$

where 43,390 is the disposable corporate income in year 5.

The proportion of the total disposable income received by the government, 0.12, is obtained as:

$$0.12 = 66{,}227 \ / \ 555.140, \qquad (25)$$

where 66,227 is the government disposable income in year 5.

The proportions of the total disposable income received by the various institutions over the 20-year projection period are shown in table 10. The proportions of the total disposable income received by the various institutions in the initial and the terminal year of the projection period (years 0 and 20, respectively) are shown in figure IV.

(iii) Rates of growth of disposable incomes

Given the projected levels of disposable incomes at dates five years apart, it is also possible to compute rates of growth of total disposable income and the disposable incomes of institutions.

a. The rate of growth of the total disposable income

The rate of growth of the total disposable income can be geometric or exponential, depending on whether one assumes that the growth occurs over discrete time intervals or continuously.

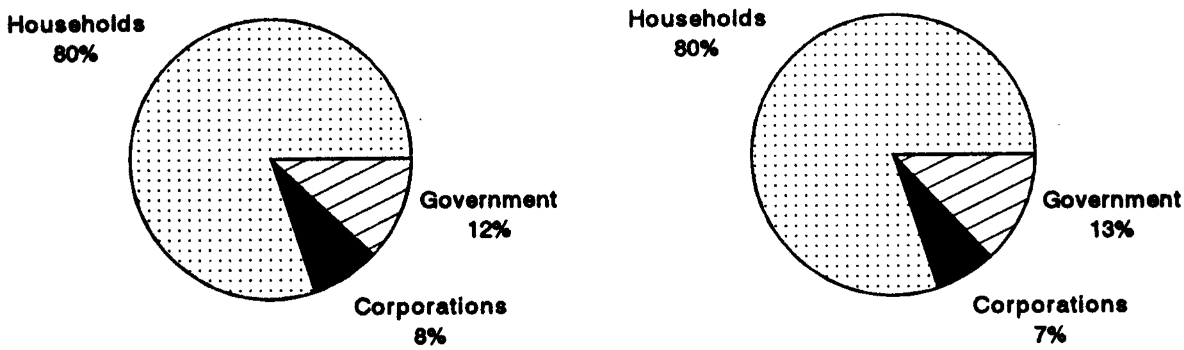
i. Geometric growth rate

If it is assumed that disposable income changes in discrete intervals, the average annual geometric rate of growth of the total disposable income for the interval 0-5, 5.70 per cent (table 10), is obtained as follows:

$$5.70 = [(555{,}140/420{,}685)^{1/5} - 1] \cdot 100, \qquad (27)$$

where 420,685 and 555,140 are the levels of total disposable income in years 0 and 5.

Figure IV. Proportions of the total disposable incomes received by various institutions in the initial and the terminal year



Year 0 Year 20

Rates of growth of the total disposable income over the 20-year projection period, which were computed using the geometric growth rate formula, are shown in table 10 and presented in figure V.

ii. Exponential growth rate

If one assumes that the total disposable income changes continuously, the average annual exponential rate of growth of this income for the interval 0-5, 5.55 per cent, is obtained as follows:

$$5.55 = [(\ln (555{,}140/420{,}685)) / 5] \cdot 100. \tag{28}$$

b. Rates of growth of disposable incomes of institutions

Rates of growth of disposable incomes of the various institutions can be also geometric or exponential.

i. Geometric growth rates

Assuming discrete growth, the geometric rates of increase of the disposable incomes of institutions for the interval 0-5 are calculated as follows:

The annual rate of growth of disposable household income, 5.71 per cent, is obtained as follows:

$$5.71 = [(445{,}523/337{,}528)^{1/5} - 1] \cdot 100, \tag{29}$$

where 337,528 and 445,523 are the levels of disposable household income in years 0 and 5, respectively;

The annual rate of growth of disposable corporate income, 4.87 per cent, is obtained as:

$$4.87 = [(43{,}390/34{,}208)^{1/5} - 1] \cdot 100, \tag{30}$$

where 34,208 and 43,390 are the levels of disposable corporate income in years 0 and 5, respectively;

The annual rate of growth of disposable government income, 6.23 per cent, is obtained as follows:

$$6.23 = [(66{,}227/48{,}949)^{1/5} - 1] \cdot 100, \tag{31}$$

where 48,949 and 66,227 are the levels of disposable government income in years 0 and 5, respectively.

Figure VI shows changes in the rates of growth of disposable incomes of households, corporations and government over the 20-year projection period.

Figure V. Rate of growth of total disposable income

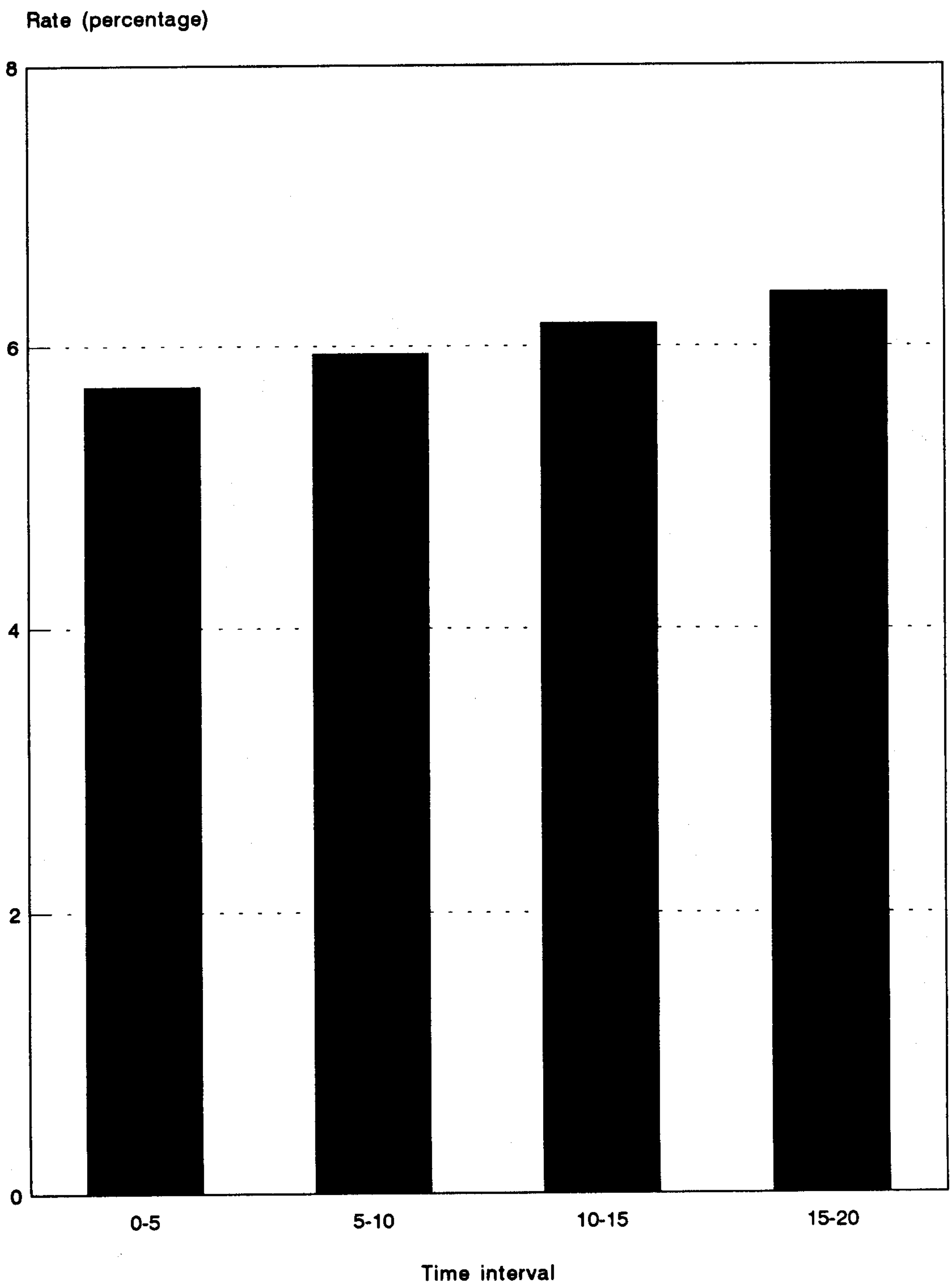
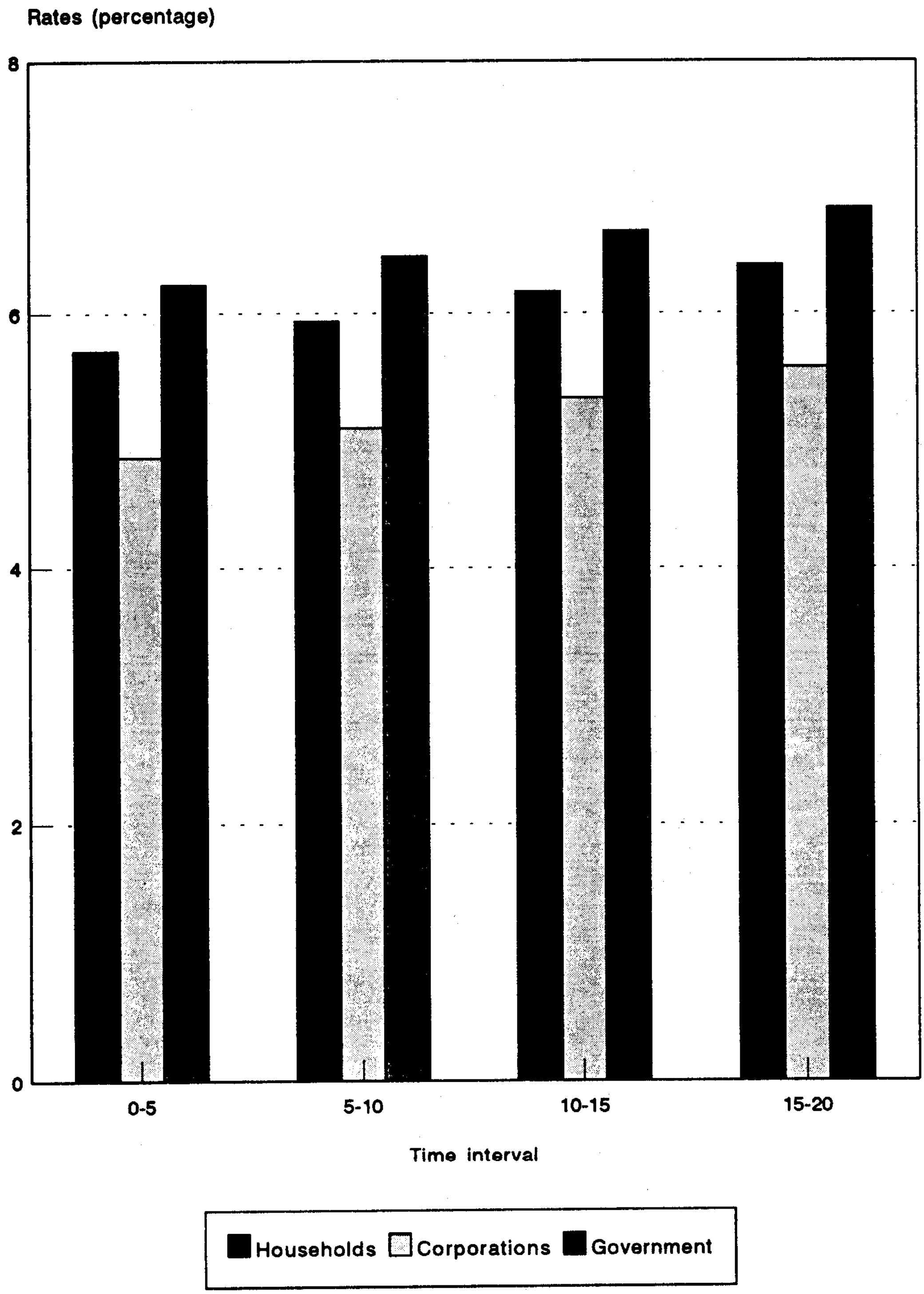


Figure VI. Rates of growth of disposable incomes of institutions



ii. Exponential growth rates

If continuous growth is assumed, rates of growth of disposable incomes of institutions would be calculated using the exponential growth rate formula. The calculations would be analogous to that indicated by equation (28) for the total disposable income.

(iv) Levels of per capita and per household disposable incomes of households

It is also possible to derive levels and rates of change of the disposable household income expressed in per capita and per household terms.

Per capita disposable income of households can be obtained by dividing the disposable household income by the population size. Thus, for the end of the projection interval 0-5, per capita disposable household income, 39.7, which is shown in the column corresponding to year 5 in table 11, can be derived as follows:

$$39.7 = 445{,}523 \ / \ 11{,}210.4, \qquad (35)$$

where 445,523 is the level of disposable household income (table 10) and 11,210.4 is the population size in year 5 (table 3).[7]

Figure VII shows the change in per capita disposable household income over the 20-year projection period.

Average disposable household income at the end of the projection interval 0-5, 271.9, which is also shown in table 11, is calculated as follows:

$$271.9 = 445{,}523 \ / \ 1{,}638.7, \qquad (36)$$

where 1,638.7 is the number of households in year 5 (table 3).

The change in average disposable household income over the projection period is indicated in figure VII.

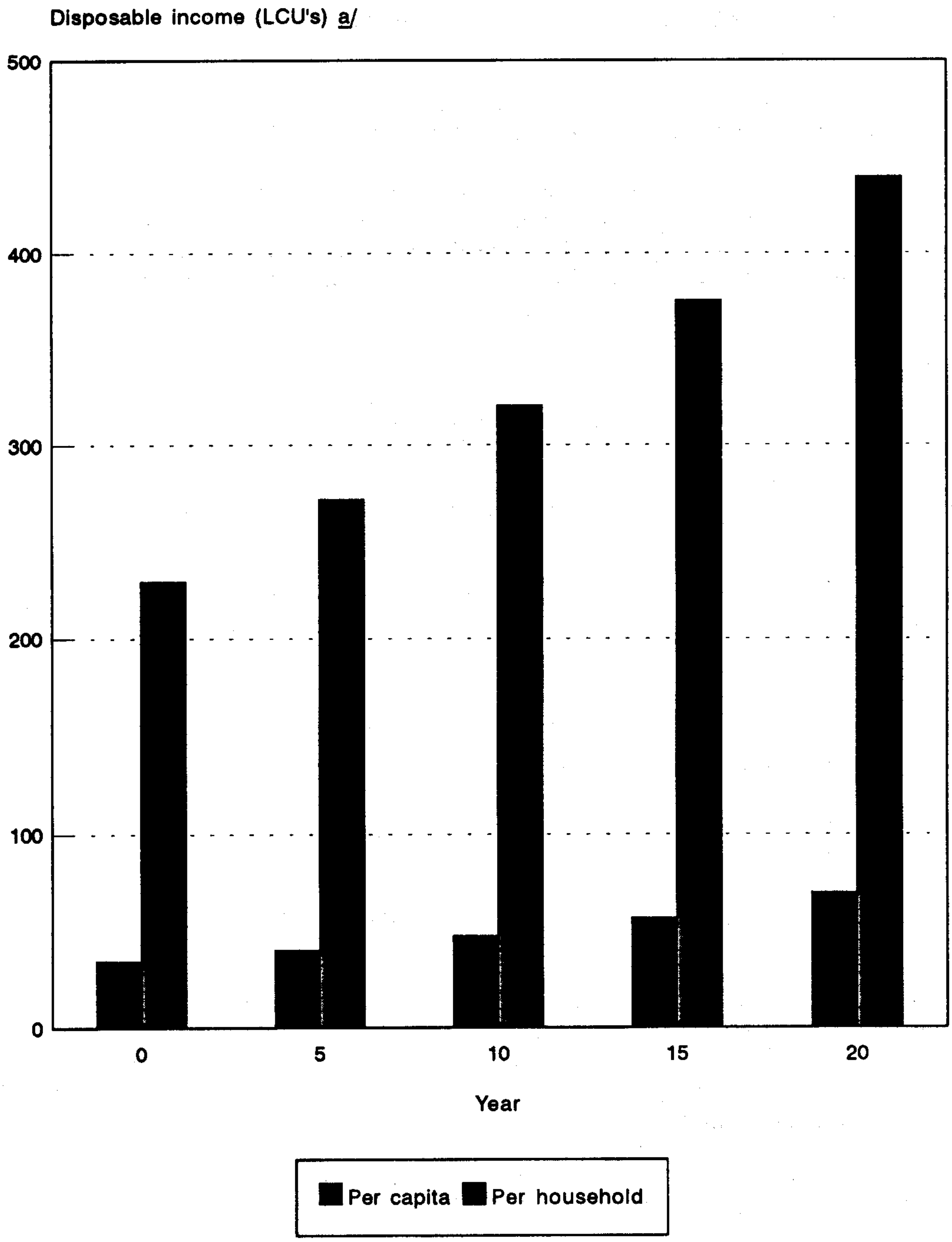
(v) Rates of change of per capita and per household disposable incomes of households

Given the levels of per capita and per household disposable incomes, it is further possible to derive the annual rates of change in those income levels. Those rates can be geometric or exponential.

a. Geometric growth rates

If one assumes that growth occurs over discrete time intervals, the annual rates of growth of per capita and per household disposable incomes of households for the interval 0-5 can be obtained using the geometric growth rate formula as follows:

Figure VII. Levels of per capita and per household disposable household income



a/ Local currency units.

Table 11. Levels and rates of growth of per capita and per household disposable incomes of households

	Year				
	0	5	10	15	20
Levels (LCUs) a/					
Per capita	33.8	39.7	47.1	56.6	69.7
Per household	229.5	271.9	320.6	375.0	439.4
Rates of growth (percentage)					
Per capita		3.32	3.46	3.75	4.24
Per household		3.45	3.35	3.19	3.22

a/ Local currency units.

The annual rate of growth of per capita disposable income of households, 3.32 per cent (table 11), is calculated as:

$$3.32 = [(39.7/33.8)^{1/5} - 1] \cdot 100, \tag{37}$$

where 33.8 and 39.7 are the levels of per capita disposable household income in years 0 and 5, respectively.

The annual rate of growth of average disposable household income, 3.45 per cent (table 11), is calculated as:

$$3.45 = [(271.9/229.5)^{1/5} - 1] \cdot 100, \tag{38}$$

where 229.5 and 271.9 are the levels of average disposable household income in years 0 and 5, respectively.

Figure VIII shows changes in the rates of growth of per capita and per household disposable incomes over the 20-year projection interval.

b. Exponential growth rates

If it is assumed that growth occurs continuously, the exponential rates of growth of per capita and per household disposable incomes of households can be obtained in a way that is analogous to that indicated by equations (39) and (40).

2. Urban-rural projection

This example shows how this method can be used to project disposable incomes for urban and rural areas. It emphasizes those calculations that are unique to urban and rural projections. The example uses the same types of inputs as those used to make the national projection. The inputs for the urban areas are shown in tables 12 through 14, while those for the rural areas are presented in tables 15 through 17.

(a) Different categories of incomes

The various categories of incomes -- factor incomes, gross incomes and disposable incomes -- for urban and rural areas can be projected using calculations that are identical to those carried out as part of the national projection, except that they are made for each location.

Thus, the inputs for the urban areas yield projected levels of different types of incomes over a 20-year period for urban areas, which are shown in table 18. The inputs for the rural areas yield projected levels of the various types of incomes over this period for rural areas, which are indicated in table 19. Aggregating those projected levels of income across urban and rural areas gives projections of different categories of incomes for the entire country, which is shown in table 20.

Figure VIII. Rates of growth of per capita and per household disposable household income

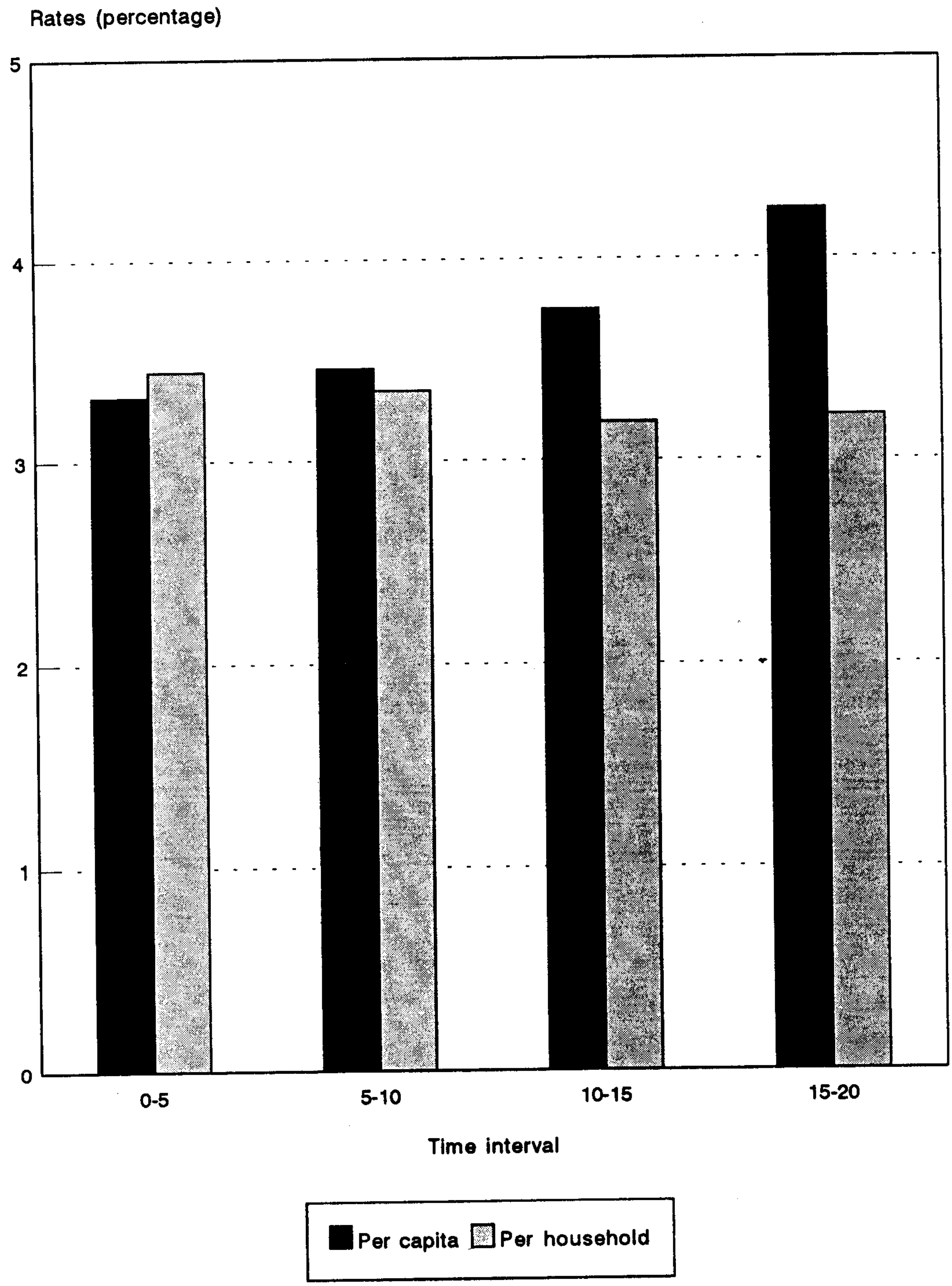


Table 12. Inputs for projecting incomes at the urban level; projected value added by industry, population size and number of households

Variable	Year 0	5	10	15	20
Value added (thousands of LCUs) a/					
Agriculture	9 000	10 433	12 095	14 022	16 255
Mining	1 400	1 874	2 507	3 355	4 490
Manufacturing	39 400	57 892	85 062	124 983	183 642
Utilities	5 500	8 081	11 874	17 447	25 635
Construction	11 100	13 505	16 431	19 990	24 321
Trade	30 700	43 058	60 392	84 702	118 799
Transportation	27 600	35 225	44 957	57 378	73 231
Services	61 500	90 364	132 774	195 088	286 649
Population size (thousands)					
	2 983.4	4 067.0	5 334.3	6 697.3	8 140.9
Number of households (thousands)					
	481.5	671.3	885.6	1 148.0	1 464.6

a/ Local currency units.

Table 13. Inputs for projecting incomes at the urban level; assumptions on the various proportions and ratios

Variable	Year 0	5	10	15	20
Proportions of value added going to wages					
Agriculture	0.1500	0.1500	0.1500	0.1500	0.1500
Mining	0.5272	0.5272	0.5272	0.5272	0.5272
Manufacturing	0.5465	0.5465	0.5465	0.5465	0.5465
Utilities	0.3225	0.3225	0.3225	0.3225	0.3225
Construction	0.7840	0.7840	0.7840	0.7840	0.7840
Trade	0.5003	0.5003	0.5003	0.5003	0.5003
Transportation	0.6193	0.6193	0.6193	0.6193	0.6193
Services	0.7337	0.7337	0.7337	0.7337	0.7337
Ratios of net indirect taxes to value added					
Agriculture	-0.0073	-0.0073	-0.0073	-0.0073	-0.0073
Mining	0.0094	0.0094	0.0094	0.0094	0.0094
Manufacturing	0.2673	0.2673	0.2673	0.2673	0.2673
Utilities	0.0005	0.0005	0.0005	0.0005	0.0005
Construction	0.0005	0.0005	0.0005	0.0005	0.0005
Trade	0.0262	0.0262	0.0262	0.0262	0.0262
Transportation	0.0240	0.0240	0.0240	0.0240	0.0240
Services	0.0193	0.0193	0.0193	0.0193	0.0193
Proportions of profits received by households	0.5613	0.5613	0.5613	0.5613	0.5613
Proportions of gross corporate income paid to households as dividends	0.3382	0.3382	0.3382	0.3382	0.3382
Proportions of gross household income paid as household income taxes	0.1565	0.1565	0.1565	0.1565	0.1565
Proportions of gross corporate income paid as corporate income taxes	0.2028	0.2028	0.2028	0.2028	0.2028

Table 14. Inputs for projecting incomes at the urban level; assumptions relating to transfers

(Thousands of LCUs) a/

Variable	Year 0	5	10	15	20
Government transfers to households	6 871	9 610	13 509	19 076	27 049
Government transfers to corporations	4 003	5 599	7 871	11 115	15 760
Net foreign transfers to households	0	0	0	0	0

a/ Local currency units.

Table 15. Inputs for projecting incomes at the rural level; projected value added by industry, population size and number of households

Variable	Year 0	5	10	15	20
Value added (thousands of LCUs) a/					
Agriculture	138 800	160 907	186 536	216 246	250 688
Mining	700	937	1 254	1 678	2 244
Manufacturing	5 700	8 375	12 306	18 081	26 567
Utilities	900	1 322	1 943	2 855	4 194
Construction	20 400	24 820	30 197	36 739	44 698
Trade	9 400	13 184	18 491	25 935	36 375
Transportation	5 300	6 764	8 633	11 018	14 062
Services	38 500	56 569	83 119	122 129	179 446
Population size (thousands)					
	7 016.6	7 130.6	7 258.0	7 433.5	7 503.1
Number of households (thousands)					
	989.3	968.1	970.1	991.2	1 022.2

a/ Local currency units.

Table 16. Inputs for projecting incomes at the rural level; assumptions on the various proportions and ratios

Variable	Year 0	5	10	15	20
Proportions of value added going to wages					
Agriculture	0.1436	0.1436	0.1436	0.1436	0.1436
Mining	0.5439	0.5439	0.5439	0.5439	0.5439
Manufacturing	0.5449	0.5449	0.5449	0.5449	0.5449
Utilities	0.3116	0.3116	0.3116	0.3116	0.3116
Construction	0.0674	0.0674	0.0674	0.0674	0.0674
Trade	0.2280	0.2280	0.2280	0.2280	0.2280
Transportation	0.6219	0.6219	0.6219	0.6219	0.6219
Services	0.7337	0.7337	0.7337	0.7337	0.7337
Ratios of net indirect taxes to value added					
Agriculture	-0.0073	-0.0073	-0.0073	-0.0073	-0.0073
Mining	0.0094	0.0094	0.0094	0.0094	0.0094
Manufacturing	0.2693	0.2693	0.2693	0.2693	0.2693
Utilities	0.0005	0.0005	0.0005	0.0005	0.0005
Construction	0.0005	0.0005	0.0005	0.0005	0.0005
Trade	0.0262	0.0262	0.0262	0.0262	0.0262
Transportation	0.0240	0.0240	0.0240	0.0240	0.0240
Services	0.0193	0.0193	0.0193	0.0193	0.0193
Proportions of profits received by households					
	0.7849	0.7849	0.7849	0.7849	0.7849
Proportions of gross corporate income paid to households as dividends					
	0.0091	0.0091	0.0091	0.0091	0.0091
Proportions of gross household income paid as household income taxes					
	0.0305	0.0305	0.0305	0.0305	0.0305
Proportions of gross corporate income paid as corporate income taxes					
	0.2028	0.2028	0.2028	0.2028	0.2028

Table 17. Inputs for projecting incomes at the rural level; assumptions relating to transfers

(Thousands of LCUs) a/

Variable	Year 0	5	10	15	20
Government transfers to households	483	600	753	956	1 228
Government transfers to corporations	4 724	5 867	7 363	9 346	12 002
Net foreign transfers to households	0	0	0	0	0

a/ Local currency units.

Table 18. Projected factor incomes, gross incomes and disposable incomes of institutions in urban areas

(Thousands of LCUs) a/

	Year				
Type of income	0	5	10	15	20
Factor incomes of:					
Households	153 504	215 075	302 793	428 154	607 809
Corporations	32 696	45 357	63 298	88 813	125 214
Gross incomes of:					
Households	172 787	241 918	340 372	481 026	682 535
Corporations	36 699	50 957	71 169	99 927	140 974
Government	47 625	67 338	95 611	136 263	194 845
Disposable incomes of:					
Households	145 745	204 058	287 104	405 745	575 718
Corporations	16 845	23 389	32 667	45 866	64 707
Government	36 751	52 129	74 232	106 072	152 036

a/ Local currency units.

Table 19. Projected factor incomes, gross incomes and disposable incomes of institutions in rural areas

(Thousands of LCUs) a/

Type of income	Year 0	Year 5	Year 10	Year 15	Year 20
Factor incomes of:					
Households	185 082	231 171	291 909	372 920	482 227
Corporations	34 618	41 707	50 569	61 760	76 051
Gross incomes of:					
Households	185 923	232 205	293 190	374 523	484 257
Corporations	39 342	47 574	57 932	71 106	88 054
Government	15 293	19 416	24 942	32 434	42 698
Disposable incomes of:					
Households	180 253	225 122	284 248	363 100	469 487
Corporations	31 005	37 493	45 656	56 039	69 396
Government	10 086	12 949	16 826	22 133	29 467

a/ Local currency units.

Table 20. Projected factor incomes, gross incomes and disposable incomes of institutions for the entire country

(Thousands of LCUs) a/

Type of income	Year 0	5	10	15	20
Factor incomes of:					
Households	338 586	446 246	594 703	801 074	1 090 036
Corporations	67 314	87 065	113 867	150 573	201 265
Gross incomes of:					
Households	358 710	474 123	633 562	855 549	1 166 792
Corporations	76 041	98 531	129 101	171 034	229 028
Government	62 918	86 754	120 554	168 698	237 543
Disposable incomes of:					
Households	325 998	429 180	571 351	768 846	1 045 205
Corporations	47 850	60 882	78 323	101 906	134 103
Government	46 837	65 078	91 057	128 205	181 503

a/ Local currency units.

(b) Other results

The projected incomes for urban and rural areas and the entire country can be further used to derive various indicators of disposable incomes at the urban-rural and the national level. Most of the indicators correspond to those that are calculated as part of the national projection, the derivation of which has been illustrated in the preceding example. Those indicators include the aggregates, indicators of the distribution by institutions and rates of growth of disposable incomes. They also include levels and growth rates of per capita and per household disposable incomes of households. Additional indicators which are computed only as part of an urban-rural projection include indicators of the locational distribution of disposable household income--proportions urban and rural, as well as those of urban-rural differentials of disposable household incomes.

The indicators that were obtained for urban and rural areas and the entire country, which correspond to indicators calculated in the national projection, are shown in tables 21 through 26.

Changes in the levels of the total disposable income for urban and rural areas and for the entire country for the 20-year projection period are shown in figure IX.

(i) Proportions of disposable household income that are urban and rural

The proportion of disposable household income that is urban is calculated as a ratio of the disposable household income for the urban areas to the disposable household income for the entire country. At the end of the projection interval 0-5, the proportion of disposable household income that is urban, 0.48, for the end of the interval 0-5, is obtained as:

$$0.48 = 204{,}058/429{,}180, \tag{41}$$

where 204,058 and 429,180 are the levels of disposable household income for the urban areas and the entire country in year 5, respectively.

The proportion of disposable household income that is rural equals the complement of the proportion urban. Thus, the proportion rural at the end of the projection interval 0-5, 0.52, is:

$$0.52 = 1 - 0.48, \tag{42}$$

where 0.48 is the proportion urban.

Changes in the proportions of disposable household income that are urban and rural over the projection period are shown in figure X.

Table 21. Disposable incomes: aggregates, indicators of the distribution and rates of growth in urban areas

Indicators	Year 0	5	10	15	20
Disposable income aggregates (thousands of LCUs) a/					
Levels of income					
Total	199 341	279 576	394 002	557 684	792 461
Household	145 745	204 058	287 104	405 745	575 718
Corporate	16 845	23 389	32 667	45 867	64 707
Government	36 751	52 129	74 232	106 072	152 036
Growth in incomes					
Total		80 235	114 426	163 682	234 777
Household		58 313	83 046	118 642	169 973
Corporate		6 544	9 278	13 200	18 840
Government		15 378	22 103	31 841	45 964
Indicators of the distribution of total disposable income by institutions					
Proportions by institutions					
Total	1.00	1.00	1.00	1.00	1.00
Households	0.73	0.73	0.73	0.73	0.73
Corporations	0.08	0.08	0.08	0.08	0.08
Government	0.18	0.19	0.19	0.19	0.19
Rates of growth of disposable incomes (percentage)					
Total		7.00	7.10	7.20	7.28
Households		6.96	7.07	7.16	7.25
Corporations		6.78	6.91	7.02	7.13
Government		7.24	7.33	7.40	7.47

a/ Local currency units.

Table 22. Levels and rates of growth of per capita and per household disposable incomes of households in urban areas

	Year				
	0	5	10	15	20
Levels (LCUs) a/					
Per capita	48.9	50.2	53.8	60.6	70.7
Per household	302.7	304.0	324.2	353.4	393.1
Rates of growth (percentage)					
Per capita		0.54	1.41	2.39	3.14
Per household		0.08	1.30	1.74	2.15

a/ Local currency units.

Table 23. Disposable incomes: aggregates, indicators of the distribution and rates of growth in rural areas

Indicators	Year 0	5	10	15	20
Disposable income aggregates (thousands of LCUs) a/					
Levels of income					
Total	221 344	275 564	346 729	441 272	568 350
Household	180 253	225 122	284 248	363 100	469 487
Corporate	31 005	37 493	45 656	56 039	69 396
Government	10 086	12 949	16 826	22 133	29 467
Growth in incomes					
Total		54 220	71 165	94 542	127 078
Household		44 870	59 125	78 853	106 387
Corporate		6 488	8 163	10 383	13 357
Government		2 862	3 877	5 307	7 334
Indicators of the distribution of total disposable income by institutions					
Proportions by institutions					
Total	1.00	1.00	1.00	1.00	1.00
Households	0.81	0.82	0.82	0.82	0.83
Corporations	0.14	0.14	0.13	0.13	0.12
Government	0.05	0.05	0.05	0.05	0.05
Rates of growth of disposable incomes (percentage)					
Total		4.48	4.70	4.94	5.19
Households		4.55	4.77	5.02	5.27
Corporations		3.87	4.02	4.18	4.37
Government		5.12	5.38	5.64	5.89

a/ Local currency units.

Table 24. Levels and rates of growth of per capita and per household disposable incomes of households in rural areas

	Year				
	0	5	10	15	20
Levels (LCUs) a/					
Per capita	25.6	31.6	39.2	48.8	62.6
Per household	182.2	232.5	293.0	366.3	459.3
Rates of growth (percentage)					
Per capita		4.21	4.40	4.52	5.08
Per household		5.00	4.73	4.57	4.63

a/ Local currency units.

Table 25. Disposable incomes: aggregates, indicators of distributions and rates of growth for the entire country

Indicators	Year 0	5	10	15	20
Disposable income aggregates (thousands of LCUs) a/					
Levels of income					
Total	420 685	555 140	740 731	998 956	1 360 811
Household	325 998	429 180	571 351	768 846	1 045 205
Corporate	47 850	60 882	78 323	101 906	134 103
Government	46 837	65 078	91 057	128 205	181 503
Growth in incomes					
Total		134 455	185 591	258 225	361 854
Household		103 182	142 171	197 495	276 359
Corporate		13 032	17 441	23 583	32 197
Government		18 241	25 980	37 148	53 297
Indicators of the distribution of total disposable income by institutions					
Proportions by institutions					
Total	1.00	1.00	1.00	1.00	1.00
Households	0.77	0.77	0.77	0.77	0.77
Corporations	0.11	0.11	0.11	0.10	0.10
Government	0.11	0.12	0.12	0.13	0.13
Indicators of the urban-rural distribution of disposable household income					
Proportions of disposable household income					
Urban	0.45	0.48	0.50	0.53	1.55
Rural	0.55	0.52	0.50	0.47	0.45
Rates of growth of disposable incomes (percentage)					
Total		5.70	5.94	6.16	6.38
Households		5.65	5.89	6.12	6.33
Corporations		4.94	5.17	5.41	5.64
Government		6.80	6.95	7.08	7.20

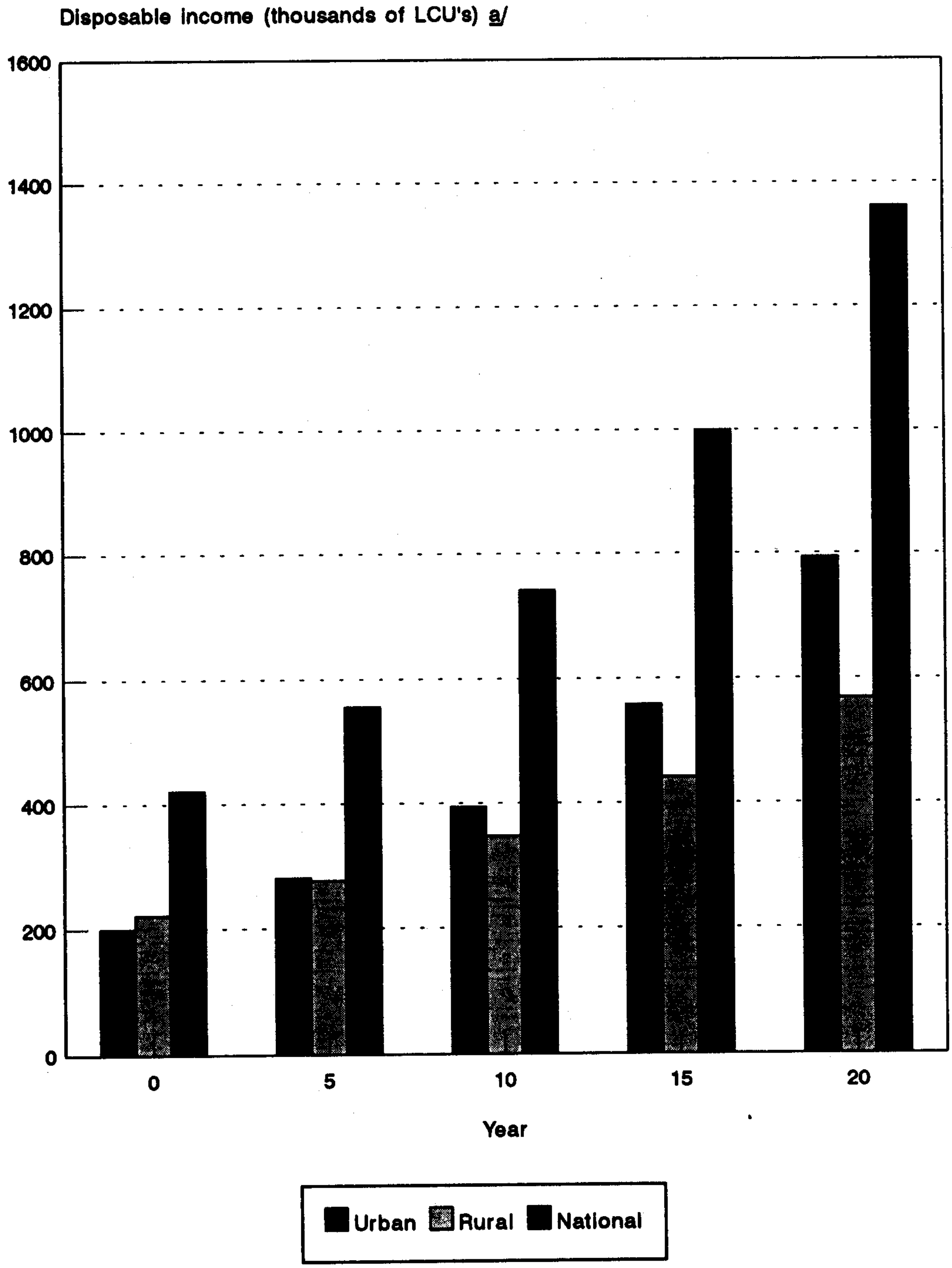
a/ Local currency units.

Table 26. Levels and rates of growth of per capita and per household disposable incomes of households for the entire country

	Year				
	0	5	10	15	20
Levels (LCUs) a/					
Per capita	32.6	38.3	45.4	54.4	66.8
Per household	221.6	261.8	307.9	359.4	420.3
Rates of growth (percentage)					
Per capita		3.29	3.43	3.70	4.19
Per household		3.39	3.30	3.14	3.18

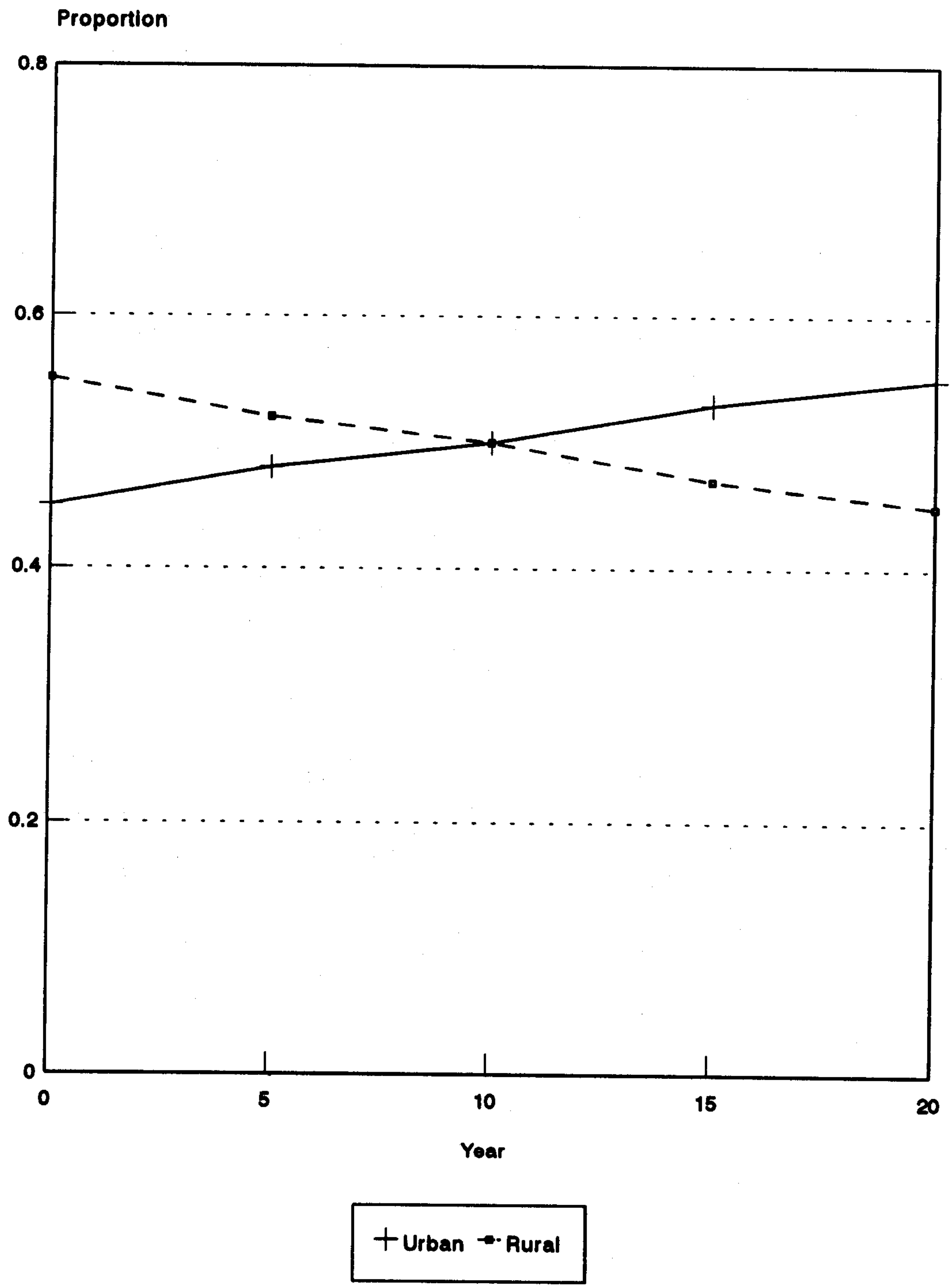
a/ Local currency units.

Figure IX. Total disposable income: urban, rural and national



a/ Local currency units.

Figure X. Proportions of disposable household income that are urban and rural



(ii) Urban-rural income differentials in per capita and per household disposable incomes of households

Given the levels of per capita and per household disposable incomes of households, it is also possible to derive urban-rural differentials in per capita and per household disposable incomes of households.

Thus, the urban-rural difference in per capita disposable household incomes expressed as a per cent of rural per capita disposable household income for the end of the projection interval 0-5, 58.9 per cent, which is shown in column 2 of table 27, can be obtained as follows:

$$58.9 = [(50.2 - 31.6) / 31.6] \cdot 100, \tag{43}$$

where 50.2 and 31.6 are, respectively, the levels of per capita disposable incomes of households in urban and rural areas in year 5 (shown in tables 22 and 24).

The urban-rural differential of per household disposable income for the end of the projection interval 0-5, 30.7 per cent, which is shown in column 3 of table 27, is obtained as follows:

$$30.7 = [(304.0 - 232.5) / 232.5] \cdot 100, \tag{44}$$

where 304.0 and 232.5 are, respectively, the levels of per household disposable income in urban and rural areas in year 5 (tables 22 and 24).

E. Summary

This chapter has described a method that uses selected relationships of the social accounting matrix to project disposable incomes for the entire country or for its urban and rural areas separately. In addition, the chapter described the types of inputs required by the method and the way they can be prepared using, among other things, a recent social accounting matrix. Lastly, two examples of projections -- national and urban-rural -- have been presented and discussed. A complete listing of the outputs that can be generated by the method is presented in box 10.

Table 27. Proportionate urban-rural differentials in per capita and per household disposable incomes of households

Year	Differences between levels of urban and rural disposable household incomes expressed as percentage of levels of rural disposable household incomes a/	
	Per capita	Per household
(1)	(2)	(3)
0	90.2	66.1
5	58.9	30.7
10	37.4	10.6
15	24.0	-3.5
20	13.0	-14.4

a/ Calculations illustrated in text.

Box 10

Outputs of a method for projecting incomes
using a social accounting matrix

1. Disposable income aggregates (national or urban, rural and national)

Levels of income:

Total

Household
Corporate
Government

Growth in incomes:

Total

Household
Corporate
Government

2. Indicators of the distribution of the total disposable income by institutions (national or urban, rural and national)

Proportions by institutions:

Households
Corporations
Government

3. Indicators of the urban-rural distribution of disposable household income (national only; if urban and rural incomes are being projected)

Proportions of disposable household income:

Urban
Rural

(continued)

Box 10 (continued)

4. <u>Rates of growth of disposable incomes</u> (national or urban, rural and national)

Total:

Household
Corporate
Government

5. <u>Indicators of per capita and per household disposable household incomes</u> (national or urban, rural and national)

Levels:
Per capita
Per household

Rates of growth:
Per capita
Per household

6. <u>Indicators of urban-rural differentials of disposable household incomes</u> (national only; if urban and rural incomes are being projected)

Percentage differences between levels of urban and rural disposable household income:
Per capita
Per household

F. Notation and equations

1. Indices, variables and special symbols

(a) List of indices

i = 1,...,I	are industries of the country's economy
k = 1,2	are urban and rural locations
t	is the year of the projection period
t'	is the given calendar year

(b) List of variables

ADHI(k, t+5)	is the average (per household) disposable household income in location k
ADHI(t+5)	is the average (per household) disposable household income
CIT(t+5)	is the corporate income taxes
DADHI(t+5)	is the difference between urban and rural average (per household) disposable household incomes expressed as per cent of the rural average (per household) disposable household income
DCI(t+5)	is the disposable corporate income
DCIG	is the growth of disposable corporate income during the interval
DGI(t+5)	is the disposable government income
DGIG	is the growth of disposable government income during the interval
DHI(k,t+5)	is the disposable household income in location k
DHI(t+5)	is the disposable household income
DHIG	is the growth of disposable household income during the interval
DIVH(t+5)	is the dividends paid to households

DPCDHI(t+5)	is the difference between urban and rural per capita disposable household incomes expressed as per cent of the rural per capita disposable household income
EGRADHI	is the average annual exponential growth rate of average (per household) disposable household income for the interval
EGRDCI	is the average annual exponential growth rate of the disposable corporate income for the interval
EGRDGI	is the average annual exponential growth rate of the disposable government income for the interval
EGRDHI	is the average annual exponential growth rate of the disposable household income for the interval
EGRPCDHI	is the average annual exponential growth rate of per capita disposable household income for the interval
EGRTDI	is the average annual exponential growth rate of the total disposable income for the interval
FIC(t+5)	is the factor income of corporations
FIH(t+5)	is the factor income of households
GCI(t+5)	is the gross corporate income
GDP(t')	is the gross domestic product at factor prices
GDP(t+5)	is the gross domestic product at factor prices
GGRDCI	is the average annual geometric growth rate of the disposable corporate income for the interval
GGRDGI	is the average annual geometric growth rate of the disposable government income for the interval
GGRDHI	is the average annual geometric growth rate of the disposable household income for the interval
GGI(t+5)	is the gross government income
GGRPCDHI	is the average annual geometric growth rate of the per capita disposable household income for the interval

GGRADHI	is the average annual geometric growth rate of the average (per household) disposable household income for the interval
GGRTDI	is the average annual geometric growth rate of the total disposable income for the interval
GHI(t+5)	is the gross household income
GTC(t+5)	is the government transfers to corporations
GTH(t+5)	is the government transfers to households
HIT(t+5)	is the household income taxes
NFTH(t')	is the net foreign transfers to households
NFTH(t+5)	is the net foreign transfers to households
NH(t+5)	is the total number of households
NIT(i,t+5)	is the net amount of indirect taxes (indirect taxes less subsidies) in industry i
NIT(t+5)	is the total net indirect taxes
PCDHI(k,t+5)	is the per capita disposable household income in location k
PCDHI(t+5)	is the per capita disposable household income
POP(t+5)	is the population size
PRCIH(t+5)	is the proportion of gross income of corporations paid to households as dividends
PRCIT(t+5)	is the proportion of gross corporate income paid as corporate income taxes
PRDCI(t+5)	is the proportion of total disposable income received by corporations
PRDGI(t+5)	is the proportion of total disposable income received by government
PRDHI(t+5)	is the proportion of total disposable income received by households
PRDHIURB(t+5)	is the proportion of disposable household income that is urban

PRDHIRUR(t+5)	is the proportion of disposable household income that is rural
PRHIT(t+5)	is the proportion of gross household income paid as household income taxes
PROF(i,t+5)	is the amount of profits in industry i
PROF(t+5)	is the total profits
PROFH(t+5)	is the amount of profits accruing to households
PRPROFH(t+5)	is the proportion of profits received by households
PRVAWG(i,t+5)	is the proportion of value added going to wages in industry i
RGTC(t')	is the ratio of government transfers to corporations to the gross domestic product in year t'
RGTH(t')	is the ratio of government transfers to households to the gross domestic product in year t'
RITVA(i,t+5)	is the ratio of net indirect taxes to value added in industry i
RNFTH(t')	is the ratio of net foreign transfers to households to the gross domestic product in year t'
TDI(t+5)	is the total disposable income
TDIG	is the growth in the total disposable income during the interval
VA(i,t+5)	is the value added at factor prices in industry i
WAGE(i,t+5)	is the wage bill of industry i
WAGE(t+5)	is the total wages

(c) <u>List of special symbols</u>

I	is the number of industries
ln	is the natural logarithm

2. Equations

A. The technique

1. National level

(a) Incomes of factors of production

(i) Wages

$$WAGE(i,t+5) = PRVAWG(i,t+5) \cdot VA(i,t+5); \qquad i = 1,\ldots,I \tag{1}$$

$$WAGE(t+5) = \sum_{i=1}^{I} WAGE(i,t+5) \tag{2}$$

(ii) Profits

$$PROF(i,t+5) = VA(i,t+5) - WAGE(i,t+5); \qquad i = 1,\ldots,I \tag{3}$$

$$PROF(t+5) = \sum_{i=1}^{I} PROF(i,t+5) \tag{4}$$

(b) Factor incomes of institutions

(i) Factor income of households

$$PROFH(t+5) = PRPROFH(t+5) \cdot PROF(t+5) \tag{5}$$

$$FIH(t+5) = WAGE(t+5) + PROFH(t+5) \tag{6}$$

(ii) Factor income of corporations

$$FIC(t+5) = PROF(t+5) - PROFH(t+5) \tag{7}$$

(c) <u>Gross incomes of institutions</u>

(i) <u>Gross income of corporations</u>

$$GCI(t+5) = FIC(t+5) + GTC(t+5) \tag{8}$$

(ii) <u>Gross income of households</u>

$$DIVH(t+5) = PRCIH(t+5) \cdot GCI(t+5) \tag{9}$$

$$GHI(t+5) = FIH(t+5) + DIVH(t+5) + GTH(t+5) + NFTH(t+5) \tag{10}$$

(iii) <u>Gross income of government</u>

a. <u>Household income taxes</u>

$$HIT(t+5) = PRHIT(t+5) \cdot GHI(t+5) \tag{11}$$

b. <u>Corporate income taxes</u>

$$CIT(t+5) = PRCIT(t+5) \cdot GCI(t+5) \tag{12}$$

c. <u>Net indirect taxes</u>

$$NIT(i,t+5) = RITVA(i,t+5) \cdot VA(i,t+5); \quad i = 1,\ldots,I \tag{13}$$

$$NIT(t+5) = \sum_{i=1}^{I} NIT(i,t+5) \tag{14}$$

$$GGI(t+5) = HIT(t+5) + CIT(t+5) + NIT(t+5) \tag{15}$$

(d) <u>Disposable incomes of institutions</u>

(i) <u>Disposable household income</u>

$$DHI(t+5) = GHI(t+5) - HIT(t+5) \tag{16}$$

(ii) Disposable corporate income

DCI(t+5) = GCI(t+5) - [DIVH(t+5) + CIT(t+5)] (17)

(iii) Disposable government income

DGI(t+5) = GGI(t+5) - [GTH(t+5) + GTC(t+5)] (18)

(e) Other results

(i) Aggregates of disposable income

a. Total disposable income

TDI(t+5) = DHI(t+5) + DCI(t+5) + DGI(t+5) (19)

b. Growth in total disposable income

TDIG = TDI(t+5) - TDI(t) (20)

c. Growth in disposable incomes of institutions

DHIG = DHI(t+5) - DHI(t) (21)

DCIG = DCI(t+5) - DCI(t) (22)

DGIG = DGI(t+5) - DGI(t) (23)

(ii) Indicators of the distribution of total disposable income

a. Proportions by institutions

PRDHI(t+5) = DIH(t+5) / TDI(t+5) (24)

PRDCI(t+5) = DCI(t+5) / TDI(t+5) (25)

$$PRDGI(t+5) = DGI(t+5) / TDI(t+5) \tag{26}$$

(iii) <u>Rates of growth of disposable incomes</u>

a. <u>The rate of growth of total disposable income</u>

i. <u>Geometric growth rate</u>

$$GGRTDI = [(TDI(t+5)/TDI(t))^{1/5} - 1] \cdot 100 \tag{27}$$

ii. <u>Exponential growth rate</u>

$$EGRTDI = [(\ln (TDI(t+5)/TDI(t))) / 5] \cdot 100 \tag{28}$$

b. <u>Rates of growth of disposable incomes of institutions</u>

i. <u>Geometric growth rate</u>

$$GGRDHI = [(DHI(t+5)/DHI(t))^{1/5} - 1] \cdot 100 \tag{29}$$

$$GGRDCI = [(DCI(t+5)/DCI(t))^{1/5} - 1] \cdot 100 \tag{30}$$

$$GGRDGI = [(DGI(t+5)/DGI(t))^{1/5} - 1] \cdot 100 \tag{31}$$

ii. <u>Exponential growth rates</u>

$$EGRDHI = [(\ln (DHI(t+5)/DHI(t))) / 5] \cdot 100 \tag{32}$$

$$EGRDCI = [(\ln (DCI(t+5)/DCI(t))) / 5] \cdot 100 \tag{33}$$

$$EGRDGI = [(\ln (DGI(t+5)/DGI(t))) / 5] \cdot 100 \tag{34}$$

(iv) <u>Levels of per capita and per household disposable incomes of households</u>

$$PCDHI(t+5) = DHI(t+5) / POP(t+5) \tag{35}$$

$$ADHI(t+5) = DHI(t+5) / NH(t+5) \tag{36}$$

(v) Rates of change of per capita and per household disposable incomes of households

a. Geometric growth rates

$$GGRPCDHI = [(PCDHI(t+5)/PCDHI(t)^{1/5} - 1] \cdot 100 \qquad (37)$$

$$GGRADHI = [(ADHI(t+5)/ADHI(t)^{1/5} - 1] \cdot 100 \qquad (38)$$

b. Exponential growth rates

$$EGRPCDHI = [(\ln (PCDHI(t+5)/PCDHI(t))) / 5] \cdot 100 \qquad (39)$$

$$EGRADHI = [(\ln (ADHI(t+5)/ADHI(t))) / 5] \cdot 100 \qquad (40)$$

2. Urban-rural level

(a) Different categories of incomes

(b) Other results

(i) Proportions of disposable household income that are urban and rural

$$PRDHIURB(t+5) = DHI(1,t+5) / DHI(1,t+5) \qquad (41)$$

$$PRDHIRUR(t+5) = 1 - PRDHIURB(t+5) \qquad (42)$$

(ii) Urban-rural differentials in per capita and per household disposable incomes

$$DPCDHI(t+5) = [(PCDHI(1,t+5) - PCDHI(2,t+5)) / PCDHI(2,t+5)] \cdot 100 \qquad (43)$$

$$DADHI(t+5) = [(ADHI(1,t+5) - ADHI(2,t+5)) / ADHI(2,t+5)] \cdot 100 \qquad (44)$$

B. The inputs

1. Types of inputs required

2. Preparation of the inputs

(a) Projections of value added, population and the number of households

(b) Assumptions on the various proportions and ratios

(i) Observations on proportions and ratios

a. Procedures to derive observations on proportions and ratios

i. National level

Value added

$$VA(i,t') = WAGE(i,t') + PROF(i,t') \qquad (45)$$

$$i = 1,\dots,I$$

Proportions of value added going to wages

$$PRVAWG(i,t') = WAGE(i,t') \,/\, VA(i,t') \qquad (46)$$

$$i = 1,\dots,I$$

Ratios of net indirect taxes to value added

$$RITVA(i,t') = NIT(i,t') \,/\, VA(i,t') \qquad (47)$$

$$i = 1,\dots,I$$

Proportion of profits received by households

$$PRPROFH(t') = PROFH(t') \,/\, PROF(t') \qquad (48)$$

Proportion of gross corporate income paid to households as dividends

$$PRCIH(t') = DIVH(t') \,/\, GCI(t') \qquad (49)$$

Proportion of gross household income paid as household income taxes

$$PRHIT(t') = HIT(t') / GHI(t') \tag{50}$$

Proportion of gross corporate income paid as corporate income taxes

$$PRCIT(t') = CIT(t') / GIC(t') \tag{51}$$

ii. Urban-rural level

Value added

$$VA(i,k,t') = WAGE(i,k,t') + PROF(i,k,t') \tag{52}$$

$i = 1,\ldots,I;$

$k = 1,2$

Proportions of value added going to wages

$$PRVAWG(i,k,t') = WAGE(i,k,t') / VA(i,k,t') \tag{53}$$

$i = 1,\ldots,I;$

$k = 1,2$

Ratios of net indirect taxes to value added

$$RITVA(i,k,t') = NIT(i,k,t') / \sum_{k'=1}^{2} VA(i,k',t') \tag{54}$$

$i = 1,\ldots,I;$

$k = 1,2$

Proportions of profits received by households

$$PRPROFH(k,t') = PROFH(k,t') / PROF(k,t') \tag{55}$$

$k = 1,2$

<u>Proportions of gross corporate income paid to households as dividends</u>

$$PRCIH(k,t') = DIVH(k,t') / GCI(t') \tag{56}$$

$$k = 1,2$$

<u>Proportions of gross household income paid as household income taxes</u>

$$PRHIT(k,t') = HIT(k,t') / GHI(k,t') \tag{57}$$

$$k = 1,2$$

<u>Proportions of gross corporate income paid as corporate income taxes</u>

$$PRCIT(k,t') = CIT(t')/GCI(t') \tag{58}$$

$$k = 1,2$$

b. <u>Illustrating the derivation of observations on proportions and ratios</u>

(ii) <u>Assumptions on future values of proportions and ratios</u>

(c) <u>Assumptions on transfers</u>

(i) <u>Observations on the relevant ratios</u>

a. <u>Procedure to derive observations on ratios</u>

i. <u>National level</u>

<u>Gross domestic product</u>

$$GDP(t') = \sum_{i=1}^{I} VA(i,t') \tag{59}$$

Ratio of government transfers to households to GDP

$$RGTH(t') = GTH(t') \,/\, GDP(t') \tag{60}$$

Ratio of government transfers to corporations to GDP

$$RGTC(t') = GTC(t') \,/\, GDP(t') \tag{61}$$

Ratio of net foreign transfers to households to GDP

$$RNFTH(t') = NFTH(t') \,/\, GDP(t') \tag{62}$$

ii. Urban-rural level

Gross domestic product

$$GDP(k,t') = \sum_{i=1}^{I} VA(i,k,t') \tag{63}$$

$$k = 1,2$$

Ratios of government transfers to households to GDP

$$RGTH(k,t') = GTH(k,t') \,/\, GDP(k,t') \tag{64}$$

$$k = 1,2$$

Ratios of government transfers to corporations to GDP

$$RGTC(k,t') = GTC(t') \,/\, [\ \sum_{k'=1}^{2} GDP(k',t)\ ] \tag{65}$$

$$k = 1,2$$

Ratios of net foreign transfers to households to GDP

$$RNFTH(k,t') = NFTH(k,t') \,/\, GDP(k,t') \qquad (66)$$

$$k = 1,2$$

b. Illustrative derivation of observations on ratios

(ii) Assumptions on future values of ratios

(iii) Deriving future values of transfers

Procedure to derive future values of transfers

i. National level

Gross domestic product

$$GDP(t+5) = \sum_{i=1}^{I} VA(i,t+5) \qquad (67)$$

Government transfers to households

$$GTH(t+5) = GDP(t+5) \cdot RGTH(t+5) \qquad (68)$$

Government transfers to corporations

$$GTC(t+5) = GDP(t+5) \cdot RGTC(t+5) \qquad (69)$$

Net foreign transfers to households

$$NFTH(t+5) = GDP(t+5) \cdot RNFTH(t+5) \qquad (70)$$

ii. Urban-rural level

Notes

1/ Throughout this chapter, "value added" refers to value added in constant factor prices. Various types of incomes, such as incomes of factors of production and incomes of institutions, are also in constant prices.

2/ It can be easily applied using an electronic spreadsheet program.

3/ Since only two factors of production are assumed in this discussion -- labour and capital -- profits going to households include rent and interest income received by households, plus the income of unincorporated business owned by households.

4/ The social accounting matrix of table 1 assumes that there are no public enterprises owned and operated by the government. Hence, the government sector is not among the institutions that are recipients of factor income and, in particular, income from capital.

5/ Indicators of the distribution of disposable corporate income and disposable government income by location are not included among the other results of the method, since they would not be of much interest to the planner.

6/ The definitions of the various variables referring to the given calendar year, t', which are used in this discussion are not given here. The definitions of those variables for the year t+5 -- the end of the projection interval (t to t+5) -- were presented in section B. Those definitions are included in section F of this chapter.

7/ Since the disposable household income and the population size are respectively expressed in thousands of local currency units and thousands of persons, per capita disposable household income is expressed in local currency units.

Annex I

SOCIAL ACCOUNTING MATRIX

A. Introduction

The social accounting matrix provides a picture of the income and product flows in an economy during a particular period, usually a year (Pyatt and Thorbecke, 1976). In this sense, it is similar to the input-output table (see box 11). However, SAM goes further than an input-output table; in addition to presenting the product flows, it shows the intervening relationships between the vector of final demand (which is generally taken as given in an input-output table) and factor incomes received owing to the production. SAM provides a more complete view, therefore, of the circular flows of income and products within an economy.

SAM is fundamentally a table consisting of an equal number of rows and columns, where each row and its corresponding column refer to a particular accounting category. These accounting categories can be grouped into factors of production (e.g., labour, capital), institutions (e.g., households, corporations, government), industries (e.g., agriculture, manufacturing), capital accounts (savings and investment) and the foreign sector (or "rest of the world"). Each row of SAM contains the receipts of a given unit, while each column contains the corresponding outlays or expenditures. Thus, SAM is, in fact, a type of double-entry accounting document.

This annex first discusses two representative social accounting matrices, which are shown in tables 1 and 2 of chapter IX. Then, the annex briefly considers the types of data that may be used to construct such matrices.

B. Description of two social accounting matrices

Table 1 in chapter IX presents a social accounting matrix of a hypothetical economy. That SAM consists of five basic types of rows and columns corresponding to five basic types of accounts. These are, respectively, accounts of factors of production, accounts of institutions, the capital account, accounts of industries and the foreign sector account. In the table, factors of production are restricted to labour and capital, whole institutions consist of households, corporations and government. The industries are agriculture, mining, manufacturing, utilities, construction, trade, transport and services. In addition to the rows and columns corresponding to these accounting categories, there is a sixth row containing the column totals and a sixth column containing the row totals. It follows from the double-entry accounting principles underlying SAM that there is always an exact correspondence between each element of the row totals and the corresponding element of the column totals.

In table 1, rows 1a and 1b, and columns 1a and 1b refer to the two factors of production -- labour and capital. In particular, rows 1a and 1b show that the factors of production receive all of their payments from the various industries (columns 4a to 4h). Moreover, they show how much factor income is generated in

Box 11

Glossary

Final goods and services
Goods and services that are consumed to satisfy wants rather than used as inputs into further stages of production.

Input-output table
A table indicating in matrix form the linkages existing among industries in an economy. Each row of the input-output matrix indicates the way in which the output of the industry is used to satisfy final demand or as inputs to other industries. Each column of the matrix shows the origins of the inputs used by the given industry, including those of factors of production (e.g. labour).

Intermediate goods and services
Goods and services used as inputs into further stages of production, an example of which is leather in shoe manufacturing.

Net foreign investment
Total income from abroad less (minus) the sum of all exports of goods and services.

the economy, how much of that income is generated by each industry and how much of that income is received by each factor of production. Rows 1a and 1b show respectively that the labour income accrues entirely to households in the form of wages and salaries and that the capital income accrues to both households and domestic corporations in the form of profits.

Rows 2a to 2c indicate where the receipts of the various institutions come from. First, row 2a shows that the receipts of households come in the form of wages and profits received from industries for supplying services of factors of production -- labour and capital -- to those industries (columns 1a and 1b). In addition, the receipts of households come from corporations and the government in the form of dividends and government transfers to households, respectively (columns 2b and 2c). Secondly, row 2b shows that the receipts of corporations are in the form of profits received from industries for supplying the services of capital (column 1b) and payments from government in the form of transfers to corporations (column 2c). Lastly, in rows 2c, government revenues are shown to consist of taxes levied on household income (column 2a) and corporate income (column 2b). In addition, government revenues come from net indirect taxes (column 2d).

The outlays of institutions are presented in columns 2a through 2c. Thus, outlays of households (shown in column 2a) consist of payments of household income taxes to government (row 2c), household savings (row 3), purchases of goods and services from industries (rows 4a to 4h) and purchases of final goods and services from the rest of the world, or final imports (row 5). Corporate outlays (column 2b) include the payments of dividends to households (row 2a) and corporate income taxes to government (row 2c), plus corporate savings (row 3). Lastly, government outlays (column 2c) include transfers to households and corporations (rows 2a and 2b), government savings (row 3) and the purchases of goods and services (row 4h).

Row 3 contains the balancing items on the capital account, including net domestic savings -- household, corporate and government savings (columns 2a to 2c) -- and net foreign investment (column 5). Column 3 presents the disposition of these savings, as purchases of capital goods and inventory from the various industries (rows 4a through 4h) and the rest of the world (row 5).

Rows 4a to 4h show that the receipts of the industries consist of purchases by institutions of final goods and services (columns 2a to 2c), purchases of intermediate goods and services by the industries themselves (columns 4a to 4h) and sales to the rest of the world, or exports (column 5). The industries spend their receipts (columns 4a to 4h) on payments to the factors of production (rows 1a and 1b), on net indirect taxes paid to government (row 2d), on payments for intermediate goods and services received from the industries themselves (rows 4a through 4h) and on purchases of intermediate goods and services from the rest of the world, or intermediate imports (row 5).

Row 5 and column 5 describe the hypothetical economy's transactions with the rest of the world. Row 5 shows that the foreign sector derives its receipts from the sale of both final goods and services to institutions (columns 2a to 2c), the sales of investment goods (column 3) and the sale of intermediate goods and services to the domestic industries (columns 4a through 4h). The rest of the world's outlays (column 5) include purchases of domestic goods and services (rows 4a through 4h) and a balancing item (row 3), which is called net foreign investment.

A SAM such as that presented in table 1 can be easily disaggregated to provide more detail if the necessary data are available. For example, households can be further classified according to location (e.g., urban or rural), principal source of income (e.g., agricultural, non-agricultural) and/or income level (e.g., high, medium and low). Table 2 in chapter IX, for example, illustrates how the SAM in table 1 can be disaggregated to show how income and product flows, including those between urban and rural locations can be depicted by SAM. The degree of detail (i.e., the number of rows and columns) in any given SAM will depend on the purpose for which it has been constructed as well as on the availability of data.

C. Types of data required to derive social accounting matrix

When SAM is not available, it must be constructed from appropriate data with the necessary detail for the types of projections desired. For example, if SAM is to be used, among other things, to project disposable incomes of urban and rural households, it must show the various selected flows by location. As suggested in the description of the method, to project incomes using SAM, only part of the matrix is used in the projection. The full SAM is necessary only to ensure that the income flows on which the projections are based are in fact internally consistent.

The amount of data required to construct SAM would depend on the degree of disaggregation desired. An extremely simple SAM, which would not be disaggregated by production industry, can be derived from the national accounts data available in most countries. However, for this purpose, the national accounts must include the "national disposable income and outlay" account, as well as the "domestic product and expenditure" account. Other sources of data used in the construction of a relatively simple SAM would include the balance of payments and financial data, which are most often available from central banks.

If more disaggregated SAMs are to be constructed (such as those presented in tables 1 and 2), it will be necessary to have access to an input-output table which provides information on inter-industrial product flows within the production sector, information on factor payments by industry and a industrial breakdown of final demand. In addition, household survey data are necessary to identify sources of income for different categories of households, as well as to show how such income is disbursed (i.e., consumption expenditures, personal savings, income taxes).

Annex II

ILLUSTRATIVE DERIVATION OF VARIOUS PROPORTIONS AND RATIOS

This annex illustrate the applications of the steps to calculate observations on the various proportions and ratios used in preparing income projections, which were described in section C of chapter IX. The use of those steps is first illustrated at the national level and then at the urban-rural level.

A. National level

The calculation of the proportions and ratios at the national level is illustrated using the SAM shown in table 1 of chapter IX.

1. Value added

To calculate the proportions of value added going to wages by industry, it is initially necessary to obtain value added at factor prices for each industry. As illustrated in table 28, value added for each industry (column 4) is obtained as the sum of labour income (column 2) and capital income (column 3) for the industry.

For example, value added in agriculture, 132,978, is obtained as follows:

$$132{,}978 = 19{,}142 + 113{,}836, \tag{45}$$

where 19,142 and 113,836 are, respectively, labour income (wages) and capital income (profits) in agriculture.

2. Proportions of value added going to wages by industry

Given the levels of value added by industry, the proportions of value added going to wages for the various industries can be obtained as shown in table 29. The proportion in each industry (column 4) is obtained by dividing the labour income (column 2) by the level of value added (column 3).

For example, the proportion of value added going to wages in agriculture, 0.1439, is obtained as follows:

$$0.1439 = 19{,}142 \;/\; 132{,}978, \tag{46}$$

where 19,142 is the labour income in agriculture and 132,978 is the value added in this industry.

Table 28. Calculating value added by industry for the entire country

(Thousands of LCUs a/)

Industry	Labour income b/	Capital income c/	Value added d/
(1)	(2)	(3)	(4)
Agriculture	19 142	113 836	132 978
Mining	1 021	896	1 917
Manufacturing	22 176	18 416	40 592
Utilities	1 845	3 903	5 748
Construction	9 070	19 265	28 335
Trade	15 766	20 367	36 133
Transportation	18 353	11 262	29 615
Services	66 043	23 969	90 012

a/ Local currency units.
b/ From table 1, row 1a, from column 4a to column 4h.
c/ From table 1, row 1b, from column 4a to column 4h.
d/ (Col. 2) + (col. 3).

Table 29. Calculating proportions of value added going to wages by industry for the entire country

Industry	Labour income a/ (thousands of LCUs) d/	Value added b/ (thousands of LCUs) d/	Proportion of value added going to wages c/
(1)	(2)	(3)	(4)
Agriculture	19 142	132 978	0.1439
Mining	1 021	1 917	0.5326
Manufacturing	22 176	40 592	0.5463
Utilities	1 845	5 748	0.3210
Construction	9 070	28 335	0.3210
Trade	15 766	36 133	0.4363
Transportation	18 353	29 615	0.6197
Services	66 043	90 012	0.7337

a/ From table 28, column 2.
b/ From table 28, column 4.
c/ (Col. 2)/(col. 3).
d/ Local currency units.

3. Ratios of net indirect taxes to value added by industry

Ratios of net indirect taxes (indirect taxes less subsidies) to value added by industry can be obtained as indicated in table 30. For each industry, this ratio (column 4) is calculated as the ratio of the amount of net indirect taxes (column 2), divided by value added (column 3).

For example, the ratio of net indirect taxes to value added in agriculture, -0.0073, is calculated as follows:

$$-0.0073 = -965 \;/\; 132{,}978, \tag{47}$$

where -965 is the amount of net indirect taxes levied on agriculture, which is the amount of indirect taxes levied on this industry less subsidies received by the industry.

4. Proportion of profits received by households

To obtain the observation of the proportion of profits going to households, 0.7141, it is necessary to divide the amount of profits received by households by total profits:

$$0.7141 = 151{,}326 \;/\; 211{,}914, \tag{48}$$

where 151,326 is the amount of profits accruing to households (row 2a and column 1b in table 1) and 211,914 is total profits (row 1b and column 6).

5. Proportion of gross corporate income paid to household as dividends

The proportion of gross corporate income going to households in the form of dividends, 0.3474, is obtained as the gross corporate income received by households as dividends, divided by the gross corporate income:

$$0.3474 = 23{,}773 \;/\; 68{,}441, \tag{49}$$

where 23,773 is the gross corporate income going to households as dividends (row 2a and column 2b in table 1) and 68,441 is gross corporate income (row 2b and column 6).

6. Proportion of gross household income paid as household income taxes

The proportion of gross household income paid as household income taxes, 0.0935, can be computed as household income taxes, divided by gross household income:

$$0.0935 = 31{,}336 \;/\; 335{,}141, \tag{50}$$

Table 30. Calculating ratios of net indirect taxes to value added by industry for the entire country

Industry	Net indirect taxes a/ (thousands of LCUs) a/	Value added b/ (thousands of LCUs) a/	Ratio of net indirect taxes to value added c/
(1)	(2)	(3)	(4)
Agriculture	-965	132 978	-0.0073
Mining	18	1 917	0.0094
Manufacturing	10 849	40 592	0.2673
Utilities	3	5 748	0.0005
Construction	13	28 335	0.0005
Trade	947	36 133	0.0262
Transportation	710	29 615	0.0240
Services	1,737	90 012	0.0193

a/ From table 1, row 2d from column 4a to column 4h.
b/ From table 28, col. 4.
c/ (Col. 2)/(Col. 3).
d/ Local currency units.

where 31,336 is household income taxes (row 2c and column 2a in table 1) and 335,141 is gross household income (row 2a and column 6).

7. Proportion of gross corporate income paid as corporate income taxes

The proportion of gross corporate income paid as corporate income taxes, 0.2028, can be obtained as corporate income taxes, divided by gross corporate income:

$$0.2028 = 13{,}881 \;/\; 68{,}441, \tag{51}$$

where 13,881 is corporate income taxes (row 2c and column 2b in table 1) and 68,441 is gross corporate income (row 2b and column 6).

B. Urban-rural level

In explaining how the various proportions and ratios required to make an urban-rural projection are obtained, the SAM shown in table 2 is used.

1. Value added

Table 31 illustrates the derivation of value added levels by industry for urban and rural areas. For either location, value added at factor cost for each industry (column 5) is derived by adding up the labour income (column 3) and the capital income (column 4) for that industry.

2. Proportions of value added going to wages by industry

Proportions of value added going to wages for the two locations are obtained as shown in table 32. The proportion for each industry in the given location (column 5) is computed by dividing the labour income (column 3) by the level of value added (column 4) for that industry and location.

3. Ratios of net indirect taxes to value added by industry

Ratios of net indirect taxes to value added by industry for the entire country are obtained as indicated in table 33. Initially, value added levels by industry for the entire country (column 4) are obtained by adding the levels of value added by industry originating in urban and rural areas (columns 2 and 3). Then, ratios of net indirect taxes to value added (column 6) are calculated by dividing the amounts of net indirect taxes (column 5) by the levels of value added (column 4). The proportions for urban and rural areas are assumed to be the same as the proportions for the entire country.

Table 31. Calculating value added by industry for urban and rural areas

(Thousands of LCUs) a/

Location	Industry	Labour income b/	Capital income c/	Value added d/
(1)	(2)	(3)	(4)	(5)
Urban	Agriculture	1 210	6 856	8 066
	Mining	681	611	1 292
	Manufacturing	19 374	16 076	35 450
	Utilities	1 600	3 362	4 962
	Construction	7 834	2 158	9 992
	Trade	13 831	13 814	27 645
	Transportation	15 403	9 469	24 872
	Services	40 642	14 749	55 391
	Total	100 575	67 095	167 670
Rural	Agriculture	17 932	106 979	124 911
	Mining	340	285	625
	Manufacturing	2 802	2 340	5 142
	Utilities	245	541	786
	Construction	1 237	17 107	18 344
	Trade	1 935	6 553	8 488
	Transportation	2 949	1 793	4 742
	Services	25 401	9 220	34 621
	Total	52 841	144 818	197 659

a/ From table 2, row 1a, from column 4a to column 4h.
b/ From table 2, row 1b, from column 4a to column 4h.
c/ (Col. 3) + (col. 4).
d/ Local currency units.

Table 32. Calculating proportions of value added going to wages by industry for urban and rural areas

Location	Industry	Labour income a/ (thousands of LCUs) d/	Value added b/ (thousands of LCUs) d/	Proportion of value added going to wages c/
(1)	(2)	(3)	(4)	(5)
Urban	Agriculture	1 210	8 066	0.1500
	Mining	681	1 292	0.5271
	Manufacturing	19 374	35 450	0.5465
	Utilities	1 600	4 962	0.3225
	Construction	7 834	9 992	0.7840
	Trade	13 831	27 645	0.5003
	Transportation	15 403	24 872	0.6193
	Services	40 642	55 391	0.7337
	Total	100 575	167 670	4.183423
Rural	Agriculture	17 932	124 911	0.1436
	Mining	340	625	0.5440
	Manufacturing	2 802	5 142	0.5449
	Utilities	245	786	0.3117
	Construction	1 237	18 344	0.0674
	Trade	1 935	8 488	0.2280
	Transportation	2 949	4 742	0.6219
	Services	25 401	34 621	0.7337
	Total	52 841	197 659	3.195166

a/ From table 31, col. 3.
b/ From table 31, col. 5.
c/ (Col. 3)/(Col. 4).
d/ Local currency units.

Table 33. Calculating ratios of net indirect taxes to value added by industry for the entire country

Industry	Value added (thousands of LCUs) a/			Net indirect taxes b/ (thousands of LCUs) a/	Ratio of net indirect taxes to value added c/
	Urban d/	Rural d/	National e/		
(1)	(2)	(3)	(4)	(5)	(6)
Agriculture	8 066	124 911	132 977	-965	-0.0073
Mining	1 292	625	1 917	18	0.0094
Manufacturing	35 450	5 142	40 592	10 849	0.2673
Utilities	4 962	786	5 748	3	0.0005
Construction	9 992	18 344	28 336	13	0.0005
Trade	27 645	8 488	36 133	947	0.0262
Transportation	24 872	4 742	29 614	710	0.0240
Services	55 391	34 621	90 012	1 737	0.0193
Total	167 670	197 659	365 329	13 312	

a/ From table 2, row 2d, from column 4a to column 4h.
b/ (Col. 5)/(col. 4).
c/ From table 31, col. 5.
d/ (Col. 2) + (cCol. 3).
e/ Local currency units.

4. Proportions of profits received by households

To derive the proportion of profits going to households in the urban areas, 0.5613, the amount of profits received by urban households (capital income accruing to those households) is divided by the urban profits (capital income in urban areas):

$$0.5613 = 37{,}660 \,/\, 67{,}096, \tag{55}$$

where 37,660 is the amount of profits accruing to urban households (row 2a (urban) and column 1b (urban) in table 2) and 67,096 is the total urban profits (row 1b (urban) and column 6 in the same table).

The proportion of profits received by rural households, 0.7849, is calculated in an analogous way:

$$0.7849 = 113{,}665/144{,}818, \qquad (55)$$

where 113,665 is the amount of profits accruing to rural households (row 2a (rural) and column 1b (rural) in table 2) and 144,818 is the total rural profits (row 1b/rural and column 6).

5. Proportions of gross corporate income paid to households as dividends

The proportion of gross corporate income going to urban households as dividends, 0.3382, can be obtained by dividing the gross corporate income going to urban households as dividends by the gross corporate income:

$$0.3382 = 23{,}148 \,/\, 68{,}441, \tag{56}$$

where 23,148 is the gross corporate income going to urban households as dividends (row 2a (urban) and column 2b) and 68,441 is the gross corporate income (row 2b and column 6).

The proportion of gross corporate income going to rural households as dividends, 0.0091, can be calculated as the gross corporate income going to rural households as dividends, divided by the gross corporate income:

$$0.0091 = 625 \,/\, 68{,}441, \qquad (56)$$

where 625 is the gross corporate income going to rural households as dividends (row 2a (rural) and column 2b).

6. Proportions of gross household income paid as household income taxes

The proportion of gross income of urban households paid as household income taxes, 0.1565, can be computed by dividing the household income taxes for the urban areas by the gross income of urban households:

$$0.1565 = 26{,}221 / 167{,}574, \tag{57}$$

where 26,221 is the household income taxes in urban areas (row 2c and column 2a (urban)) and 167,574 is the gross income of urban households (row 2a (urban) and column 6).

The proportion of gross income of rural households paid as household income taxes, 0.0305, can be computed in an analogous way:

$$0.0305 = 5{,}116 / 167{,}567, \tag{57}$$

where 5,116 is the household income taxes in rural areas (row 2c and column 2a (rural)) and 167,567 is the gross income of rural households (row 2a (rural) and column 6).

7. Proportions of gross corporate income paid as corporate income taxes

The proportion of gross corporate income paid as corporate income taxes, for the entire country 0.2028, can be computed by dividing the corporate income taxes by the gross income of corporations:

$$0.2028 = 13{,}881 / 68{,}441, \tag{58}$$

where 13,881 is the corporate income taxes (row 2c and column 2b) and 68,441 is the gross income of corporations (row 2b and column 6). This proportion is then assumed to be the same in both urban and rural areas.

Annex III

ILLUSTRATIVE DERIVATION OF THE RATIOS OF VARIOUS TRANSFERS TO GROSS DOMESTIC PRODUCT AND OF FUTURE VALUES OF THOSE TRANSFERS

This annex illustrates the derivation of observations on the ratios of various transfers to GDP using the steps discussed in section C of chapter IX, first for the entire country and then for urban and rural areas. Further, the annex illustrates how the assumed future values of those ratios can be used along with the projected GDP to obtain the future values of the transfers using the steps that were also discussed in section C. Illustrative calculations of the future values of transfers are discussed only for the entire country. Such calculations for urban and rural areas are not be presented owing to the similarities of the procedures applying to the national and urban-rural level.

A. Deriving observations on ratios

The illustrative derivation of the ratios are initially that for the entire country.

1. National level

To show how the various ratios of transfer to GDP at the national level can be calculated, the SAM shown in table 1 is used along with table 28.

(a) Gross domestic product

To obtain the observations on ratios, gross domestic product at factor cost must first be derived. The gross domestic product, 365,331, can be obtained as the sum of the value added levels by industry, which are shown in column 4 of table 28.

(b) Ratio of government transfers to households to GDP

The ratio of government transfers to households to GDP, 0.0181, is obtained as:

$$0.0181 = 6,625 \;/\; 365,331, \tag{60}$$

where 6,625 is the amount of government transfers to households (row 2a and column 2c in table 1).

(c) Ratio of government transfers to corporations to GDP

The ratio of government transfers to corporations to GDP, 0.0215, is obtained as:

$$0.0215 = 7,853 \;/\; 365,331, \tag{61}$$

where 7.853 is the amount of government transfers to corporations (row 2b and column 2c).

(d) Ratio of net foreign transfers to households to GDP

The ratio of net foreign transfers to households to GDP, 0, is obtained as follows:

$$0 = 0 \;/\; 365{,}331, \tag{62}$$

where 0 on the right-hand side is the net foreign transfers to households (row 2a and column 5).

2. Urban-rural level

The various ratios that can be calculated for urban and rural areas can be calculated in an analogous way. To illustrate those calculations, the SAM shown in table 2 is used together with table 31.

(a) Gross domestic product

Gross domestic product in urban areas, 167,670, can be obtained by adding up the levels of value added by industry generated in the urban areas, which are shown in column 5 of table 31.

Gross domestic product in rural areas, 197,659, can be obtained in an analogous way.

(b) Ratios of government transfers to households to GDP

The ratio of government transfers to urban households to urban GDP, 0.0369, is obtained as:

$$0.0369 = 6{,}189 \;/\; 167{,}670, \tag{64}$$

where 6,189 is the amount of government transfers to urban households (row 2a (urban) and column 2c in table 2).

The ratio of government transfer to rural households to rural GDP, 0.0022 can be obtained in an analogous way:

$$0.0022 = 436 \;/\; 197{,}659 \tag{64}$$

where 436 is the amount of government transfers to rural households (row 2a (rural) and column 2c).

(c) Ratio of government transfers to corporations to GDP

The ratio of government transfers to corporations to GDP, for the entire country, 0.0215 is obtained as:

$$0.0215 = 7{,}853 \,/\, (167{,}670 + 197{,}659), \quad (65)$$

where 7,853 is the amount of government transfers to corporations (row 2b and column 2c in table 2), while the sum of 167,670 and 197,659 stands for the economy's GDP. Then this ratio is imputed to urban and rural areas.

(d) Ratio of net foreign transfers to households to GDP

The ratio of net foreign transfers to urban households to the urban GDP, 0, is obtained as:

$$0 = 0 \,/\, 167{,}670, \quad (66)$$

where 0 on the right-hand side is the net foreign transfers to urban households (row 2a (urban) and column 5).

The ratio of net foreign transfers to rural households to the rural GDP is obtained in an analogous fashion.

B. Derivation of future values of transfers

This illustration only concern the national level, since the derivation of the future values of transfers for urban and rural areas is essentially the same as that for the entire country. The illustration refers to the end of the projection interval 0-5, for which specific levels of value added by industry and specific values of the relevant ratios are assumed.

(a) Gross domestic product

To illustrate the derivation of the level of gross domestic product for the end of the interval 0-5, the following value added levels are assumed for that date:

Industry	Value added (Thousand of local currency units)
Agriculture	171 341
Mining	2 810
Manufacturing	66 267
Utilities	9 404
Construction	38 325
Trade	56 242
Transport	41 990
Services	146 933

Given these value added levels, the gross domestic product in year 5 is 533,312.

(b) Government transfers to households

The amount of government transfers to households at the end of the interval 0-5, 9,653, is calculated as follows:

$$9{,}653 = (533{,}312)\ (0.0181), \tag{68}$$

where 0.0181 is the assumed ratio of government transfers to households to GDP for the end of the interval.

(c) Government transfers to corporations

The amount of government transfers to corporations at the end of the interval 0-5, 11,466, is calculated as follows:

$$11{,}466 = (533{,}312) \cdot (0.0215), \tag{69}$$

where 0.0215 is the assumed ratio of government transfers to corporations to GDP for the end of the interval.

(d) Net foreign transfers to households

Net foreign transfers to households at the end of the interval 0-5, 0, are as follows:

$$0 = (533{,}312) \cdot (0), \tag{70}$$

where 0 on the right-hand side is the assumed ratio of government transfers to corporations to GDP for the end of the interval.

This concludes the illustrative derivations of observations of the ratios of various transfers to GDP and future values of those transfers.

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X. PROJECTING HOUSEHOLD CONSUMPTION AND SAVINGS USING PER HOUSEHOLD SPECIFICATIONS OF DEMAND SYSTEMS

A. Introduction

Projections of household consumption (see box 12) and household savings can be of considerable value in comprehensive planning. For example, projections of household consumption can be used as indications of future household consumption demand, which is a major component of total final demand. In addition, projections of household consumption can provide an indication, albeit partial, of possible future changes in the standard of living of the population. Projections of household savings, which may be a significant part of overall savings of the economy provide the basis for preparing projections of total domestic savings.

This chapter describes a method for preparing projections of household consumption and savings at the national or urban-rural level employing one of two alternative demand systems. The first draws on a model formulated by Kelley (1969), which postulates that the household consumption of any given group of commodities is determined by total household expenditure and household size. The other demand system, which is similar to the household consumption and savings module of the Bachue-Philippines economic-demographic model (Rodgers and others, 1978), assumes that household consumption and savings are functions of household disposable income and household size.

Thus, the method can indicate the effects on household spending behaviour of household resources and household size. In the case of urban-rural projections, the method can also indicate the effects on aggregate spending behaviour of differences between urban and rural areas in their consumption and savings patterns. However, the method does not show the effects of commodity prices on spending behaviour. Nor does it take into consideration other potentially influential factors, such as the composition of the household, the age of the household head and the socio-economic class of the household.

In spite of their common conceptual underpinnings, the two demand systems used by the method differ in the way they treat household savings. When the Kelley-type demand system is used, household savings are an input into the projection and are therefore exogenous (see box 13). If, however, the Bachue-Philippines-type demand system is used, household savings are obtained in the course of making the projection and are therefore endogenous.

Both demand systems can be formulated using either linear or non-linear functional forms. Moreover, each system can be estimated using cross-sectional information or time series data. However, owing to limited time series information, in many developing countries the planner would normally have no choice but to use cross-sectional data. This may be a disadvantage, since estimates of consumption functions based on cross-section information (or even short-time series) may yield projections that systematically understate future increases in household consumption (overstate future increases in household savings) as household income grows.

Box 12

Glossary

Comprehensive planning
A form of development planning, sometimes referred to as aggregative, global or overall planning which covers most or all sectors of the economy. This planning, unlike sectoral planning, is concerned with a full range of variables, including aggregate output, household and government consumption, savings and investment, imports and exports, employment and incomes.

Demand systems
A set of functions explaining consumption behaviour alone, or consumption as well as savings behaviours of a group of households, which make a population group or the total population.

Economic-demographic model
A mathematical representation of key economic and demographic variables and their interrelationships. The model may be used to make projections of output, use of productive factors and components of final demand, as well as the components of population change, population size and the structure of the labour force.

Household consumption
The value of 'final' goods and services consumed by households over a specified time period.

Household disposable income
The income of a household, after taxes and/or transfers, which is available for consumption or savings.

Household savings
The portion of household disposable income that is not spent on consumption over a specified time period.

Box 13

Glossary

Average household size
The mean number of members per household.

Average household savings ratio
Proportion of disposable household income devoted to savings.

Endogenous
A variable is said to be endogenous with respect to a model if its value is determined within the model.

Exogenous
A variable is said to be exogenous with respect to a model if its value is determined outside the model.

Marginal propensity to consume
For a given time period, the change in the value of household consumption, divided by the change in the disposable household income.

Partial coefficient
A coefficient in a function seeking to explain variations in a given variable (dependent variable) in terms of variations in other relevant variables (independent variables). The coefficient measures partial or ceteris paribus effect of any given independent variable on the dependent variable.

B. The technique

1. Overview

This overview lists the inputs required by the method, indicates the type of results that can be generated and outlines the computational steps involved in preparing household consumption and savings projections.

(a) Inputs

To project household consumption and savings, the following inputs are needed:

(i) Projected average household disposable income;
(ii) Projected average household size;

(iii) Projected number of households;
(iv) Estimates of the coefficients of household consumption functions by commodity group.

Moreover, if the projection is to involve exogenous savings, the inputs should include:

(v) Assumptions on the average household savings ratio.

Alternatively, if the projection involves endogenous savings, the inputs should include:

(vi) Estimates of the coefficients of the household savings function.

The inputs are listed in box 14.

If a national projection is sought, those inputs would need to be specified for the entire country. To prepare a projection for urban and rural areas, the inputs would be required for urban and rural locations.

Since this method will be described in the context of preparing quinquennial projections, the projected disposable household income, projected number of households and projected average household size must be for dates five years apart. In addition, if the projection is to utilize assumptions on the average savings ratio of households, those assumptions must also be for dates five years apart. Given appropriate annual inputs, the method could be used for preparing annual projections.

(b) Outputs

In the case of a national projection, the method can be used to generate the following outputs:

(i) Levels of average household consumption by commodity group;
(ii) Level of average household savings;
(iii) Various household consumption and savings aggregates, such as levels of total household consumption by commodity group and total household savings;
(iv) Indicators of the spending pattern of households, such as proportions of total disposable household income that are spent on commodities of different groups or saved;
(v) Rates of change of household consumption or savings, including that of total household consumption and total household savings.

If the technique is used to prepare an urban-rural projection, the result would include all those listed under (i) through (v), which would be for urban and rural areas as well as for the entire country. In addition, they would include indicators of the urban-rural distribution of household consumption and household savings. The outputs that can be produced by using the method are indicated in box 15.

Box 14

Inputs for preparing household consumption and savings projections using per household demand systems

1. Per household disposable household income (national or urban and rural)

2. Number of households (national or urban and rural)

3. Average household size (national or urban and rural)

4. Estimates of consumption functions (national or urban and rural)

    Coefficients of linear consumption functions of the demand system with exogenous or endogenous savings, or

    Coefficients of non-linear (multiplicative) or log-linear consumption functions of the demand system with exogenous or endogenous savings

5. Assumptions on per household average savings ratio (national or urban and rural; if the demand system used includes exogenous savings)

6. Estimates of savings function(s) (national or urban and rural; if the demand system used includes endogenous savings)

    Coefficients of linear savings function(s) of the demand system with endogenous savings, or

    Coefficients of non-linear (multiplicative) or log-linear savings function(s) of the demand system with endogenous savings

(c) Computational steps

For any given projection date, the first step yields levels of per household consumption by commodity group and the level of per household savings pertaining to that date.

If household savings are exogenous, the level of average household expenditure is first obtained as a product of average disposable household income and the complement of the assumed average household savings ratio for

Box 15

Types of outputs of the method for preparing household consumption and savings projections using perhousehold demand systems

1. Levels of household consumption by commodity group and household savings (national or urban, rural and national)

2. Household consumption and savings aggregates (national or urban, rural and national)

   Levels of total household consumption, household consumption by broad commodity group and of household savings

   The growth in total household consumption, household consumption by broad commodity group and in household savings

3. Indicators of the spending pattern of households (national or urban, rural and national)

   Proportions of household disposable income saved and proportions spent on goods and services in broad commodity groups

4. Indicators of the urban-rural distribution of total household consumption and household savings

   Proportions of total household consumption and household savings in different locations

5. Rates of growth of household consumption and savings (national or urban, rural and national)

   Rates of growth in total household consumption, household consumption by broad commodity groups and in household savings

that date (assumed here to be in constant prices). Then, levels of average household consumption by commodity group are obtained by evaluating household consumption functions using average household expenditure and the projected average household size. The level of average household savings is calculated as the difference between average disposable household income and average household expenditures.

If household savings are endogenous, average household consumption by commodity group and average household savings are obtained in a direct way, by evaluating consumption and savings functions using the level of average disposable household income and the projected average household size for that date.

This technique can be used to calculate other results, including total household consumption by commodity group and total household savings. Those aggregates can be obtained as products of the levels of average household consumption by commodity group and average household savings, on the one hand, and number of households, on the other. The method can also be used to calculate other aggregates, such as total household consumption. It can also be used to calculate indicators of the spending pattern of households and rates of increase of various household consumption and savings aggregates.

2. National level

This section will initially describe a procedure to make a national level projection in which savings are exogenous. Then, a procedure to make the same type of projection with endogenous savings will be introduced.

(a) Procedure assuming exogenous savings

The description of this procedure will initially present consumption functions with exogenous savings in which average household expenditure and average household size are the explanatory variables.[1] Later, steps to derive levels of average household consumption by commodity group and the level of average household savings will be introduced. Steps to derive other results for a given projection date or interval will also be described. A summary of those steps is shown in box 16.

(i) Consumption functions

Three types of consumption functions will be considered: linear, multiplicative and log-linear.

Linear. A simple specification of a consumption function in this system postulates that the average household consumption in a given commodity group is a linear function of average household expenditure and average household size. Linear consumption functions of this sort can be written for the various commodity groups as follows:

$$AHC(g,t') = a(g) + b(g) \cdot AHE(t') + c(g) \cdot AHS(t'); \qquad (1)$$

$$g = 1,\ldots,G,$$

where:

$g = 1,\ldots,G$ are commodity groups,

Box 16

Computational steps to project household consumption
and savings at the nationalal level using the
demand system with exogenous savings

The steps used to project household consumption and savings at the national level over a five-year projection interval with the demand system with exogenous savings are as follows:

(1) Compute for the end of the projection interval per household total household expenditure as a product of per household disposable household income and the complement of the average household savings ratio for that date.

(2) Derive projected levels of average household consumption by commodity group at the end of the interval by evaluating empirically estimated household consumption functions using the projected average household expenditure and the average household size for that date.

(3) If the consumption functions employed are linear, use the projected levels of average household consumption as obtained in step 2.

(4) If the consumption functions are non-linear or log-linear, calculate an adjustment factor as a ratio of the average household expenditure to the sum of the levels of average household consumption obtained in step 2. Apply this factor to those levels in order to derive adjusted levels of average household consumption by commodity group for the date in question.

(5) Derive the level of average household savings as the difference between the average disposable household income and the average household expenditure obtained in step 1.

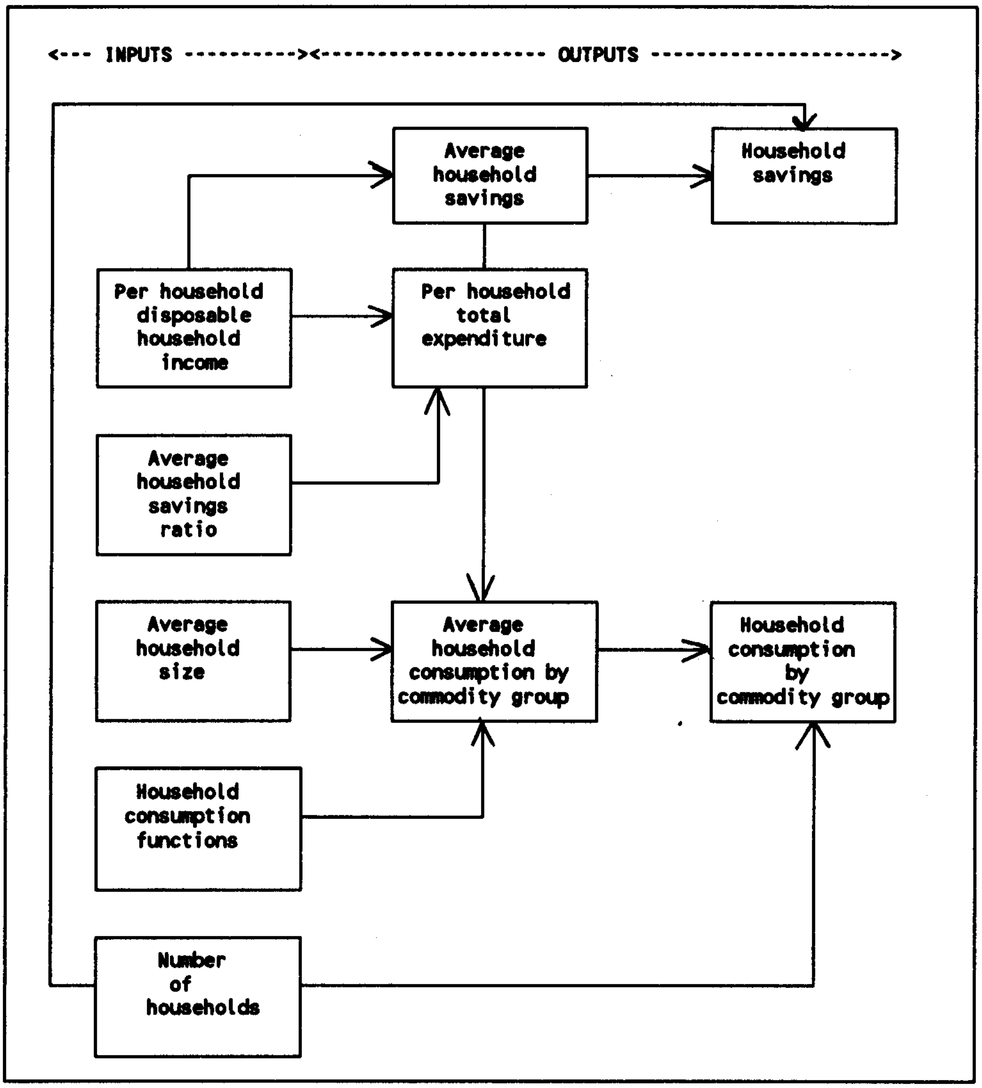
(6) Calculate levels of household consumption by commodity group and the level of household savings as products of the levels of per household consumption (obtained in step 2 or step 4) and the level of average household savings, on the one hand, and the number of households, on the other, for the date.

(7) Calculate various household consumption and savings aggregates, such as total household consumption and the increase in total household consumption.

(8) Derive indicators of the spending pattern of households, such as proportions of total household disposable income spent on various goods and services.

(9) Obtain rates of growth of household consumption and savings, such as the rate of growth of total household consumption.

Figure XI. Steps to project household consumption and savings using the demand system with exogenous savings



G	is the number of commodity groups,
t'	is the calendar year,
AHC(g,t')	is the average household consumption of goods and services in commodity group g in year t',
AHE(t')	is the average household expenditure in year t',
AHS(t')	is the average household size in year t',
a(g)	is the intercept coefficient for commodity group g,
b(g)	is the partial coefficient of average household expenditure for commodity group g, and
c(g)	is the <u>partial coefficient</u> (see box 13) of average household size for commodity group g.

The partial coefficients of average household expenditure in the functions shown in equation (1), the b(g)'s, are <u>marginal propensities to consume</u> out of average household expenditure.

<u>Multiplicative</u>. A consumption function having per household total expenditure and average household size as explanatory variables can also take a multiplicative form. This specification postulates that average household consumption by commodity group is a non-linear function of the average household expenditure and the average household size of the following type:

$$AHC(g,t') = a(g) \cdot AHE(t')^{b(g)} \cdot AHS(t')^{c(g)}; \qquad (2)$$

$$g = 1,\ldots,G,$$

where:

a(g)	is the slope coefficient for commodity group g,
b(g)	is the exponent of average household expenditure for commodity group g, and
c(g)	is the exponent of average household size for commodity group g.

<u>Log-linear</u>. The non-linear functions indicated in equation (2) can be transformed into log-linear consumption functions by taking logarithms of their left-hand and right-hand sides as follows:

$$\ln AHC(g,t') = \ln a(g) + b(g) \cdot \ln AHE(t') + c(g) \cdot \ln AHS(t'); \qquad (3)$$

$$g = 1,\ldots,G,$$

where:

ln is the natural logarithm.

The exponents in equation (2), b(g)'s and c(g)'s, become the partial coefficients of the functions indicated in equation (3). Moreover, the partial coefficients of average household expenditure in these functions have a different meaning from the partial coefficients of the same variable in the functions shown in equation (1). They stand for elasticities of levels of average household consumption by commodity group with respect to the average household expenditure. That is, they express the percentage changes in levels of average household consumption for different commodity groups for a given percentage change in average household total expenditure.

The non-linear or log-linear functions embody assumptions which differ from those of the linear functions. Thus, in the non-linear or log-linear functions, marginal propensities to consume vary with the levels of consumption and total household expenditure, while the elasticities of consumption with respect to total household expenditure remain fixed. These elasticities are equal to the partial coefficients, b(g)'s. In the linear functions, marginal propensities to consume are fixed (they are equal to b(g)'s), while the elasticities of consumption with respect to total household expenditure vary with the levels of consumption and total expenditure.

In spite of these differences, the multiplicative and log-linear functions tend to yield consumption projections over the medium term that are similar to those that can be obtained using the linear functions. Therefore, there is often little reason to select one form over the other in making medium-term consumption projections. Linear functions are, however, often preferred since they are easier to estimate and to use in making projections.

(ii) Average household consumption and savings

To obtain levels of average household consumption by commodity group and the level of household savings, it is initially necessary to calculate average household expenditure.

a. Average household expenditure

Average household expenditure can be derived for a given projection date as a product of the average household disposable income and the complement of the assumed per household average savings ratio. Thus, for the end of the projection interval (t to t+5), per household total expenditure is:

$$AHE(t+5) = ADHI(t+5) \cdot [1 - ASVR(t+5)], \qquad (4)$$

where:

t is the year of the projection period,

AHE(t+5)	is the average household expenditure at the end of the interval,
ADHI(t+5)	is the average disposable household income at the end of the interval, and
ASVR(t+5)	is the average savings ratio at the end of the interval.

b. Average household consumption by commodity group

Given average household expenditure, levels of average household consumption by commodity group can be projected using estimates of linear, multiplicative or log-linear consumption functions.

Linear. If estimates of linear consumption functions are used, average household consumption by commodity group can be obtained for the end of the projection interval (t to t+5) as follows:

$$AHC(g,t+5) = a^*(g) + b^*(g) \cdot AHE(t+5) + c^*(g) \cdot AHS(t+5); \qquad (5)$$

$$g = 1,\ldots,G,$$

where:

AHC(g,t+5)	is the average household consumption of goods and services in commodity group g at the end of the interval,
AHE(t+5)	is the average household expenditure at the end of the interval,
AHS(t+5)	is the average household size at the end of the interval,
a*(g)	is the estimate of the intercept coefficient for commodity group g of the consumption function,
b*(g)	is the estimate of the partial coefficient of average household expenditure for commodity group g in the consumption function, and
c*(g)	is the estimate of the partial coefficient of average household size for commodity group g in the consumption function.

Through much of this chapter, per household total household expenditure will be abbreviated as average household expenditure. Similarly, per household disposable household income will be abbreviated as average household disposable.

Multiplicative. Alternatively, average household consumption can be obtained for the end of the projection interval using estimates of multiplicative consumption functions. For the reason given below, the use of those functions would yield preliminary levels of average household consumption by commodity group as follows:

$$AHC^*(g,t+5) = a^*(g) \cdot AHE(t+5)^{b^*(g)} \cdot AHS(t+5)^{c^*(g)}; \qquad (6)$$

$$g = 1,\ldots,G,$$

where:

AHC*(g,t+5) — is the preliminary level of average household consumption of goods and services in commodity group g at the end of the interval,

a*(g) — is the estimate of the slope coefficient for commodity group g in the consumption function,

b*(g) — is the estimate of the exponent of average household expenditure for commodity group g in the consumption function, and

c*(g) — is the estimate of the exponent of average household size for commodity group g in the consumption function.

Log-linear. Estimates of the coefficients of log-linear consumption functions could be used to project the logarithms of the preliminary levels of per household consumption by commodity group as follows:

$$\ln AHC^*(g,t+5) = [\ln a(g)]^* + b^*(g) \cdot AHE(t+5) + c^*(g) \cdot AHS(t+5);(\qquad (7)$$

$$g = 1,\ldots,G,$$

where:

[lna(g)]* — is the estimate of the logarithm of the intercept coefficient for commodity group g in the log-linear consumption function.

Once the logarithms of the preliminary levels of average household consumption are obtained as indicated in equation (7), the preliminary levels themselves can be obtained by calculating antilogarithms of the results:

$$AHC^*(g,t+5) = \text{antiln}[\ \ln AHC^*(g,t+5)\ ]; \qquad (8)$$

$$g = 1,\ldots,G,$$

where:

antiln — is the antilogarithm of the natural logarithm.

c. Adjusted levels of average household consumption by commodity group

Levels of average household consumption by commodity group obtained as shown by equation (5) can be used directly in further calculations. On the other hand, levels of average household consumption by commodity group derived as indicated by equation (6) or by equations (7) and (8) must be treated as preliminary levels owing to the fact that they will not, as a rule, add up to the average household expenditure. To obtain the actual levels of average household consumption, the preliminary levels must be adjusted. In particular, this adjustment may involve a uniform, proportionate increase or decrease in the preliminary levels.

To perform such an adjustment, it would be necessary to calculate an appropriate adjustment factor and then apply it to each preliminary value of average household consumption by commodity group. For the end of the projection interval (t to t+5), the adjustment factor can be obtained as follows:

$$AF(t+5) = AHE(t+5) \;/\; [\; \sum_{g=1}^{G} AHC^{*}(g,t+5) \;], \qquad (9)$$

where:

AF(t+5) is the adjustment factor applying to the preliminary levels of average household consumption by commodity group at the end of the interval.

After calculating the requisite adjustment factor, the adjusted levels of average household consumption by commodity group at the end of the projection interval can be obtained by multiplying the preliminary value by the adjustment factor:

$$AHC(g,t+5) = AHC^{*}(g,t+5) \cdot AF(t+5); \qquad (10)$$

$$g = 1,\ldots,G.$$

d. Average household savings

Given the average household expenditure, derived as indicated in equation (4), the level of average household savings can be obtained as the difference between the average disposable household income and the average household expenditure. Thus, for the end of the projection interval (t to t+5):

$$AHSV(t+5) = ADHI(t+5) - AHE(t+5), \qquad (11)$$

where:

AHSV(t+5) is the average household savings at the end of the interval.

(iii) Household consumption and savings

Given the projected average household consumption by commodity group and the projected average household savings, projected aggregate household consumption of a commodity group by all households and aggregate household savings can be obtained as products of the levels of average household consumption and savings and the number of households.

In particular, levels of household consumption by commodity group at the end of the projection interval (t to t+5) can be obtained as follows:

$$HC(g,t+5) = AHC(g,t+5) \cdot NH(t+5); \quad g = 1,\ldots,G, \tag{12}$$

where:

HC(g,t+5) is the household consumption of goods and services in commodity group g at the end of the interval, and

NH(t+5) is the number of households at the end of the interval.

Household savings at the end of the projection interval can be obtained in an analogous way:

$$HSV(t+5) = AHSV(t+5) \cdot NH(t+5), \tag{13}$$

where:

HSV(t+5) is household savings at the end of the interval.

(iv) Other results

Once the levels of household consumption and household savings are projected for the end of a given interval, several derived indicators can be calculated. These indicators include household consumption and savings aggregates, indicators of the spending pattern of households and rates of change of household consumption and savings.

a. Household consumption and savings aggregates

A key aggregate that one can calculate from the projected levels of household consumption by commodity group is the level of total household consumption. It is also possible to obtain the levels of household consumption by broad commodity groups, such as food and clothing. Once the total and broad-commodity-group levels of household consumption are obtained for different dates five years apart, increases in total household consumption and in household consumption for broad groups over the intervening projection intervals can be calculated. In addition, one can calculate increases in household savings for those projection intervals.

i. Total household consumption

Total household consumption can be obtained by aggregating the levels of household consumption classified by commodity group. For the end of the projection interval (t to t+5), this total can be obtained as follows:

$$HC(t+5) = \sum_{g=1}^{G} HC(g,t+5), \tag{14}$$

where:

HC(t+5) is the total household consumption at the end of the interval.

ii. Household consumption by broad commodity groups

If the projection of household consumption and savings involves several different commodity groups, projected household consumption levels by those groups can be aggregated into levels of consumption for a relatively small number of broader groups. The rules of aggregation used in deriving household consumption levels by broad groups may vary from one application to another depending on the primary commodity group used in the projection. Therefore, in this description of the method, this aggregation will be considered in general terms. It will be illustrated as part of the projection examples in section D using arbitrarily selected commodity groups.

In particular, the levels of household consumption for broad commodity groups at the end of the given projection interval (t to t+5) can be obtained as follows:

$$HC(h,t+5) = A\ [\ HC(g,t+5)\ ]; \tag{15}$$

$$h = 1,\ldots,H,$$

where:

h = 1,...,H	are broad commodity groups,
H	is the number of broad commodity groups,
HC(h,t+5)	is the household consumption of goods and services in broad commodity group h at the end of the interval, and
A	is an aggregation procedure indicating the way household consumption levels by commodity groups are aggregated to obtain household consumption levels by broad commodity groups.

iii. Growth in total household consumption

The growth in total household consumption over the projection interval equals the difference between the levels of total household consumption at the end and at the beginning of the interval:

$$HCGR = HC(t+5) - HC(t), \tag{16}$$

where:

HCGR is the growth of household consumption during the interval.

iv. Growth of household consumption by broad commodity groups

The increase in household consumption in various broad commodity groups over the projection interval is obtained as follows:

$$HCGR(h) = HC(h,t+5) - HC(h,t), \tag{17}$$

where:

HCGR(h) is the growth of household consumption in broad commodity group h over the interval.

v. Growth in household savings

The growth in household savings over the projection interval equals the difference between household savings at the end and at the beginning of the interval:

$$HSVGR = HSV(t+5) - HSV(t), \tag{18}$$

where:

HSVGR is the growth of household savings during the interval.

b. Indicators of the spending pattern of households

Once the household consumption and savings aggregates are obtained, it is possible to derive proportions of disposable household income that are spent on goods and services in various broad commodity groups or are saved.

i. Disposable household income

To calculate proportions of disposable income spent on goods and services or saved, it is initially necessary to obtain disposable household income as the product of average disposable household income and the number of households. For the end of the projection interval, this can be obtained as follows:

$$DHI(t+5) = ADHI(t+5) \cdot NH(t+5), \tag{19}$$

where:

DHI(t+5) is the disposable household income at the end of the interval.

ii. Proportions of disposable household income spent on goods and services by broad commodity groups

The proportions of disposable household income spent on goods and services in different broad commodity groups can be obtained by dividing the levels of household consumption in broad groups by the level of disposable household income. For the end of the projection interval, these proportions can be obtained as follows:

$$PRHC(h,t+5) = HC(h,t+5) \ / \ DHI(t+5); \qquad (20)$$

$$h = 1,\ldots,H,$$

where:

PRHC(h,t+5) is the proportion of household disposable income spent on consumption of goods and services in broad commodity group h at the end of the interval.

iii. Proportion of disposable household income saved

The proportion of disposable household income that is saved can be obtained as the level of household savings divided by the level of disposable household income. For the end of the projection interval, this proportion is obtained as follows:

$$PRHSV(t+5) = HSV(t+5) \ / \ DHI(t+5), \qquad (21)$$

where:

PRHSV(t+5) is the proportion of disposable household income saved at the end of the interval.[3/]

c. Rates of growth of household consumption and savings

As part of household consumption and savings projection, it is also possible to compute the average annual rates of growth of household consumption -- total and by broad commodity groups. It is also possible to compute average annual rates of growth of household savings.

i. The rate of growth of household consumption

The average annual rate of growth of household consumption for a given projection interval can be computed from household consumption at the beginning and at the end of the interval. If it is assumed that growth in household consumption occurs over discrete intervals, then the percentage growth rate can be obtained using the formula for calculating a geometric growth rate:

$$GGRHC = [\ (\ HC(t+5) \ / \ HC(t) \ )^{1/5} - 1 \ ] \cdot 100, \qquad (22)$$

where:

GGRHC is the average annual geometric growth rate of household consumption for the interval.

Alternatively, if it is assumed that growth is continuous, then the percentage growth rate of household consumption can be calculated using the formula for calculating an exponential growth rate:

$$EGRHC = [\ \ln (\ HC(t+5)/HC(t)\ )\ /\ 5\ ] \cdot 100, \tag{23}$$

where:

EGRHC is the average annual exponential growth rate of household consumption for the interval.

ii. Rates of growth of household consumption by broad commodity groups

If it is assumed that growth of household consumption is discrete, percentage rates of increase of household consumption by broad commodity groups can be obtained as follows:

$$GGRHC(h) = [\ (\ HC(h,t+5)\ /\ HC(h,t)\ )^{1/5} - 1\ ] \cdot 100; \tag{24}$$

$$h = 1,\ldots,H,$$

where:

GGRHC(h) is the average annual geometric growth rate of household consumption in broad commodity group h for the interval.

If the projections were based on the assumption of continuous growth, then the percentage rates of growth of household consumption by broad groups would be calculated using the formula for obtaining the exponential growth rate. The calculations would be as follows:

$$EGRHC(h) = [\ \ln (\ HC(h,t+5)/HC(h,t)\ )\ /\ 5\ ] \cdot 100; \tag{25}$$

$$h = 1,\ldots,H,$$

where:

EGRHC(h) is the average annual exponential growth rate of household consumption in broad commodity group h for the interval.

iii. The rate of growth of household savings

If it is assumed that growth in household savings occurs over discrete intervals, the percentage growth rate can be obtained using the formula for calculating a geometric growth rate:

$$GGRHSV = [(HSV(t+5) / HSV(t))^{1/5} - 1] \cdot 100, \tag{26}$$

where:

GGRHSV is the average annual geometric growth rate of household savings for the interval.

Alternatively, if it is assumed that growth is continuous, then the percentage rate of growth of household savings can be calculated as follows:

$$EGRHSV = [\ln (HSV(t+5)/HSV(t)) / 5] \cdot 100, \tag{27}$$

where:

EGRHSV is the average annual exponential growth rate of household savings for the interval.

(b) Procedure based on the demand system with endogenous savings

The previous section dealt with a demand system in which savings were exogenous. This section describes a demand system in which savings are endogenous. The description of this procedure will first introduce consumption and savings functions, in which average disposable household income and average household size are the explanatory variables.[3/] Then, it will discuss steps to obtain levels of average household consumption by commodity group and the level of average household savings. It will also outline the remaining steps needed to complete the projection. A summary of those steps is presented in box 17.

(i) Consumption functions

Levels of average household consumption by commodity group can be expressed as functions of average household disposable income and average household size. As in the previously discussed demand system, consumption functions may be linear, multiplicative or log-linear.

Linear. Linear specifications of consumption functions for the various commodity groups can be written as follows:

$$AHC(g,t') = a(g) + b(g) \cdot ADHI(t') + c(g) \cdot AHS(t'); \tag{28}$$

$$g = 1,\ldots,G,$$

Box 17

Computational steps to project household consumption and savings at the national level using the demand system with endogenous savings

The steps used to project household consumption and savings at the national level over a five-year projection interval with the demand system with endogenous savings are as follows:

(1) Derive projected levels of per household consumption and per household savings at the end of the interval by evaluating empirically estimated household consumption and savings functions using the projected average (per household) disposable household income and the average household size for that date.

(2) If the consumption and savings functions employed are linear, use the projected levels in further computations as obtained in step 1.

(3) If the functions are non-linear or log-linear, calculate an adjustment factor as a ratio of the average disposable household income to the sum of the levels of average household consumption and average household savings. Then, apply this factor to the levels in question in order to derive adjusted levels of average household consumption and average household savings for the date in question.

(4) Calculate levels of household consumption by commodity group and the level of household savings as products of levels of average household consumption and average household savings obtained in step 1 or step 3 and the number of households for the date.

(5) Calculate various household consumption and savings aggregates, such as total household consumption and the increase in total household consumption.

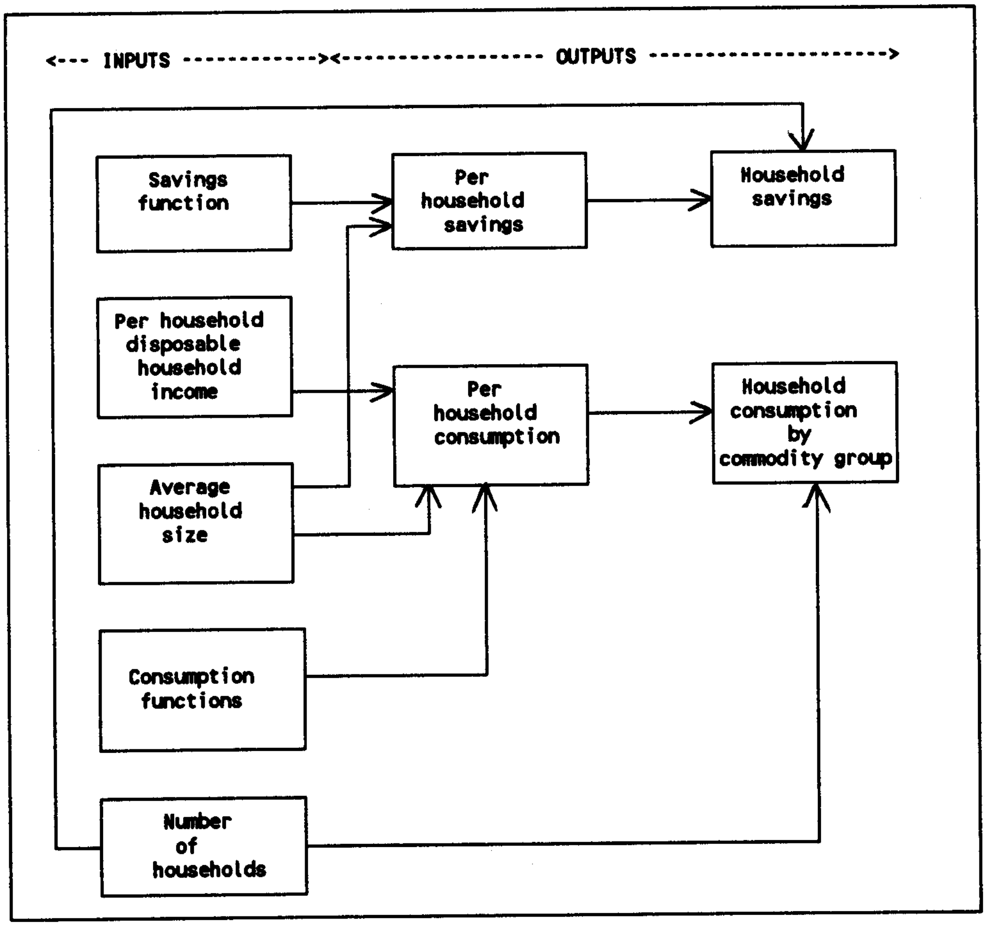
(6) Derive indicators of the spending pattern of households, such as proportions of total disposable household income spent on various goods and services.

(7) Obtain rates of growth of household consumption and savings, such as the rate of growth of total household consumption.

where:

ADHI(t')	is the average disposable household income in year t',
a(g)	is the intercept coefficient for commodity group g,
b(g)	is the partial coefficient of average disposable household income for commodity group g, and
c(g)	is the partial coefficient of the average household size for commodity group g.

Figure XII. Steps to project household consumption and savings at the national level using the demand system with endogenous savings



The partial coefficients of the average disposable household income equation (28), b(g)'s, are marginal propensities to consume out of average disposable household income.

Multiplicative. Consumption functions with average disposable household income and average household size as explanatory variables that have a multiplicative form are as follows:

$$AHC(g,t') = a(g) \cdot ADHI(t')^{b(g)} \cdot AHS(t')^{c(g)}; \qquad (29)$$

$$g = 1,\ldots,G,$$

where:

a(g) is the slope coefficient of the non-linear consumption function for commodity group g,

b(g) is the exponent of the average disposable household income for commodity group g, and

c(g) is the exponent of the average household size for commodity group g.

Log-linear. The multiplicative functions shown in equation (29) can be transformed into log-linear consumption functions as follows:

$$\ln AHC(g,t') = \ln a(g) + b(g) \cdot \ln ADHI(t') + c(g) \cdot \ln AHS(t'); \qquad (30)$$

$$g = 1,\ldots,G.$$

The exponents in the functions shown in equation (29), b(g)'s and c(g)'s, become the partial coefficients of the functions indicated in equation (30). In addition, the partial coefficients of the disposable income variables in those functions have a different meaning from the partial coefficients of this variable in the functions shown in equation (28). They are elasticities of levels of average household consumption with respect to average disposable household income. In other words, they express the percentage changes in levels of average household consumption for the various commodity groups for the given percentage change in average disposable household income.

The multiplicative or log-linear consumption functions of this demand system embody assumptions that differ from those of the linear functions. Thus, in the multiplicative or log-linear functions, marginal propensities to consume vary with the levels of consumption and disposable household income, while the elasticities of consumption with respect to disposable household income remain fixed. These elasticities are equal to the partial coefficients, b(g)'s. In the linear functions, marginal propensities to consume are fixed (they are equal to b(g)'s), while the elasticities of consumption with respect to disposable household income vary with the levels of consumption and income.

(ii) Savings functions

Like consumption functions, savings functions may be linear, multiplicative or log-linear.

Linear. A linear specification of the savings function assumes that the level of average household savings is a linear function of average disposable household income and average household size:

$$AHSV(t') = a + b \cdot ADHI(t') + c \cdot AHS(t'), \tag{31}$$

where:

AHSV(t')	is the level of average household savings in year t',
a	is the intercept coefficient of the savings function,
b	is the partial coefficient of average disposable household income in the savings function, and
c	is the partial coefficient of household size in the savings function.

The partial coefficient of average disposable household income in equation (31), b, is the marginal propensity to save out of average household disposable income.

Multiplicative. A multiplicative counterpart of the linear savings functions shown in equation (31) is the following:

$$AHSV(t') = a \cdot ADHI(t')^{b} \cdot AHS(t')^{c}, \tag{32}$$

where:

a	is the slope coefficient of the savings function in the demand system with endogenous savings,
b	is the exponent of average disposable household income in the savings function in the demand system with endogenous savings, and
c	is the exponent of household size in the savings function in the demand system with endogenous savings.

Log-linear. The multiplicative function shown in equation (32) can be transformed into a log-linear savings function by taking logarithms of its left-hand and right-hand sides:

$$\ln AHSV(t') = \ln a + b \cdot \ln ADHI(t') + c \cdot \ln AHS(t'), \tag{33}$$

The exponents in equation (32), b and c, become the partial coefficients of the function indicated in equation (33). Moreover, the partial coefficient of average disposable household income has a different meaning here from that of the partial coefficient of the same variable in the function shown in equation (31). It stands for the elasticity of the levels of average household savings with respect to average disposable household income. That is, it expresses the percentage change in the level of average household savings for the given percentage change in average disposable household income.

As in the case of the consumption functions, the multiplicative or log-linear savings functions embody assumptions that are different from those of the linear savings function. Thus, in the multiplicative or log-linear functions, the marginal propensity to save varies with the levels of savings and disposable income, while the elasticity of savings with respect to average disposable household income remains fixed. This elasticity is equal to the partial coefficient of average disposable household income, b. In the linear function, the marginal propensity to save is fixed (it is equal to b), while the elasticity of savings with respect to average disposable household income varies with the levels of savings and income.

(iii) Average household consumption and savings

To project levels of average household consumption by commodity groups and average household savings with the demand system with endogenous savings, it is necessary to evaluate consumption and savings functions of this system.

a. Levels of per household consumption by commodity group

Linear. Levels of per household consumption by commodity group can be obtained for the end of the projection interval by evaluating estimates of linear consumption functions as follows:

$$AHC(g,t+5) = a^*(g) + b^*(g) \cdot ADHI(t+5) + c^*(g) \cdot AHS(t+5); \qquad (34)$$

$$g = 1,\ldots,G,$$

where:

$a^*(g)$ is the estimate of the intercept coefficient for commodity group g,

$b^*(g)$ is the estimate of the partial coefficient of average disposable household income for commodity group g, and

$c^*(g)$ is the estimate of the partial coefficient of household size for commodity group g.

Multiplicative. Levels of per household consumption by commodity group can also be obtained for the end of the projection interval using multiplicative consumption functions. In particular, the use of these functions would yield preliminary levels of average household consumption as follows:

$$AHC^*(g,t+5) = a^*(g) \cdot ADHI(t+5)^{b^*(g)} \cdot AHS(t+5)^{c^*(g)}; \quad g = 1,\ldots,G, \tag{35}$$

where:

a*(g)	is the estimate of the slope coefficient for commodity group g,
b*(g)	is the estimate of the exponent of average disposable household income for commodity group g, and
c*(g)	is the estimate of the exponent of household size for commodity group g.

Log-linear. Alternatively, estimates of log-linear consumption functions could be used to project the logarithms of the preliminary levels of average household consumption by commodity group as follows:

$$\ln AHC^*(g,t+5) = [\ln a(g)]^* + b^*(g) \cdot ADHI(t+5) + c^*(g) \cdot AHS(t+5); \quad g = 1,\ldots,G, \tag{36}$$

where:

[lna(g)]*	is the estimate of the logarithm of the intercept coefficient for commodity group g.

Once the logarithms of preliminary levels of average household consumption are obtained as indicated in equation (36), the preliminary levels themselves can be obtained by calculating antilogarithms of the results:

$$AHC^*(g,t+5) = \text{antiln}[\ \ln AHC^*(g,t+5)\ ]; \quad g = 1,\ldots,G. \tag{37}$$

b. Average household savings

Like consumption functions, savings functions can take many forms, including linear, multiplicative and log-linear.

Linear. The level of average household savings can be obtained for the end of the projection interval by evaluating the estimated linear savings function as follows:

$$AHSV(t+5) = a^* + b^* \cdot ADHI(t+5) + c^* \cdot AHS(t+5), \tag{38}$$

where:

a*	is the estimate of the intercept coefficient,

b* — is the estimate of the partial coefficient of average disposable household income variable, and

c* — is the estimate of the partial coefficient of average household size.

Multiplicative. A preliminary level of average household savings can also be obtained for the end of the projection interval using a multiplicative savings function as follows:

$$AHSV^*(t+5) = a^* \cdot ADHI(t+5)^{b^*} \cdot AHS(t+5)^{c^*}, \qquad (39)$$

where:

AHSV*(t+5) — is the preliminary level of average household savings at the end of the interval,

where:

a* — is the estimate of the slope coefficient of the savings function in the demand system with endogenous savings,

b* — is the estimate of the exponent of average disposable household income in the savings function in the demand system with endogenous savings, and

c* — is the estimate of the exponent of average household size in the savings function in the demand system with endogenous savings.

Log-linear. Alternatively, the logarithm of the preliminary level of average household savings for the end of the given projection interval can be obtained using an estimate of a log-linear savings function as follows:

$$\ln AHSV^*(t+5) = [\ln a]^* + b^* \cdot ADHI(t+5) + c^* \cdot AHS(t+5), \qquad (40)$$

where:

[lna]* — is the estimate of the logarithm of the intercept coefficient.

Once the logarithm of the preliminary level of average household savings is obtained as indicated in equation (40), the preliminary level itself can be obtained by calculating the antilogarithm of the result:

$$AHSV^*(t+5) = \text{antiln}[\ \ln AHSV^*(t+5)\ ]; \qquad (41)$$

c. Levels of average household consumption by commodity group average and household savings

Levels of average household consumption and savings obtained as indicated by equations (34) and (38), respectively, can be used directly in further calculations. However, levels of average household consumption and savings obtained as shown in equations (35) and (39) or in equations (36) and (37), plus (40) and (41), must be treated as preliminary owing to the fact that those levels will not, as a rule, add up to the average disposable household income used to project them. To obtain the levels of household consumption and savings themselves, the preliminary levels need to be adjusted. The adjustment may involve a uniform, proportionate increase or decrease in the preliminary levels.

To perform such an adjustment, it is necessary to calculate an appropriate adjustment factor and apply it to each preliminary level of average household consumption and savings. For the end of the projection interval, the adjustment factor can be obtained as follows:

$$AF(t+5) = ADHI(t+5) \;/\; [\; \sum_{g=1}^{G} AHC^{*}(g,t+5) + AHSV^{*}(t+5) \;], \tag{42}$$

where:

AF(t+5) — is the adjustment factor applying to the preliminary levels of average household consumption by commodity group or average household savings at the end of the interval.

After the adjustment factor has been computed, levels of average household consumption and savings at the end of the projection interval can be obtained as follows:

$$AHC(g,t+5) = AHC^{*}(g,t+5) \cdot AF(t+5); \tag{43}$$

$$g = 1,\ldots,G,$$

and

$$AHSV(t+5) = AHSV^{*}(t+5) \cdot AF(t+5); \tag{44}$$

3. Urban-rural level

The previous section dealt with projections at the national level; this section will deal with projections for urban and rural areas. It will first discuss briefly the procedure for projecting household consumption and savings using a demand system with exogenous savings. Then, it will outline the procedure to prepare those projections employing a demand system with endogenous savings.

(a) Procedure based on the demand system with exogenous savings

The following procedure is based on a demand system that is an urban-rural equivalent of the national-level demand system with exogenous savings. It consists of steps to project levels of average household consumption by commodity group and average household savings using, in part, consumption functions of this system. It also includes steps for deriving other results.

(i) Consumption functions

This demand system consists of linear consumption functions, which are urban-rural equivalents of the functions shown in equation (1). Alternatively, it may include multiplicative non-linear functions or log-linear functions, which are counterparts of the functions indicated in equation (2) or equation (3), respectively.

(ii) Levels of average household consumption and savings

The steps used by this procedure to project average household consumption by commodity group and average household savings are urban-rural equivalents of the steps indicated in equations (4) through (11).

(iii) Levels of household consumption and savings

Levels of household consumption and savings for urban and rural areas can be derived from projected levels of average household consumption and savings for those areas by means of calculations which are urban-rural equivalents of the steps shown in equations (12) and (13).

(iv) Other results

The derived indicators discussed in connection with the national projections can also be computed as part of an urban-rural projection. Those indicators are, however, calculated separately for urban and rural areas and for the entire country, using steps analogous to those indicated by equations (14) through (27). In addition, indicators of the distribution of total household consumption and of household savings by residential location -- proportions urban and rural -- can be calculated.

a. Proportions of national household consumption that are urban or rural

The proportion of national household consumption urban at the end of the projection interval can be computed by dividing the level of total household consumption in urban areas (k=1) by the level of total household consumption for the entire country:

$$HCURB(t+5) = HC(1,t+5) \;/\; HC(t+5), \tag{45}$$

where:

k=1,2	are urban and rural locations,
HCURB(t+5)	is the proportion of national household consumption that is urban at the end of the interval, and
HC(k,t+5)	is the level of total household consumption in location k at the end of the interval.

The proportion of national household consumption that is rural can be found as a complement of the proportion urban:

HCRUR(t+5) = 1 - HCURB(t+5), (46)

where:

HCRUR(t+5) is the proportion of national household consumption that is rural at the end of the interval.

b. <u>Proportions of national household savings that are urban or rural</u>

The proportion of household savings urban at the end of the projection interval can be computed by dividing the level of household savings in urban areas (k=1) by the level of household savings for the entire country:

HSVURB(t+5) = HSV(1,t+5) / HSV(t+5), (47)

where:

HSVURB(t+5) is the proportion of national household savings that is urban at the end of the interval, and

HSV(k,t+5) is the level of household savings in location k at the end of the interval.

The proportion of national household savings that is rural can be found as a complement of the relevant proportion urban:

HSVRUR(t+5) = 1 - HSVURB(t+5), (48)

where:

HSVRUR(t+5) is the proportion of national household savings that is rural at the end of the interval.

(b) <u>Procedures based on the demand system with endogenous savings</u>

Projections of consumption and savings can be made using a demand system that is an urban-rural counterpart of the national-level demand system with endogenous savings. The procedure consists of steps to project levels of average household consumption by commodity group and average household savings using consumption and savings functions of this system. It also includes steps to project other results.

(i) <u>Consumption and savings function</u>

This system includes linear consumption and savings functions, which are urban-rural equivalents of the functions shown in equations (28) and (31), respectively. Alternatively, it may include multiplicative consumption and savings functions or log-linear consumption and savings functions, which are counterparts of the functions indicated in equations and (32) or those shown in equations (30) and (33), respectively.

(ii) Levels of average household consumption and savings

The steps employed to obtain levels of average household consumption and savings are urban-rural counterparts of the steps shown in equations (34) through (44).

(iii) Household consumption and savings and other results

To project levels of household consumption by commodity group and to project household savings, as well as other results, this procedure uses steps that are identical to those used to make urban-rural projections with the demand system with exogenous savings.

C. The inputs

This section initially lists the inputs required by the method and then describes how they can be prepared.

1. Types of inputs required

The following inputs are required to project household consumption and savings using a particular demand system:

(a) Projected average disposable household income;
(b) Projected average household size;
(c) Projected number of households;
(d) Estimates of the coefficients of household consumption functions by commodity group that are part of the demand system used.

In addition, if the procedure being used is based on the demand system with exogenous savings, the inputs must also include:

(e) Assumptions on the average savings ratio.

Alternatively, if the procedure is based on the demand system with endogenous savings, the inputs should include:

(f) Estimates of the coefficients of the household savings functions.

Depending on whether one wishes to make a national projection or a projection for urban and rural areas, the inputs will be for the entire country or for urban and rural areas.

2. Preparation of the inputs

To apply the method, projections of average disposable household income are required. These projections can be prepared by the method of income projections based on the social accounting matrix described in chapter IX of this module. Also, projections of the number and average size of households are needed, they can be made using the household projection method that was described in the first module of this volume (chap. III). In addition, estimates of the coefficients of consumption functions for each commodity group need to be prepared. If the projection procedure is based on a demand system with exogenous savings, assumptions on the average savings ratio are also required.

Initially, the preparation of assumptions on future levels of the average savings ratio will be considered. This will be followed by a discussion relating to the estimation of the coefficients of the consumption and savings functions.

(a) Assumptions on the average savings ratio

To prepare assumptions on future levels of the average household savings ratio for the national or urban-rural projection, it would first be necessary to select the level (or levels) of this savings ratio for the base year of the projection. In selecting the level(s), it would be necessary as a rule to use recent information on household income and savings. The data may not be available in the data set used to estimate the consumption functions, since the demand system with exogenous savings would be typically used in cases where the data do not include reliable information on disposable household income and household savings.

For a national projection, the household income and savings data that are needed to select the level of the average household savings ratio may come from the national accounts (see box 18) or a social accounting matrix. The data required to select levels of the savings ratio for the urban-rural projection would normally come from a social accounting matrix, which includes household income and savings disaggregated by urban-rural location. The national accounts would not typically contain income and savings data subdivided by location.

Whichever data source is used, the average household savings ratio for the entire country or a given area (urban or rural) for a recent year or period could be obtained as a ratio of the level of household savings to that of disposable household income for the entire country or the area in question. The savings ratio for that period can then be used as a basis for deciding on the average savings ratio for the base year of the projection. The observed savings ratio may be of a limited value, however, for formulating assumptions on future values of this ratio. Typically, those assumptions could be made by taking into account the likely future changes in disposable household income and average household size, as well as other factors that may have an effect on household savings behaviour.

In deciding on the average household savings ratio for dates five years following the initial year of projection, it would be important to consider changes in the projected level of average disposable household income between the initial year and the year for which an assumption on the level of the savings ratio is to be made. For example, if disposable income is projected to increase over time, the assumptions on the future average household savings ratio must take that increase into account. All other things being equal, the more rapid the projected increase in disposable household income, the more likely it is that the average savings ratio will increase over the projection period.

Box 18

Glossary

Budget survey
A random sample survey of households conducted in order to collect information on expenditures of households on various individual consumption goods and services or groups of those goods and services. Such a survey may also collect information on the size and characterization of households.

Cluster of households
A group of households in a sample survey selected from the same community or geographical area.

Coefficient of determination, R^2
The measure of the goodness of fit of a regression equation, which denotes the proportion of the variance in the dependent variable associated with independent variable(s) included in the regression. The coefficient may lie between 0 and 1; when it is close to 0, it suggests a weak relationship, when it is close to 1, a strong one.

Income and expenditure survey
A random sample survey of households carried out in order to gather data on household income and expenditures. Such a survey may provide income by services in addition to the total income of household, as well as information on household savings and on expenditures on different consumer goods and services. The survey may collect information on household size and characterization.

Income elasticity of savings
The responsiveness of the amount of money saved to changes in the consumer's income, measured by the proportionate change in savings divided by the proportionate change in income.

National accounts
A system of accounts that provide for a systematic and integrated recording of transaction flows in an economy. It brings into a coherent system data ranging in degree of aggregation from consolidated accounts of the country to detailed input-output and flow-of-funds tables. They include production and goods and services accounts along with outlay and capital finance accounts for institutions, such as households and government.

Random disturbance term
The term added to a regression equation which ensures equality between the left-hand and the right-hand side of the equation for each observation. The disturbance or error term may represent random disturbances in an observation or it may reflect errors of measurement.

(continued)

Box 18 (continued)

Statistically significant

An estimate of a particular statistic, such as a partial regression coefficient, is said to be statistically significant if the probability that it could have occurred by chance is less than a specified percentage (often 5 per cent).

t-statistic

In regression analysis, a statistic calculated for each partial coefficient which makes it possible for the analyst to determine whether or not the coefficient is statistically significant.

Whether the increase in average disposable household income may lead to a rise in the average savings ratio will in part depend on whether that increase is associated with an increase in the average household size. Where the projected increase in average disposable household income is greater than that in average household size, disposable household income in per capita terms will increase, which is likely to contribute to the increase in the average household savings ratio. This will be true if the income elasticity of savings is greater than unity, as is often the case.

In developing countries, average household size often declines as per capita incomes rise. The decline may be a consequence of a variety of influences, including fertility reduction and a transition in the family structure from the extended to the nuclear family. In view of this, the decline in household size is typically accompanied by shifts in the composition of the household. Those shifts often amount initially to a reduction in the number of children in the household, which can later be followed by an increase in the proportion of elderly and a rise in the average age of the household head.

Changes in the household composition may alter the household's propensity to save. Thus, empirical studies indicate that the reduction in young-age dependency (proportion of children) in the household may increase the household propensity to save (Mason, 1988). Evidence relating to the impact of the increase in old-age dependency (proportion of elderly) on household savings is less conclusive, but suggests that among certain categories of households the increase in the proportion of household members who are elderly tends to depress savings. Moreover, it has been shown that in certain countries, there is a clear-cut inverse U-shaped relationship between the age of the household head and the household's propensity to save (Mason and others, 1987b), which is consistent with the so-called life-cycle hypothesis of household savings. If shifts in the household composition are considered likely, the assumptions on future trends in the household propensity to save should take into account their likely impact on household savings.

(b) Estimates of the functions of alternative demand systems

Whether or not the demand system selected to make projections involves exogenous savings, estimates of the functions may be prepared using standard methods of regression analysis, such as ordinary least squares (OLS). The estimates of the functions can be for the entire country or for urban and rural areas. The estimation could use time series information or cross section data. In the majority of applications in developing countries, however, only cross-sectional data would be available and, therefore, only this type of data will be considered below.

(i) Cross-sectional data

Cross-sectional data that could be used to estimate the consumption functions of the demand system with exogenous savings would typically come from a household budget survey that includes information on expenditures for various goods and services, quantities of various products consumed from own production and estimates of total household expenditure. The survey data should also include, at the minimum, information on household size. This type of data would make it possible to derive observations on the value of household consumption for the various groups of commodities, on the total household expenditure and on the average household size, which would suffice to estimate consumption functions of this demand system.

To estimate consumption and savings functions of the demand system with endogenous savings, the requisite data should come from a household income and expenditure survey, which, in addition to information collected in a typical household budget survey, would include data on household savings and income. Information collected in such a survey would provide observations on the value of household consumption of the various commodity groups and household savings, as well as on disposable household income and household size, which would be required to estimate functions of this demand system. Box 19 discusses in greater detail the data needed in estimating the two demand systems and outlines their preparation for analysis.

If the savings information collected in the household income and expenditures survey is inadequate or unreliable, the income data may also be untrustworthy. In such situations it would not be warranted to estimate the demand system with endogenous savings. In those instances it would be better to use the income and expenditure survey data to estimate the system with exogenous savings, i.e., consumption functions with total household expenditure and average household size as explanatory variables.

(ii) Procedures to estimate alternative demand systems

This section will first describe procedures to estimate coefficients of alternative demand systems at the national level and then describe procedures for estimating demand systems at the urban-rural level. An application of the procedures to estimate demand systems will be presented in a later section. The application will use cross-sectional data for clusters of households which were derived from a household sample survey. The procedure can also be applied to cross-sectional data for individual households collected in a survey.

Whichever demand system is to be estimated and irrespective of whether it would be estimated at the national or the urban-rural level, it would not be possible to determine a priori which specification might be more suitable. The user of the method would therefore normally need to estimate functions of different specifications, linear and non-linear, compare the results and select for use those specifications that appear most robust in terms of goodness of fit, statistical significance of coefficients and so on.

The demand systems that can be used with the method to make urban-rural projections of household consumption and savings are urban-rural counterparts of the national-level demand systems. In view of this, procedures to estimate the former systems are urban-rural equivalents of the procedures for estimating the national-level demand systems.

a. Demand system with exogenous savings

Procedures to estimate consumption functions of the demand system with exogenous savings will be described in this section. They will involve linear, multiplicative and log-linear specifications.

Box 19

Requisite survey data and their preparation
for analysis

To estimate consumption functions of the per-household demand system with exogenous savings from a budget survey, the survey data must make it possible for the user to derive observations on the value of household consumption for selected commodity groups along with those on total household expenditure and household size. The observations can be for the individual households included in the sample. Alternatively, they can be averages for well-defined clusters of households, examples of which are groups of households sampled from individual urban blocks or rural villages.

To estimate consumption and savings functions of the per-household demand system with endogenous savings from an income and expenditure survey, the information should enable the analyst to obtain observations on the value of household consumption for chosen commodity groups and the value of household savings. It should also make it possible for one to derive observations on disposable household income and household size. The observations can be values of those variables for individual households or averages for clusters of households.

Where the observations are not readily available, the user of the method will need to prepare them. Whether they are to be derived using a budget survey or an income and expenditure survey, their preparation may involve estimation of the value of own consumption, which is the consumption of goods and services produced by the household for own production.

Linear. To estimate the coefficients of linear consumption functions it is necessary to rewrite the functions shown in equation (1) and to add a random disturbance term to each to obtain the following:

$$AHC(g,j) = a(g) + b(g) \cdot AHE(j) + c(g) \cdot AHS(j) + u(g,j); \qquad (49)$$

$$g = 1,\ldots,G,$$

where:

j	is the cluster of households,
AHC(g,j)	is the average household consumption of goods and services in commodity group g in cluster j,
AHE(j)	is the average household expenditure in cluster j,
AHS(j)	is the average household size in cluster j, and
u(g,j)	is the random disturbance term for commodity group g in cluster j.

In view of the fact that the illustrative estimation of the various functions will be based on observations for the clusters of households, the household cluster is used here in place of the calendar year.

The functions shown in equation (49) can be estimated using various regression techniques, such as ordinary least squares, using cross-sectional information on average household consumption by commodity group, average household expenditure and average household size.

Multiplicative. If estimates of the coefficients of multiplicative consumption functions are wanted, the following approach can be used. First, it would be necessary to take the logarithms of the left-hand and right-hand sides of the functions shown in equation (2) and add a disturbance term to each in order to obtain:

$$\ln AHC(g,j) = \ln a(g) + b(g) \cdot \ln AHE(j) + c(g) \cdot \ln AHS(j) + u(g,j); \qquad (50)$$

$$g = 1,\ldots,G.$$

The resultant log-linear functions could then be estimated using a regression technique such as OLS.

The result would be estimates of the logarithms of the intercept coefficients of the multiplicative consumption functions, [lna(g)]*'s, and estimates of the partial coefficients, b*(g)'s and c*(g)'s. The estimates of the partial coefficients can be used as obtained by OLS, while those of the logarithms of the intercept coefficients would need to be transformed into estimates of the intercept coefficients of the original equations. This can be done by taking antilogarithms of the estimates of the logarithms of intercept coefficients:

$$a^*(g) = \text{antiln } [\ln a(g)]^*; \qquad g = 1,\ldots,G. \tag{51}$$

Log-linear. To estimate the log-linear consumption functions, it would be initially necessary to rewrite the multiplicative functions indicated in equation (2), shown in equation (3) and to add random disturbance terms to them in order to obtain the functions indicated in equation (50). Those functions could be estimated by a regression technique such as OLS. The estimates of the logarithms of the intercept coefficients and of partial coefficients can be used directly from this estimation.

b. Demand system with endogenous savings

In the demand system with endogenous savings it is necessary to estimate consumption functions by commodity group and to estimate a savings function. First, procedures to estimate consumption functions will be described. Then, procedures to estimate the savings function will be considered.

i. Consumption functions

In this demand system, consumption functions may, *inter alia*, be linear, multiplicative or log-linear.

Linear. To derive estimates of linear consumption functions, it would be necessary to rewrite the functions shown in equation (28) and to add random disturbance terms to obtain:

$$AHC(g,j) = a(g) + b(g) \cdot ADHI(j) + c(g) \cdot AHS(j) + u(g,j); \qquad g = 1,\ldots,G, \tag{52}$$

where:

ADHI(j) is the average disposable household income in household cluster j.

The functions shown in equation (52) could be estimated using a regression technique, such as OLS, using cross-sectional information on average household consumption by commodity group, average disposable household income and average household size.

Multiplicative. To estimate coefficients of consumption functions having a multiplicative form, it would be necessary to rewrite the functions of equation , to take logarithms of the left-hand and right-hand sides and to add a disturbance term to each:

$$\ln AHC(g,j) = \ln a(g) + b(g) \cdot \ln ADHI(j) + c(g) \cdot \ln AHS(j) + u(g,j); \qquad g = 1,\ldots,G. \tag{53}$$

The resultant log-linear functions could then be estimated using a regression technique such as OLS.

The result would be estimates of the logarithms of the intercept coefficients of the non-linear consumption functions, [lna(g)]*'s, and estimates of the partial coefficients, b*(g)'s and c*(g)'s. While estimates of the partial coefficients can be used as obtained by OLS, those of the logarithms of the intercept coefficients must be transformed into estimates of the intercept coefficients. This can be done by taking antilogarithms of the estimates of the logarithms of intercept coefficients:

$$a^*(g) = \text{antiln}\ [\ln a(g)]^*;y \qquad g = 1,\ldots,G. \tag{54}$$

Log-linear. To estimate the log-linear consumption functions, it would first be necessary to suitably rewrite the multiplicative form functions shown in equation and to add random disturbance terms in order to obtain the functions indicated in equation (54). Those functions could then be estimated by a regression technique such as OLS. Estimates of the logarithms of the intercept coefficients and of partial coefficients can be used directly from this estimation.

ii. Savings function

Procedures to estimate the savings function of this demand system are analogous to those for estimating consumption functions. As with consumption functions, savings functions can be linear, multiplicative or log-linear.

Linear. To estimate the coefficients of a linear savings function it is necessary to rewrite the function shown in equation (31) and to add a random disturbance term:

$$AHSV(j) = a + b \cdot ADHI(j) + c \cdot AHS(j) + u(j), \tag{55}$$

where:

AHSV(j) is the average household savings in household cluster j, and

u(j) is the random disturbance term for household cluster j.

The function shown in equation (55) can be estimated using cross-sectionalnformation on average household savings, average disposable household income and average household size.

Multiplicative. To estimate coefficients of a multiplicative savings function, it is necessary to transform the function shown in equation (32) into a log-linear function:

$$\ln AHSV(j) = \ln a + b \cdot \ln ADHI(j) + c \cdot \ln AHS(j) + u(j); \tag{56}$$

The resultant log-linear functions could then be estimated using a regression technique such as OLS.

The result would be an estimate of the logarithm of the intercept coefficient of the non-linear savings function, [lna]*, and estimates of the partial coefficients, b* and c*. While estimates of the partial coefficients can be used as obtained by OLS, that of the logarithm of the intercept coefficient must be transformed into an estimate of the intercept coefficient. This can be done by taking the antilogarithm of the estimate of the logarithm of the intercept coefficient:

$$a^* = \text{antiln}\ [\ln a]^*; \tag{57}$$

Log-linear. To estimate a log-linear savings function, it is first necessary to suitably rewrite the function shown in equation (32) and to add a random disturbance term in order to obtain the function indicated in equation (56). That function could then be estimated.

(iii) Illustrative estimation

This section will use two sets of cross-sectional data on clusters of urban and rural households to illustrate procedures for estimating alternative demand systems, initially at the national level and then at the urban-rural level. The data sets have been obtained from information required to estimate those demand systems that came from a household income and expenditure survey. Those data sets consist of observations on the relevant variables for a total of 363 clusters, which included 227 urban clusters and 136 rural clusters. Observations for the first 10 clusters in the two data sets are respectively shown in tables 34 and 35. Observations in the first data set are those on the means of per-household consumption levels by commodity group, total per-household expenditure and household size. Observations in the second set include the means of per-household consumption levels by commodity group, per-household savings, per-household disposable household income and household size.

a. National level

Initially, the estimation of the national-level demand systems with exogenous savings will be illustrated. Then, the estimation of the national-level demand system with endogenous savings will be discussed.

i. Demand system with exogenous savings

Linear. To project household consumption and savings using estimates of a national-level demand system with exogenous savings which consists of linear consumption functions, it is necessary to estimate the functions indicated in equation (49). If OLS the regression technique is applied to the data illustrated in table 34 to estimate those functions, the results will be those shown in table 36.

For the most part, those results will be satisfactory as a basis for making projections of household consumption. All of the estimated partial coefficients

Table 34. Observations on average household expenditures by commodity group, average total household expenditure and average household size: averages for 10 clusters of households

Household cluster	Commodity group									Total expenditure	Average household size	Location
	Food	Clothing	Housing	Fuel and light	Durables	Trans-portation	Personal care	Rec-reation	Services			
1	56.46	3.65	5.83	1.88	3.67	0.46	2.13	3.13	2.42	79.63	3.75	Rural
2	77.66	10.38	0.35	5.22	0.98	1.06	1.63	9.71	4.62	111.59	7.50	Urban
3	38.63	2.96	0.27	6.57	6.76	1.36	4.35	13.25	2.67	76.80	1.50	Rural
4	87.88	23.75	7.45	11.08	27.23	2.45	4.90	12.63	16.14	193.52	5.67	Urban
5	143.26	12.92	0.00	27.01	12.38	6.33	6.08	10.58	8.52	227.09	7.75	Rural
6	119.46	19.43	0.00	29.03	7.83	5.67	3.27	10.33	2.70	197.72	9.00	Urban
7	66.65	6.00	0.00	24.12	8.60	1.00	3.80	9.67	0.74	120.58	5.00	Rural
8	76.83	10.43	15.35	18.43	5.98	1.17	3.21	12.01	2.97	146.38	6.50	Urban
9	108.74	10.51	2.e-	16.85	3.63	0.47	2.65	6.97	5.37	155.20	5.40	Rural
10	168.44	8.80	2.96	14.64	6.38	8.10	3.00	5.99	3.81	222.12	13.00	Urban

Table 35. Observations on average household expenditures by commodity group, average household savings, average household disposable income and average household size: average for 10 clusters of households

Household cluster	Commodity group									Savings	Disposable income	Average household size	Location
	Food	Clothing	Housing	Fuel and Light	Durables	Trans-portation	Personal care	Rec-reation	Services				
1	56.46	3.65	5.83	1.88	3.67	0.46	2.13	3.13	2.42	122.91	54.01	3.75	Rural
2	77.66	10.38	0.35	5.22	0.98	1.06	1.63	9.71	4.62	48.75	21.38	7.50	Urban
3	38.63	2.96	0.27	6.57	6.76	1.36	4.35	13.25	2.67	4.27	54.05	1.50	Rural
4	87.88	23.75	7.45	11.08	27.23	2.45	4.90	12.63	16.14	33.04	39.98	5.67	Urban
5	143.26	12.92	0.00	27.01	12.38	6.33	6.08	10.58	8.52	33.77	33.66	7.75	Rural
6	119.46	19.43	0.00	29.03	7.83	5.67	3.27	10.33	2.70	49.82	27.50	9.00	Urban
7	66.65	6.00	0.00	24.12	8.60	1.00	3.80	9.67	0.74	19.54	28.02	5.00	Rural
8	76.83	10.43	15.35	18.43	5.98	1.17	3.21	12.01	2.97	17.54	25.22	6.50	Urban
9	108.74	10.51	0.02	16.85	3.63	0.47	2.65	6.97	5.37	2.39	29.18	5.40	Rural
10	168.44	8.80	2.96	14.64	6.38	8.10	3.00	5.99	3.81	99.52	24.74	13.00	Urban

Table 36. Estimates of the coefficients of linear consumption functions of the demand system with exogenous savings for the entire country a/

Commodity group	Coefficients			R-square
	Intercept	Total Expenditure b/	Household size b/	
(1)	(2)	(3)	(4)	(5)
Food	8.25409	0.45736 (34.53)	1.79908 (6.10)	0.818
Clothing	-5.10517	0.09787 (18.04)	0.36523 (3.02)	0.548
Housing	-1.53936	0.07527 (8.40)	-0.80691 (4.04)	0.166
Fuel and light	7.10181	0.03182 (6.08)	0.33412 (2.86)	0.158
Durables	-7.46518	0.15902 (19.12)	-1.14775 (6.19)	0.504
Transportation	-0.24468	0.01670 (8.46)	-0.00764 (0.17)	0.186
Personal care	-0.24493	0.02999 (14.79)	-0.00118 (0.03)	0.414
Recreation	-0.31213	0.07188 (17.33)	-0.18899 (2.04)	0.473
Other services	-0.66485	0.06008 (12.46)	-0.34597 (3.22)	0.305

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

of the total expenditure variable (column 3) are positive, as expected, and as indicated by t-statistics (see box 18), all are statistically significant at the 0.01 level. One would expect the coefficients to be positive in view of the fact that, all other things being equal, the increase in average household expenditure will lead to higher average household consumption expenditures for the different groups of commodities.

Most of the estimates of the partial coefficients of average household size (column 4) have plausible signs and are statistically significant at the 0.01 level. The signs of the coefficients of this variable are mostly positive for the groups of commodities that are considered necessities such as food and clothing. They are negative for the groups of commodities that are often classified as luxuries, such as durables or personal care items. This is what one would expect in view of the fact that, all other things being equal, an increase in household size would reduce the per capita total expenditure of the household, which in turn would contribute to an increase in household consumption of necessities and a reduction in the consumption of luxuries.

The coefficients of determination, R^2s (column 5), vary between a high of 0.818 (for food) and a low of 0.158 (for fuel and light). Overall, their values are relatively high. This is mainly due to the fact that the observations used to estimate the functions are meant for small clusters of households, most of which consist of four to eight households. If observations for individual households were used, the R^2s would have been much lower. However, in view of the relatively low values of this coefficient for commodity groups such as housing, fuel and light, and transportation, the forecast errors in the case of those functions could be fairly high.

Multiplicative. Further, if estimates of multiplicative consumption functions with average household expenditure and average household size as explanatory variables were required, it would be necessary to estimate the log-linear functions indicated in equation (50). Estimates of the coefficients of those functions based on the data shown in table 34 are presented in table 37.

Some of these results are worse while others are better than those shown in table 36. The estimated partial coefficients of the total expenditure variable are again all positive and significant at the 0.01 level. Estimates of the coefficients of the average household size variable are less satisfactory in so far as the coefficient estimate for transportation is now positive, although not significant. In addition, the coefficients of the variables for clothing, personal care, recreation and other services are not statistically significant. However, the coefficients of determination, R^2s, are uniformly higher than in table 36, except for durables and recreation. Thus, the multiplicative specification of the consumption functions provides an overall better fit than the linear specification.

The estimates of partial coefficients, such as those presented in table 39, can be used as derived by OLS while the estimates of the logarithms of the intercept coefficients need to be transformed into estimates of the intercept coefficients themselves. As illustrated in table 38, the latter estimates (column 3) can be obtained by taking antilogarithms of the estimates of the logarithms of the intercept coefficients (column 2). Thus, the estimate of the intercept coefficient for food, 1.066, can be calculated as:

Table 37. Estimates of the coefficients of log-linear consumption functions of the demand system with exogenous savings for the entire country a/

Commodity group	Coefficients			R-square
	Intercept	Total Expenditure b/	Household size b/	
(1)	(2)	(3)	(4)	(5)
Food	0.06394	0.85094 (42.14)	0.08103 (4.56)	0.867
Clothing	-4.44341	1.33373 (20.80)	0.05102 (0.90)	0.600
Housing	-6.98415	1.74544 (9.70)	-0.65227 (4.12)	0.207
Fuel and light	-0.00680	0.46408 (8.83)	0.12863 (2.78)	0.262
Durables	-8.15466	2.08854 (18.26)	-0.30735 (3.05)	0.498
Transportation	-5.21825	1.07696 (8.82)	0.13423 (1.25)	0.228
Personal care	-3.81541	1.06207 (18.34)	-0.06628 (1.30)	0.516
Recreation	-4.14287	1.22101 (14.92)	-0.03213 (0.45)	0.433
Other services	-5.90110	1.50331 (17.75)	-0.06563 (0.88)	0.503

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 38. Computing estimates of intercept coefficients of non-linear consumption functions of the demand system with exogenous savings for the entire country

Commodity group	Intercepts of log-linear functions a/	Intercepts of non-linear functions b/
(1)	(2)	(3)
Food	0.06394	1.066
Clothing	-4.44341	0.012
Housing	-6.98415	0.001
Fuel and light	-0.00680	0.993
Durables	-8.15466	0.000
Transportation	-5.21825	0.005
Personal care	-3.81541	0.022
Recreation	-4.14287	0.016
Other services	-5.90110	0.003

a/ From table 37, col. 2.
b/ Antiln (col. 2).

Table 39. Estimates of the coefficients of linear consumption and savings functions of the demand system with endogenous savings for the entire country a/

Commodity group/ savings	Coefficients			R-square
	Intercept	Disposable income b/	Household size b/	
(1)	(2)	(3)	(4)	(5)
Food	21.37484	0.33896 (24.67)	1.64642 (4.31)	0.707
Clothing	-2.53092	0.07427 (15.73)	0.31218 (2.38)	0.490
Housing	1.21632	0.05134 (6.79)	-0.77994 (3.71)	0.115
Fuel and light	8.56691	0.01947 (4.44)	0.37173 (3.05)	0.120
Durables	-2.33004	0.11358 (14.94)	-1.15076 (5.44)	0.383
Transportation	-0.14322	0.01519 (9.62)	-0.04619 (1.05)	0.223
Personal care	1.05454	0.02059 (11.41)	-0.00792 (0.16)	0.307
Recreation	2.24612	0.04958 (13.09)	-0.16966 (1.61)	0.345
Other services	0.17481	0.05112 (13.17)	-0.44325 (4.11)	0.328
Savings	-29.62929	0.26589 (13.86)	0.25156 (0.47)	0.400

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

$$1.066 = \text{antiln}\ (0.06394), \tag{51}$$

where 0.06394 is the estimate of the logarithm of the intercept coefficient of the non-linear function for food.

Log-linear. Estimates of the log-linear consumption functions with the average household expenditure variable and average household size can be obtained directly by estimating the functions shown in equation (50). Estimates of such functions based on the cross-sectional data presented in table 34 are those shown in table 37 and discussed above.

ii. Demand system with endogenous savings

Linear. To prepare household consumption and savings projections using estimates of a national-level demand system with endogenous savings consisting of linear consumption and savings functions, it is necessary to estimate the consumption functions indicated in equation (52), along with the savings function shown in equation (55). If the OLS regression technique is applied to the data illustrated in table 35, the results will be those shown in table 39.

The results for the consumption functions with endogenous savings will be less satisfactory as the basis for making projections of household consumption than those estimated from linear functions in the demand system using exogenous savings (see table 36). In the consumption functions shown in table 39, all of the estimated partial coefficients of average household income (column 3) are positive, as expected, and all are statistically significant at the 0.01 level. Moreover, estimates of the partial coefficients of average household size (column 4) have largely plausible signs and are statistically significant at the 0.01 level, except for the coefficients of the functions for transportation, personal care and recreation.

However, the coefficients of determination (column 5), which vary between a high of 0.708 (for food) and a low of 0.116 (for housing), are generally lower than those obtained by estimating linear consumption functions of the demand system with exogenous savings (see table 36). In as many as seven functions, the R^2s are lower than those obtained for the linear consumption functions of the former demand system. This may be in part due to the fact that it is more difficult to accurately measure the disposable income than the total expenditure of a household.

The results for the saving function indicate that the coefficient of average disposable income is both positive, as expected, and highly significant. The coefficient of average household size is also positive, contrary to what has often been theorized, but it is not statistically significant. The coefficient of determination, 0.401, is higher than most of those obtained for the consumption functions.

Multiplicative. If estimates of multiplicative consumption and savings functions are sought, it is necessary to estimate the log-linear consumption functions indicated in equation (53) and the log-linear savings function shown in equation (56). The OLS estimates of the coefficients of those functions based on the data shown in table 35 are those presented in table 40.

Some of the results for the log-linear specification as shown in table 40 are worse while others are better than those for the linear specification as shown in table 39. The estimated partial coefficients of the average disposable household income are all positive and significant at the 0.01 level as in the latter table. The estimates of the coefficients of average household size are less satisfactory in that those for transportation and recreation are now positive, but are not significant. However, the per cent of the variance in household consumption for the various commodity groups that is explained, R^2, is uniformly higher in the log-linear specification than in the linear specification. The per cent of the variance in household savings that is explained is, however, lower. Thus, for this data set, the multiplicative specification of the consumption functions provides a better fit than the linear specification. However, for the savings functions, the multiplicative specification provides a poorer fit.

The estimates of the partial coefficients, such as those presented in table 40, can be used as derived by OLS, while the estimates of the logarithms of the intercepts need to transformed into estimates of the intercept coefficients themselves. As illustrated in table 41, the latter estimates (column 3) can be obtained by taking antilogarithms of the estimates of the logarithms of the intercept coefficients (column 2). Thus, the estimate of the intercept coefficient for food, 1.571, can be calculated as:

$$1.571 = \text{antiln}(0.45194), \tag{54}$$

where 0.45194 is the estimate of the logarithm of the slope coefficient of the multiplicative function for food.

Log-linear. Estimates of the log-linear consumption and savings functions with average disposable income and average household size can be obtained directly by estimating the functions shown in equations (53) and (56). Estimates of such functions based on the cross-sectional data presented in table 35 are those shown in table 40 and discussed above.

b. Urban-rural level

The previous section illustrated the estimation of demand systems at the national level. In this section the estimation of demand systems with exogenous and endogenous savings for urban and rural areas will be illustrated respectively using the data sets that are partially presented in tables 34 and 35.

i. Demand system with exogenous savings

It is possible to estimate an urban-rural demand system with exogenous savings using linear, multiplicative and log-linear specifications.

Linear. To prepare projections of household consumption and savings using linear consumption functions, one must estimate functions that are urban-rural equivalents of those indicated in equation (49). If the OLS regression method is employed along with the data for urban household clusters, which were partially illustrated in table 34 in order to estimate consumption functions for the urban

Table 40. Estimates of the coefficients of log-linear consumption and savings functions of the demand system with endogenous savings for the entire country a/

Commodity group/ savings	Coefficients			R-square
	Intercept	Logarithm of disposable income b/	Logarithm of household size b/	
(1)	(2)	(3)	(4)	(5)
Food	0.45194	0.76064 (30.64)	0.06578 (2.82)	0.782
Clothing	-3.94705	1.21711 (18.77)	0.01651 (0.27)	0.555
Housing	-5.49886	1.40662 (7.86)	-0.61800 (3.68)	0.146
Fuel and light	0.35711	0.38393 (7.42)	0.13351 (2.75)	0.221
Durables	-7.54419	1.94309 (17.26)	-0.37727 (3.57)	0.471
Transportation	-5.16610	1.06047 (9.11)	0.07320 (0.67)	0.237
Personal care	-3.16912	0.91327 (15.12)	-0.06990 (1.23)	0.427
Recreation	-3.40662	1.05145 (12.67)	0.02733 (0.35)	0.365
Other services	-5.51664	1.41086 (17.07)	-0.12118 (1.56)	0.485
Savings	-7.17562	1.76600 (10.97)	0.17551 (1.16)	0.318

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 41. Computing estimates of intercept coefficients of multiplicative consumption and savings functions of the demand system with endogenous savings for the entire country

Commodity group/ savings	Intercepts of log-linear functions a/	Intercepts of multiplicative functions b/
(1)	(2)	(3)
Food	0.45194	1.571
Clothing	-3.94705	0.019
Housing	-5.49886	0.004
Fuel and light	0.35711	1.429
Durables	-7.54419	0.001
Transportation	-5.1661	0.006
Personal care	-3.16912	0.042
Recreation	-3.40662	0.033
Other services	-5.51664	0.004
Savings	-7.17562	0.001

a/ From table 40, col. 2.
b/ Antiln (col. 2).

areas, the results will be those shown in table 42. The use of the same method with the data for rural household clusters, which were also partially shown in table 34, yields the results presented in table 43.

Those results would be largely satisfactory as a basis for projecting household consumption for urban and rural areas. The estimated partial coefficients of average household expenditure (column 3) are positive and statistically significant at the 0.01 level in both tables. Most of the estimates of the partial coefficients of average household size (column 4) have plausible signs. However, two of them for the urban areas (those for transportation and personal care) and several for the rural areas (those for durables and personal care through other services) are not statistically significant at the 0.10 level. The R^2s (column 5) vary roughly within the same range as in the case of the national-level linear consumption functions with average household expenditure and average household size as explanatory variables. Moreover, the R^2s obtained for the rural areas are higher than those derived for the urban areas in six out of nine commodity groups, indicating that for this data set the goodness of fit would on average be better for rural than for urban areas.

Multiplicative. To obtain estimates of urban-rural multiplicative consumption functions with average household expenditure and average household size as explanatory variables, it would be necessary to estimate the urban-rural equivalents of the log-linear functions indicated in equation (50). The estimates of the coefficients of those functions for urban and rural areas based on the cross-sectional data shown in table 34 are those presented respectively for the two locational areas in tables 44 and 45.

Some of those results are poorer while others are better than those obtained in the case of urban and rural linear consumption functions of this demand system (see tables 44 and 45). As usual, the estimated partial coefficients of the average household expenditure are all positive and highly significant. However, the estimates of the coefficients of average household size are less satisfactory in so far as their signs do not indicate any plausible pattern. This may be largely due to the fact that many of those coefficients are not statistically significant. On the other hand, R^2s obtained with the non-linear specification are, in some two thirds of the cases higher than those obtained by employing the linear specification. Again, judging on the basis of the R^2s, the multiplicative specification of the consumption functions appears to fit this data set better than the linear specification.

The estimates of partial coefficients, such as those presented in tables 44 and 45, can be used as derived by OLS, while the estimates of the logarithms of the intercepts must be transformed into estimates of the intercept coefficients themselves. As illustrated in table 46, the latter estimates (column 3) can be obtained by taking antilogarithms of the estimates of the logarithms of the intercept coefficients (column 2). Thus, the estimate of the slope coefficient for food in the urban areas, 0.861, can be calculated as:

$$0.861 = \text{antiln}\ (-0.14943),$$

where -0.14943 is the estimate of the logarithm of the intercept coefficient of the log-linear function for food in the urban areas.

Table 42. Estimates of the coefficients of linear consumption functions of the demand system with exogenous savings for urban areas a/

Commodity group	Coefficients			R-square
	Intercept	Total Expenditure b/	Household size b/	
(1)	(2)	(3)	(4)	(5)
Food	3.60568	0.46441 (26.87)	2.03457 (5.47)	0.803
Clothing	-4.30001	0.09364 (12.64)	0.41580 (2.61)	0.474
Housing	0.88853	0.05949 (6.91)	-0.83710 (4.52)	0.196
Fuel and light	8.58413	0.02649 (3.95)	0.32505 (2.25)	0.111
Durables	-9.09294	0.17943 (14.75)	-1.39836 (5.34)	0.494
Transportation	0.20915	0.01306 (5.47)	0.03362 (0.66)	0.136
Personal care	-0.53271	0.03069 (14.71)	-0.00298 (0.06)	0.512
Recreation	0.37513	0.07373 (13.30)	-0.19353 (1.62)	0.448
Other services	0.26307	0.05906 (8.37)	-0.37706 (2.48)	0.238

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 43. Estimates of the coefficients of linear consumption functions of the demand system with exogenous savings for rural areas a/

Commodity group	Coefficients			R-square
	Intercept	Total Expenditure b/	Household size b/	
(1)	(2)	(3)	(4)	(5)
Food	11.53589	0.48157 (18.99)	1.14211 (2.26)	0.815
Clothing	-5.50762	0.10189 (10.67)	0.26703 (1.41)	0.586
Housing	-6.50785	0.14020 (6.14)	-1.24296 (2.74)	0.223
Fuel and light	5.83054	0.03701 (3.51)	0.33362 (1.59)	0.183
Durables	-4.28076	0.08414 (9.42)	-0.16989 (0.96)	0.460
Transportation	-0.76536	0.02652 (6.26)	-0.14482 (1.72)	0.245
Personal care	-0.08378	0.03760 (7.48)	-0.06971 (0.70)	0.352
Recreation	0.72694	0.04131 (6.34)	0.07988 (0.62)	0.324
Other services	-0.94801	0.04975 (7.62)	-0.19525 (1.50)	0.338

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 44. Estimates of the coefficients of log-linear consumption functions of the demand system with exogenous savings for urban areas a/

Commodity group	Coefficients			R-square
	Intercept	Logarithm of total expenditure b/	Logarithm of household size b/	
(1)	(2)	(3)	(4)	(5)
Food	-0.14943	0.87610 (32.89)	0.11162 (5.13)	0.852
Clothing	-3.11006	1.10698 (13.62)	-0.00735 (0.11)	0.472
Housing	-5.54916	1.63949 (6.80)	-1.05503 (5.35)	0.210
Fuel and light	0.68863	0.35427 (5.74)	-0.09229 (1.83)	0.167
Durables	-7.56784	2.01049 (13.41)	-0.33408 (2.72)	0.446
Transportation	-4.23960	0.90073 (5.16)	0.13862 (0.97)	0.126
Personal care	-4.52506	1.18066 (16.59)	-0.04860 (0.84)	0.563
Recreation	-3.31735	1.10514 (10.99)	-0.01840 (0.22)	0.364
Other services	-5.19181	1.43307 (13.20)	-0.19241 (2.17)	0.440

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 45. Estimates of the coefficients of log-linear consumption functions of the demand system with exogenous savings for rural areas a/

Commodity group	Coefficients			R-square
	Intercept	Logarithm of total expenditure b/	Logarithm of household size b/	
(1)	(2)	(3)	(4)	(5)
Food	-0.06682	0.90237 (24.70)	-0.03342 (1.12)	0.873
Clothing	-5.00976	1.42176 (11.66)	0.07792 (0.78)	0.611
Housing	-6.26481	1.37043 (4.21)	-0.12560 (0.47)	0.144
Fuel and light	-0.18232	0.47817 (4.41)	0.16569 (1.87)	0.255
Durables	-7.09591	1.78732 (8.49)	-0.18638 (1.08)	0.403
Transportation	-5.47408	1.11337 (5.34)	0.12579 (0.74)	0.263
Personal care	-3.78188	1.08231 (9.43)	-0.09506 (1.02)	0.459
Recreation	-3.35895	0.97455 (6.25)	0.16232 (1.28)	0.346
Other services	-5.12315	1.23485 (7.85)	0.14692 (1.14)	0.438

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 46. Computing estimates of slope coefficients of multiplicative consumption functions of the demand system with exogenous savings for urban and rural areas

Commodity group	Intercepts of log-linear functions a/	Slopes of corresponding multiplicative functions b/
(1)	(2)	(3)
	Urban	
Food	-0.14943	0.861
Clothing	-3.11006	0.045
Housing	-5.54916	0.004
Fuel and light	0.68863	1.991
Durables	-7.56784	0.001
Transportation	-4.23960	0.014
Personal care	-4.52506	0.011
Recreation	-3.31735	0.036
Other services	-5.19181	0.006
	Rural	
Food	-0.06682	0.935
Clothing	-5.00976	0.007
Housing	-6.26481	0.002
Fuel and light	-0.18232	0.833
Durables	-7.09591	0.001
Transportation	-5.47408	0.004
Personal care	-3.78188	0.023
Recreation	-3.35895	0.035
Other services	-5.12315	0.006

a/ From tables 44 and 45, col. 2.
b/ Antiln (col. 2).

Estimates of log-linear consumption functions for urban and rural areas which include average household expenditure and average household size can be obtained directly by estimating urban-rural equivalents of the functions shown in equation (50). Estimates of such functions based on the cross-series data illustrated in table 34 are those shown in tables 44 and 45 and discussed above.

ii. Demand system with endogenous savings

It is possible to estimate an urban-rural demand system with endogenous savings using linear, multiplicative and log-linear specifications.

Linear. Where urban-rural projections of household consumption and savings are to be prepared using linear consumption and savings functions, it would be necessary to estimate urban-rural equivalents of the consumption functions indicated in equation (52), along with an urban-rural counterpart of the savings function shown in equation (55). If those urban-rural functions are estimated with the OLS regression method using the means of the relevant variables for urban and rural household clusters as shown in table 35, the results will be those contained in tables 47 and 48.

The results for the consumption functions presented in those tables may be less satisfactory as the basis for making projections of household consumption than those shown in tables 42 and 43. All of the estimated partial coefficients of average disposable household income (column 3) shown in tables 47 and 48 are positive and highly significant. The estimates of the partial coefficients of average household size (column 4) have plausible signs, but a number of the coefficients for the rural areas are not statistically significant. As far as the signs and the significance of the coefficients are concerned, the results are similar to those obtained for the demand system with exogenous savings as shown in tables 42 and 43.

However, the results relating to coefficients of determination (column 5), which vary between a high of 0.717 (for food in the rural areas) and a low of 0.070 (for light and fuel in the urban areas) are on average less satisfactory than those obtained by estimating linear consumption functions of the demand system with exogenous savings (see tables 42 and 43). In the case of six functions for the urban areas and all nine functions for the rural areas, the R^2s are lower than those obtained for similar functions, considered earlier in relation to tables 44 and 45. In view of this, the forecast errors in the case of the function with average disposable household income can be greater than those of the functions with average household expenditure.

The results for the savings function indicate that the coefficient of average disposable household income in the function is positive and highly significant for either location. The coefficient of average household size is however, positive for urban areas, which is contrary to expectations. The coefficient of the same variable is negative for rural areas, as expected, and highly significant. The coefficients of determination in those two functions 0.422 and 0.419) are comparable to those obtained for the consumption functions and slightly higher than the value of this coefficient obtained by estimating the national-level linear savings function (0.401).

Table 47. Estimates of the coefficients of linear consumption and savings functions of the demand system with endogenous savings for urban areas a/

Commodity group/ savings	Coefficients			R-square
	Intercept	Disposable income b/	Household size b/	
(1)	(2)	(3)	(4)	(5)
Food	23.87613	0.33721 (18.54)	1.36859 (2.75)	0.671
Clothing	-0.45770	0.06946 (10.85)	0.26599 (1.52)	0.410
Housing	4.05422	0.03978 (5.48)	-0.88636 (4.46)	0.139
Fuel and light	10.88366	0.01237 (2.21)	0.35948 (2.35)	0.070
Durables	-0.24445	0.12418 (11.10)	-1.59126 (5.20)	0.356
Transportation	0.15943	0.01320 (7.04)	-0.02436 (0.47)	0.198
Personal care	0.97647	0.02127 (11.10)	-0.03624 (0.69)	0.381
Recreation	4.54777	0.04781 (9.31)	-0.23879 (1.70)	0.288
Other services	1.18470	0.05283 (9.49)	-0.56668 (3.72)	0.286
Savings	-44.98017	0.28188 (10.93)	1.34961 (1.91)	0.421

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 48. Estimates of the coefficients of linear consumption and savings functions of the demand system with endogenous savings for rural areas a/

Commodity group/ savings	Coefficients			R-square
	Intercept	Disposable income b/	Household size b/	
(1)	(2)	(3)	(4)	(5)
Food	17.65948	0.34160 (13.73)	2.10492 (3.46)	0.716
Clothing	-4.46838	0.07514 (9.42)	0.43491 (2.23)	0.539
Housing	-4.08369	0.09228 (4.89)	-0.87302 (1.89)	0.155
Fuel and light	6.23104	0.02704 (3.22)	0.39781 (1.94)	0.172
Durables	-3.32323	0.06095 (8.18)	-0.01737 (0.10)	0.402
Transportation	-0.56422	0.02034 (6.01)	-0.11082 (1.34)	0.232
Personal care	0.70036	0.02325 (5.42)	-0.04822 (0.46)	0.245
Recreation	1.32006	0.02854 (5.34)	0.17195 (1.32)	0.275
Other services	-0.48445	0.03718 (7.03)	-0.11941 (0.92)	0.307
Savings	-12.98694	0.29368 (9.46)	-2.03719 (2.68)	0.418

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Multiplicative. If estimates of multiplicative consumption and savings functions were sought for urban and rural areas, it would be necessary to estimate urban-rural equivalents of the log-linear consumption functions indicated in equation (53) and urban-rural equivalents of the log-linear savings function shown in equation (56). The OLS estimates of the coefficients of those urban and rural functions are presented in tables 49 and 50.

Some of the household consumption results for the linear functions (as shown in tables 49 and 50) are worse while others are better than those for the log-linear functions (as shown in tables 47 and 48). The estimated partial coefficients of average disposable household income are positive and highly significant. The estimates of the coefficients of average household size are less satisfactory in so far as those for transportation, recreation and other services in the rural areas are now positive. Moreover, a number of coefficients of average household size are not statistically significant in both urban and rural areas. However, the coefficient of determination for the various commodity groups, R^2, is higher than in the case where the linear specification was used, as shown in tables 47 and 48.

The coefficients of household savings functions for the log-linear specification (as shown in tables 49 and 50) are almost uniformly less satisfactory than those for the linear specification (as indicated in tables 47 nd 48). As expected, the estimated partial coefficients of average disposable household income are positive and highly significant. The estimate of the coefficient of average household size for urban areas is positive (contrary to expectations) and significant at the 0.01 level. The estimate of the coefficient of the same variable for rural areas is negative (as expected), but barely significant at the 0.10 level. In addition, the R^2s in those functions are lower (0.264 and 0.366) than in the linear savings functions (0.422 and 0.419).

The estimates of partial coefficients such as those presented in tables 49 and 50 can be used as derived by OLS while the estimates of the logarithms of the intercepts need to be transformed into estimates of the intercept coefficients. As illustrated in table 51, the latter estimates (column 3) can be obtained by taking antilogarithms of the estimates of the logarithms of the intercept coefficients (column 2). Thus, the estimate of the slope coefficient for food for urban areas, 1.282, can be calculated as:

$$1.282 = \text{antiln}\ (0.24873),$$

where 0.24873 is the estimate of the logarithm of the intercept coefficient of the log-linear function for food for urban areas.

Log-linear. Estimates of the log-linear consumption and savings functions with the household income variable and the household size variable can be obtained directly by estimating urban-rural equivalents of the functions shown in equations (53) and (56). Estimates of such functions, based on the cross-sectional data presented in table 35, are those shown in tables 49 and 50 and discussed above.

Table 49. Estimates of the coefficients of log-linear consumption and savings functions of the demand system with endogenous savings for urban areas a/

Commodity group/ savings	Coefficients			R-square
	Intercept	Logarithm of disposable income b/	Logarithm of household size b/	
(1)	(2)	(3)	(4)	(5)
Food	0.24873	0.80305 (23.73)	0.04531 (1.56)	0.754
Clothing	-2.52682	0.99803 (11.68)	-0.07109 (0.97)	0.400
Housing	-3.08203	1.14517 (4.59)	-1.06414 (4.95)	0.129
Fuel and light	1.17891	0.25635 (4.08)	0.08746 (1.62)	0.111
Durables	-6.75418	1.86364 (12.05)	-0.49294 (3.70)	0.394
Transportation	-4.57391	0.98007 (5.76)	0.02079 (0.14)	0.149
Personal care	-3.74671	1.03201 (13.08)	-0.12183 (1.79)	0.448
Recreation	-2.34021	0.91437 (8.56)	-0.07035 (0.77)	0.263
Other services	-4.78060	1.36344 (12.40)	-0.31692 (3.35)	0.410
Savings	-7.05172	1.59595 (6.78)	0.58577 (2.89)	0.263

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 50. Estimates of the coefficients of log-linear consumption and savings functions of the demand system with endogenous savings for rural areas a/

Commodity group/ savings	Coefficients			R-square
	Intercept	Logarithm of disposable income b/	Logarithm of household size b/	
(1)	(2)	(3)	(4)	(5)
Food	0.51378	0.74556 (16.94)	0.08484 (2.17)	0.775
Clothing	-4.40930	1.24953 (10.10)	0.12368 (1.22)	0.588
Housing	-5.61963	1.18861 (4.01)	-0.07405 (0.28)	0.135
Fuel and light	0.13451	0.39290 (3.95)	0.19396 (2.19)	0.236
Durables	-6.61625	1.63633 (8.63)	-0.15972 (0.95)	0.410
Transportation	-5.02488	0.98350 (5.18)	0.15926 (0.94)	0.255
Personal care	-2.97436	0.86776 (7.80)	-0.02094 (0.21)	0.381
Recreation	-2.75811	0.81144 (5.62)	0.21490 (1.68)	0.316
Other services	-4.83538	1.14092 (8.08)	0.16045 (1.28)	0.448
Savings	-7.81193	2.06645 (8.04)	-0.29850 (1.31)	0.365

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 51. Computing estimates of slope coefficients of multiplicative consumption and savings functions of the demand system with endogenous savings for urban and rural areas

Commodity group/ savings	Intercepts of log-linear functions a/	Slopes of corresponding multiplicative functions b/
(1)	(2)	(3)
	Urban	
Food	0.24873	1.282
Clothing	-2.52682	0.080
Housing	-3.08203	3.251
Fuel and light	1.17891	3.251
Durables	-6.75418	0.001
Transportation	-4.57391	0.010
Personal care	-3.74671	0.024
Recreation	-2.34021	0.096
Other services	-4.78060	0.008
Savings	-7.05172	0.001
	Rural	
Food	0.51378	1.672
Clothing	-4.40930	0.012
Housing	-5.61963	0.004
Fuel and light	0.13451	0.144
Durables	-6.61625	0.001
Transportation	-5.02488	0.007
Personal care	-2.97436	0.051
Recreation	-2.75811	0.063
Other services	-4.83538	0.008
Savings	-7.81193	0.000

a/ From tables 49 and 50, col. 2.
b/ Antiln (col. 2).

(c) Calibration of the empirically estimated functions

After obtaining satisfactory estimates of the relevant functions of the chosen demand system, the planner will sometimes desire to make special adjustments in the estimated coefficients. Although the adjustments may apply either to the estimates of the intercepts or to those of the partial coefficients or both, they will most often be restricted to the intercept estimates. Those adjustments, which are typically referred to as "calibration", ensure that, once adjusted, the functions are capable of precisely producing the levels of average household consumption by commodity group and, where appropriate, level(s) of per-household savings for a particular year or a group of years to which the data used in the calibration pertain. If left unadjusted, the functions will be capable of producing mean levels of average household consumption by commodity group and, where appropriate, level(s) of average household savings for the year to which data used in estimating the functions refer, using mean levels of explanatory variables for that year. The calibration procedures for consumption and savings functions of different forms are described in the annex.

D. Illustrative examples of projections

This section will present two examples illustrating the use of household demand systems in projecting household consumption and savings. These examples will indicate how the relevant calculations are made for the projection interval 0-5. In addition, they will provide complete projection results for a 20-year period.

The length of the projection period is identical to that used in other examples in this volume. However, projections of household consumption and savings over such a long time period may not be equally robust as projections of some other variables. Therefore, the results pertaining to years 15 and 20 obtained by the procedures described in this chapter may need to be taken with caution.

The first example will show how to prepare a national projection using a procedure based on the demand system with exogenous savings consisting of log-linear consumption functions. The second example will illustrate the preparation of an urban-rural projection employing the demand system with endogenous savings consisting of linear consumption and savings functions.

This section will not illustrate how to make projections of household consumption and savings using a demand system consisting of multiplicative functions. This approach would give the same results as that using log-linear transformations of those functions.

1. National projection

The calculations presented in this example will be based on the inputs contained in table 52, panel A, which shows projected levels of average disposable household income, projected numbers of households and the projected

Table 52. Inputs for projecting household consumption and savings for the entire country

PANEL A: Projected average disposable household income, number of households and average household size, as well as assumptions on average savings ratio

Variable	Year 0	5	10	15	20
Average disposable household income (in LCUs a/	229.5	271.9	320.6	375.0	439.4
Number of households (in thousands)	1 470.7	1 638.7	1 854.7	2 138.4	2 486.2
Average household size	6.80	6.84	6.80	6.62	6.31
Average savings ratio	0.14	0.15	0.16	0.17	0.18

PANEL B: Estimates of the coefficients of log-linear consumption functions of the demand system with exogenous savings

Commodity group	Adjusted intercept coefficient b/	Average total expenditure coefficient c/	Average household size coefficient d/
Food	8.17054	0.85094	0.08103
Clothing	-4.31692	1.33373	0.05102
Housing	-5.90697	1.74544	-0.65227
Fuel and light	6.56136	0.46408	0.12863
Durables	-7.78724	2.08854	-0.30735
Transportation	-4.84061	1.07696	0.13423
Personal care	-3.65109	1.06207	-0.06628
Recreation	-3.93007	1.22101	-0.03213
Other services	-5.70018	1.50331	-0.06563

a/ Local currency units.
b/ From table 68, col. 7.
c/ From table 37, col. 3.
d/ From table 37, col. 4.

average household size for dates five years apart. The initial year of the projection is denoted as year 0. Also shown in the panel are assumptions on the average household savings ratio for those same dates. The calculation will use the coefficients of the log-linear consumption functions of the demand system with exogenous savings, which were presented in table 37. The functions used in this example were calibrated as explained in the annex.

(a) Average household consumption and savings

To project household consumption and savings for a given date, it is initially necessary to prepare projections of average household consumption by commodity group and the level of average household savings for that date.

(i) Average household expenditure

Deriving projections of levels of average household consumption and savings starts with calculating the level of average household expenditure, which can be obtained as a product of average disposable household income and the complement of the assumed average savings ratio. Thus, average household expenditure for the end of the projection interval 0-5, 231.1, can be obtained as follows:

$$231.1 = (271.9) [1 - 0.15], \tag{4}$$

where 271.9 is the average disposable household income for year 5 and 0.15 is the average savings ratio for the same date.

(ii) Average household consumption by commodity group

To derive levels of average household consumption by commodity group for a given date using log-linear consumption functions, one should first obtain the logarithms of preliminary levels of average household consumption by evaluating the estimates of those functions for that date. This is done by using the logarithm of the average household expenditure and that of the average household size for the date in question as indicated by equation (7) and illustrated in table 53 for the end of the interval 0-5.

In particular, the logarithm of the preliminary level of average household consumption for each commodity group in year 5 (column 7) is obtained by adding the adjusted intercept coefficient for the commodity group in question (column 2) to the sum of two products. The first product is that of the estimate of the coefficient of average household expenditure for the commodity group concerned (column 3) and the logarithm of the projected level of average household expenditure in year 5 (column 5). The second product is that of the estimate of the coefficient of average household size for the commodity group (column 4) and the logarithm of the projected average household size in year 5 (column 6).

For example, the logarithm of the preliminary level of average household consumption for food in year 5, 4.86910, is obtained as:

Table 53. Deriving preliminary levels of average household consumption by commodity group for the entire country: end of projection interval 0-5

Commodity group	Estimates of the coefficients of log-linear Consumption functions a/			Average per household expenditure in year 5 b/ (LCUs c/	Average household size in in year 5 d/	Logarithm of projected preliminary Level of average per-household consumption in year 5 e/	Projected preliminary Level of average per-household consumption in year 5 f) (Thousands LCUs c/
	Adjusted intercept coefficient	Logarithm of average household expenditure coefficient	Logarithm household size coefficient				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Food	8.17054	0.85094	0.08103	231.1	6.84	4.86910	130.20411
Clothing	-4.31692	1.33373	0.05102	231.1	6.84	3.04055	20.91683
Housing	-5.90697	1.74544	-0.65227	231.1	6.84	2.33913	10.37220
Fuel and light	6.56136	0.46408	0.12863	231.1	6.84	2.83888	17.09677
Durables	-7.78724	2.08854	-0.30735	231.1	6.84	2.98953	19.87644
Transportation	-4.84061	1.07696	0.13423	231.1	6.84	1.27928	3.59407
Personal care	-3.65109	1.06207	-0.06628	231.1	6.84	2.00221	7.40545
Recreation	-3.93007	1.22101	-0.03213	231.1	6.84	2.65399	14.21073
Other services	-5.70018	1.50331	-0.06563	231.1	6.84	2.35601	10.54884

a/ From table 52, panel B.
b/ Calculation illustrated in text.
c/ Local currency units.
d/ From table 52, panel A.
e/ (Col. 2) + (col. 3) . (ln (col. 5)) + (col. 4) . (ln(col. 6)).
f/ Antiln (col. 7).

$$4.86910 = 0.08171 + [\ (0.85094)\ (\ln\ (231.1))\ ] + [\ (0.08103)\ (\ln\ (6.84))\ ], \qquad (7)$$

where 0.08171 is the adjusted intercept coefficient for food, where 0.85094 is the estimate of the coefficient of average household expenditure in the consumption function for food and 231.1 is the projected average household expenditure in year 5. The estimate of the household size coefficient in the same function is 0.08103, while 6.84 is the projected average household size in year 5.

Once the logarithms of the preliminary levels of average household consumption by commodity group are obtained for a given date, it is necessary to take antilogarithms of those results in order to derive from them preliminary levels of average household consumption. Thus, for year 5, the preliminary level for each commodity group (column 8) is obtained by taking the antilogarithm of the result obtained by evaluating the function for that date (column 7). For example, the preliminary level of average household consumption of food, 130.2, is obtained as:

$$130.2 = \text{antiln}\ (4.86910), \qquad (8)$$

where 4.86910 is the logarithm of the preliminary level of average household consumption of food in year 5.

(iii) <u>Adjusted levels of average household consumption by commodity group</u>

The projected preliminary levels of average household consumption would not normally add up to the average household expenditure. This is due to the fact that demand systems with exogenous savings consisting of log-linear consumption functions do not possess the adding-up property, typical of demand systems composed of linear functions. Therefore, it would be necessary to compute an adjustment factor and use it to modify the preliminary levels in order to obtain the adjusted levels of average household consumption by commodity group.

The adjustment factor can be computed for a particular projection date as the ratio of the average household expenditure to the sum of the preliminary levels of average household consumption for various commodity groups at that date. Thus, the adjustment factor for the end of the projection interval 0-5, 0.98672, is calculated as follows:

$$0.98672 = (231.1)\ /\ (130.2 + 20.9 + 10.4 + 17.1 + 19.9 + 3.6 + 7.4 + 14.2 + 10.5), \qquad (9)$$

where 231.1 is the average household expenditure in year 5, while the numbers in the denominator enclosed by parentheses are the preliminary levels of average household consumption obtained for that year (table 53, column 8).

Given the adjustment factor, the final level of average household consumption for each commodity group can be obtained as the product of this factor and the corresponding preliminary level. Thus, the final level of average household consumption of food in year 5, 128.5, is obtained as follows:

$$128.5 = (130.2)\ (0.98672), \tag{10}$$

where 0.98672 is the adjustment factor for year 5 and 130.2 is the preliminary level of average household consumption of food in that year. The final levels are shown in table 54.

(iv) Average household savings

Given the projected average disposable household income and the projected average household expenditure, which is calculated as explained earlier, the level of average household savings can be obtained as the difference between the two. Thus, the level of average household savings for the end of the projection interval 0-5, 40.8, is obtained as:

$$40.8 = 271.9 - 231.1, \tag{11}$$

where 271.9 and 231.1 are, respectively, the average disposable household income and the average household expenditure for year 5.

Performing the calculations illustrated above for the relevant dates over the entire projection period produces the projected levels of average household consumption and savings for the entire period.

(b) Levels of household consumption and savings

Once the adjusted levels of average household consumption and average household savings are obtained, the levels of aggregate household consumption by commodity group and the aggregate level of household savings can be obtained by multiplying the final per household levels by the number of households.[1/] Thus, the aggregate household consumption of food at the end of the projection interval 0-5, 210.5 (in millions of local currency units), can be calculated as:

$$210.5 = [\ (128.5)\ (1{,}638.7)\ ]/1{,}000, \tag{12}$$

where 128.5 and 1,638.7 are respectively the final level of average household consumption of food and the projected number of households in year 5.

Similarly, the level of aggregate household savings at the end of the interval 0-5, 66.8, can be obtained as:

$$66.8 = [\ (40.8)\ (1{,}638.7)\ ]/1{,}000, \tag{13}$$

where 40.8 is the level of average household savings in year 5.

These calculations can be performed for the relevant dates over the entire projection period to obtain the levels of household consumption and savings for the period, as shown in table 55.

Table 54. Projected levels of average household consumption by commodity group and average household savings

(LCUs) a/

Commodity group	Year 0	5	10	15	20
Food	113.3	128.4	144.3	160.1	176.5
Clothing	16.8	20.6	24.9	29.7	35.2
Housing	7.8	10.2	13.2	17.0	22.1
Fuel and light	15.8	16.8	17.8	18.7	19.4
Durables	14.2	19.6	26.6	35.7	48.1
Transportation	3.0	3.5	4.1	4.7	5.3
Personal care	6.2	7.3	8.4	9.7	11.1
Recreation	11.6	14.0	16.6	19.5	22.9
Other services	8.2	10.4	12.9	15.8	19.3
Savings	32.1	40.7	51.2	63.7	79.0

a/ Local currency units.

Table 55. Projected levels of household consumption by commodity group and projected levels of household savings

(Millions of LCUs) a/

Commodity group	Year				
	0	5	10	15	20
Food	166.6	210.5	267.6	342.3	438.8
Clothing	24.8	33.8	46.3	63.5	87.5
Housing	11.5	16.7	24.5	36.4	55.1
Fuel and light	23.2	27.6	33.1	40.0	48.3
Durables	20.9	32.1	49.4	76.5	119.7
Transportation	4.4	5.8	7.6	10.0	13.3
Personal care	9.1	11.9	15.7	20.8	27.7
Recreation	17.1	22.9	30.9	41.8	56.9
Other services	12.1	17.0	23.9	33.8	48.0
Savings	47.2	66.8	95.1	136.3	196.6

a/ Local currency units.

(c) Other results

Other results that may be useful in planning can be obtained as part of a national projection. These include various household consumption and savings aggregates, indicators of the spending pattern of households and the rates of growth of household consumption and savings.

(i) Household consumption and savings aggregates

Household consumption aggregates, which can be derived from the consumption projections by commodity group, include household consumption along with household consumption in various broad commodity groups at dates five years apart. They also include increases in household consumption, increases in household consumption by broad commodity groups, and increases in household savings over the intervening intervals.

a. Household consumption

Household consumption at the end of a given projection interval is obtained by aggregating the projected levels of household consumption by commodity group. Thus, household consumption in year 5, 378.7, is computed by adding the projected levels of household consumption in the various commodity groups. This number is shown in table 56 (in the column corresponding to year 5), along with other results derived for the entire 20-year projection period. The growth in total household consumption over this period is indicated in figure XIII.

Also shown in table 56 and figure XIII are levels and changes in household savings over the 20-year projection period.

b. Household consumption by broad commodity groups

Household consumption in broad commodity groups can be obtained by aggregating projected levels of household consumption for the various primary commodity groups, using appropriate aggregation rules. To illustrate this aggregation, it will be assumed that there are three broad groups -- food, clothing and other -- the first two of which are identical to the first two primary commodity groups, while the third is an aggregation of the primary commodity groups ranging from housing to other services.

Therefore, household consumption of the broad group food in year 5 is 210.5, while that of clothing in the same year is 33.8.

Household consumption of other commodities in year 5, 134.4, is obtained as:

$$134.4 = 16.8 + 27.6 + 32.1 + 5.8 + 12.0 + 23.0 + 17.1, \qquad (15)$$

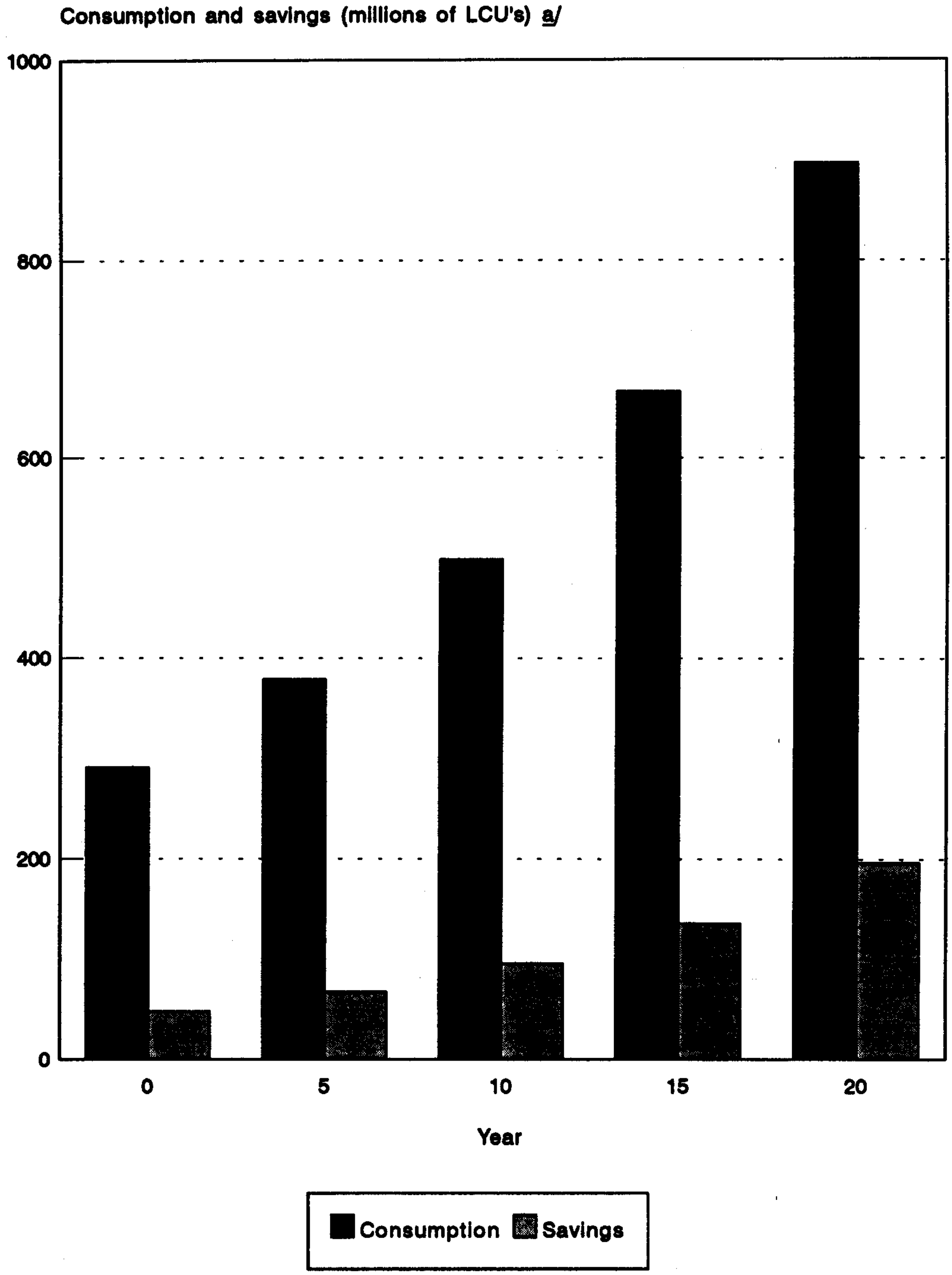
where the numbers on the right-hand side, 16.8 through 17.1 are, respectively, projected levels of household consumption of housing through that of other services in year 5.

Table 56. Household consumption and savings aggregates, indicators of the pattern of household spending and rates of household consumption and savings change for the entire country

Indicators	Year 0	5	10	15	20
Household consumption and savings aggregates (in millions of LCUs) a/					
Levels of household consumption and savings:					
Consumption	290.2	378.7	499.4	665.5	895.7
Food	166.6	210.5	267.6	342.3	438.8
Clothing	24.8	33.8	46.3	63.5	87.5
Other	98.7	134.3	185.4	259.6	369.3
Savings	47.2	66.8	95.1	136.3	196.6
Growth in household consumption and savings:					
Consumption		88.5	120.7	166.1	230.2
Food		43.9	57.1	74.6	96.4
Clothing		9.0	12.5	17.3	24.0
Other		35.6	51.1	74.2	109.7
Savings		19.6	28.3	41.1	60.3
Indicators of the household spending pattern					
Proportions of total disposable household income spent or saved:					
Food	0.49	0.47	0.45	0.42	0.40
Clothing	0.07	0.07	0.07	0.07	0.07
Other	0.29	0.30	0.31	0.32	0.33
Savings	0.14	0.15	0.16	0.17	0.18
Rates of growth of household consumption and savings:					
Consumption		5.46	5.69	5.90	6.12
Food		4.78	4.92	5.04	5.08
Clothing		6.38	6.48	6.54	6.61
Other		6.34	6.65	6.95	7.30
Savings		7.17	7.31	7.45	7.60

a/ Local currency units.

Figure XIII. Household consumption and household savings



a/ Local currency units

Levels of household consumption for the various broad commodity groups over the projection period are presented in figure XIV.

c. Growth in household consumption

The growth in household consumption over a given projection interval equals the difference between the household consumption at the end of the interval and the household consumption at its beginning. For the interval 0-5, the growth in total household consumption, 88.5, is obtained as:

$$88.5 = 378.7 - 290.3, \tag{16}$$

where 290.3 and 378.7 are, respectively, household consumption at the beginning and the end of the interval (shown in the first two columns of table 56 corresponding to years 0 and 5 respectively).

d. Growth in household consumption by broad commodity groups

The increase in household consumption in each broad commodity group over an interval is obtained as the difference between the levels of household consumption in that group at the end and the beginning of the interval. For example, the growth of household consumption of food over the 0-5 interval, 43.9, is:

$$43.9 = 210.5 - 166.7, \tag{17}$$

where 166.7 and 210.5 are, respectively, the levels of household consumption of food in years 0 and 5.

e. Growth in household savings

The growth in household savings over a given interval can be obtained as the difference between household savings at the end of the interval and household savings at its beginning. For the interval 0-5, the growth in household savings, 19.6, is:

$$19.6 = 66.8 - 47.3, \text{ [a]} \tag{18}$$

where 47.3 and 66.8 are, respectively, household savings at the beginning and the end of the interval (see table 56, columns corresponding to years 0 and 5).

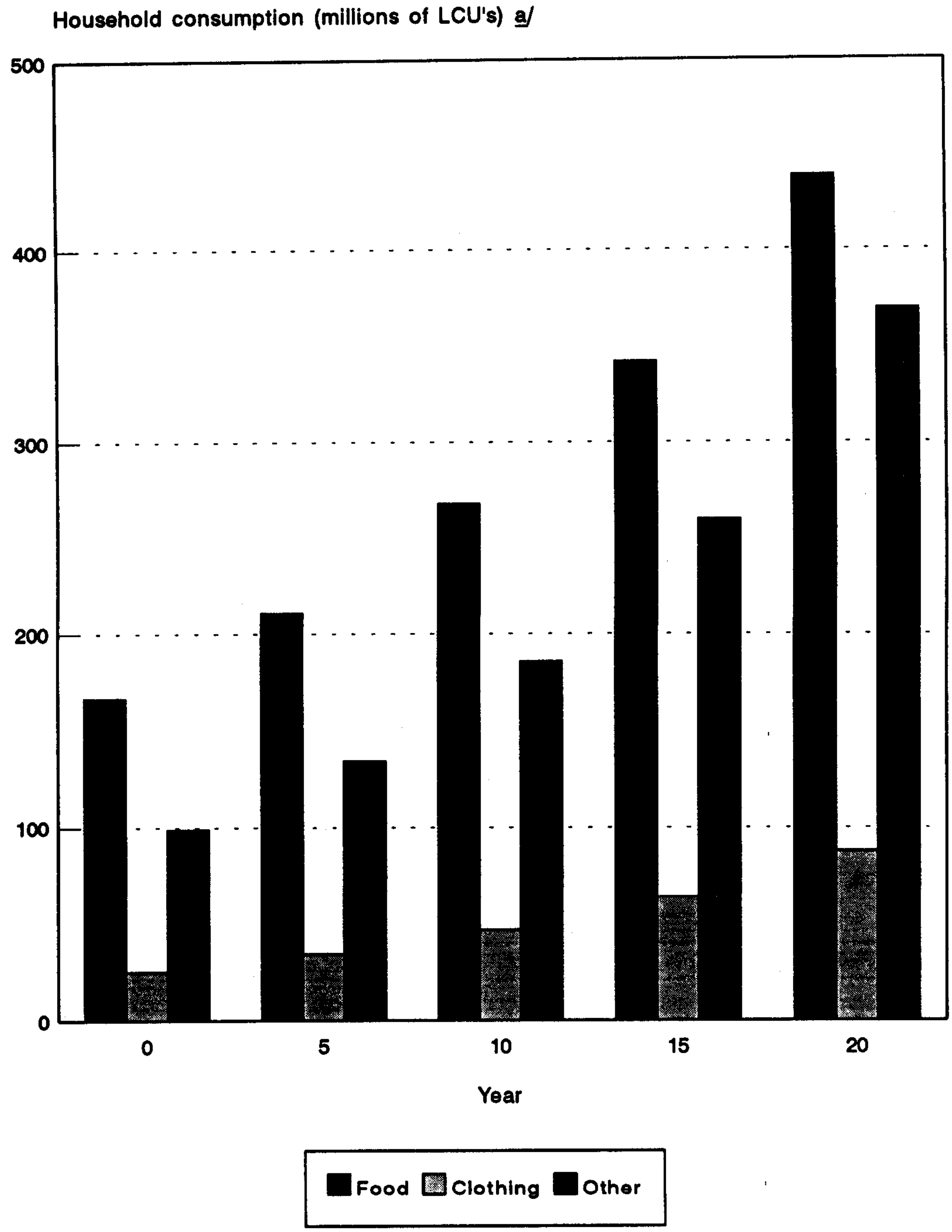
(ii) Indicators of the spending pattern of household

To obtain the proportions of total disposable income spent on various commodities or saved, it is initially necessary to obtain the total disposable household income.

a. Disposable household income

Disposable household income for the end of a given projection interval can be obtained as the product of average disposable household income and the number

Figure XIV. Household consumption by broad groups (food, clothing and other)



a/ Local currency units.

of households at that date. Thus, the disposable household income for the end of the interval 0-5, 445.6 (in millions of local currency units), is obtained as follows:

$$445.6 = [\ (271.9)\ (1{,}638.7)\ ]/1{,}000, \tag{19}$$

where 271.9 is the average disposable household income in year 5 and 1,638.7 is the number of households in that year, in thousands (see table 52).

b. <u>Proportions of disposable household income spent on goods and services in broad commodity groups</u>

For the end of a given interval, each of these proportions can be obtained as the ratio of the level of household consumption of goods and services in a given broad commodity group to the level of disposable household income. Thus, the proportion of household disposable income spent on food at the end of the interval 0-5, 0.47, is:

$$0.47 = 210.5/445.6, \tag{20}$$

where 210.5 and 445.6 are, respectively, the level of household consumption of food and the disposable household income in year 5.

c. <u>Proportion of disposable household income saved</u>

The proportion of disposable household income saved at a given date can be obtained as a ratio of household savings to disposable household income at that date. Thus, for the end of the projection interval 0-5, this proportion, 0.15, is obtained as follows:

$$0.15 = 66.8/445.6, \tag{21}$$

where 66.8 is the level of household savings in year 5.

The proportions of disposable household income spent on goods and services in broad commodity groups and saved for the various dates are presented in table 56. The proportions obtained for the initial and the terminal year of the 20-year projection period are also shown in figure XV.

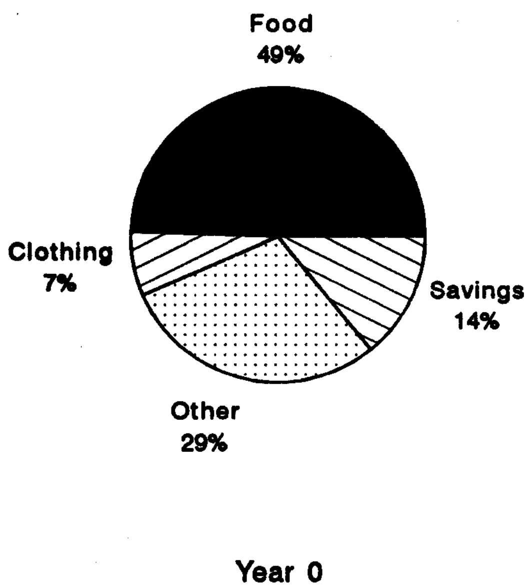
(iii) <u>Rates of growth of household consumption and savings</u>

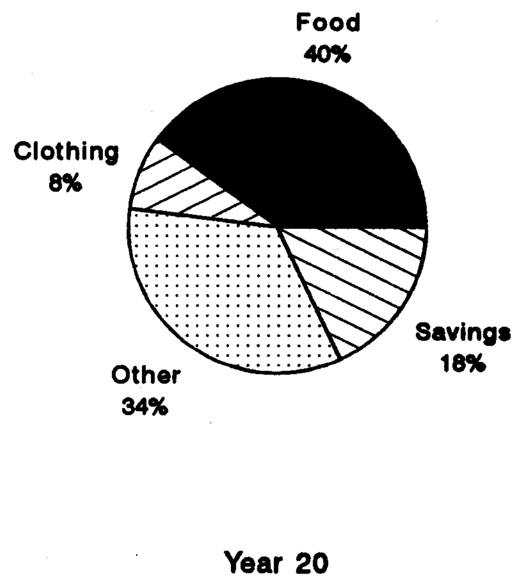
Rates of growth of household consumption can be calculated for household consumption and for household consumption by broad commodity groups. Also, it is possible to compute rates of growth of household savings.

a. <u>The rate of growth of household consumption</u>

If the growth in household consumption is assumed to occur over discrete intervals, the average annual growth rate of household consumption for a given interval is obtained using the geometric growth rate formula. For the projection

Figure XV. Proportions of disposable household income spent or saved in the initial and the terminal years





interval 0-5, this annual growth rate, 5.46 per cent (table 56), is obtained as follows:

$$5.46 = [\ (378.7/290.3)^{1/5} - 1\ ] \cdot 100, \tag{22}$$

where 290.3 and 378.7 are the levels of total household consumption in years 0 and 5, respectively, and 5 is the length of the interval.

Rates of growth of household consumption over the 20-year projection period, which were computed using the geometric growth rate formula, are shown in table 56 and illustrated in figure XVI.

If the planner assumes that growth in household consumption is continuous, the average annual growth rate of total household consumption for a given interval is obtained by substituting the same data as above in the exponential growth rate formula. For the projection interval 0-5, this annual growth rate, 5.32 per cent, is obtained as follows:

$$5.32 = [\ \ln (378.7 / 290.3) / 5\ ] \cdot 100; \tag{23}$$

Though they are similar, the exponential rate of growth will be somewhat smaller than the geometric rate of growth.

b. Rates of growth of household consumption by broad commodity groups

Assuming discrete growth, the rates of increase in household consumption by broad commodity groups can be obtained in a way analogous to that of calculating the rate of growth of total household consumption. Thus, the rate of increase of household consumption of food for the interval 0-5, 4.78 per cent, is:

$$4.78 = [\ (210.5 / 166.7)^{1/5} - 1\ ] \cdot 100; \tag{24}$$

where 166.7 and 210.5 are the levels of household consumption of food in years 0 and 5, respectively.

Geometric rates of growth of household consumption by broad commodity groups over the 20-year projection interval are shown in table 56 and figure XVII. As might be expected, the "other" category is projected to grow more rapidly than food or clothing.

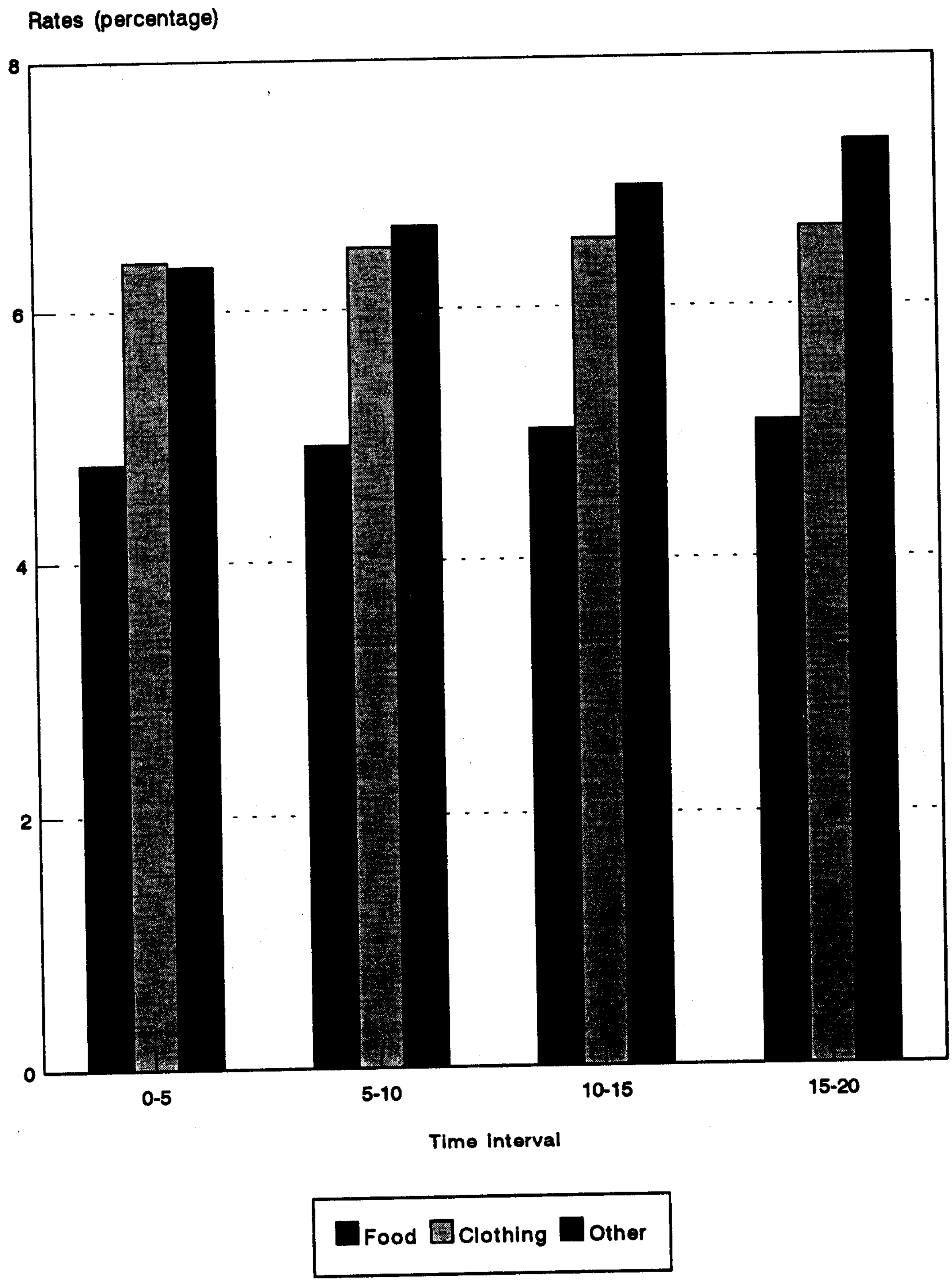
If continuous growth is assumed, rates of household consumption by sector would be calculated using the exponential growth rate formula. The calculations would be performed as indicated by equation (25).

c. The rate of growth of household savings

Assuming that household savings grow over discrete intervals, the average annual growth rate of household savings for a given interval is obtained by means

Figure XVI. Rates of growth of household consumption and household savings

Figure XVII. Rates of growth of household consumption by broad commodity groups



of the geometric growth rate formula. For the projection interval 0-5, this annual growth rate, 7.18 per cent (table 56), is obtained as follows:

$$7.18 = [\ (66.8\ /\ 47.3\ )^{1/5} - 1\ ] \cdot 100; \tag{26}$$

where 47.3 and 66.8 are the levels of household savings in years 0 and 5, respectively.

Rates of growth of household savings over the entire projection period which were computed using the geometric growth rate formula are shown in table 56 and figure XVI. As might be expected, savings is projected to grow more rapidly than consumption.

If it is assumed that growth in household savings is continuous, the average annual growth rate of household savings for a given interval is obtained by substituting the same data as above in the exponential growth rate formula. For the projection interval 0-5, this annual growth rate, 6.90 per cent, is obtained as follows:

$$6.90 = [\ \ln\ (66.8\ /\ 47.3)\ /\ 5\ ] \cdot 100; \tag{27}$$

As is to be expected, the exponential growth rate of savings is slightly less than the geometric growth rate.

2. Urban-rural projection

The procedure for projecting household consumption and savings for urban and rural areas is similar to that for the country as a whole. This example will illustrate calculations by which urban and rural projections can be preparedusing the inputs for urban areas shown in table 57 and the inputs for rural areas shown in table 58. These inputs include projected levels of average disposable household income, projected numbers of households and projected average household sizes. The tables also show estimates of the coefficients of linear consumption and savings functions of the demand system with endogenous savings, which come from table 47 in the case of urban areas and table 48 in the case of rural areas. The intercepts of those functions have been adjusted as described in the annex.

The example will focus on calculations that are unique to linear functions, those that involve both consumption and savings functions and calculations that are related to procedures unique to urban-rural projections.

(a) Average household consumption and savings

As in the national projection, it is initially necessary to project levels of average household consumption by commodity group and level of average household savings.

In the case of linear functions, those levels can be obtained directly by evaluating the functions. In this example, it can be done by using projected

Table 57. Inputs for projecting household consumption and savings for urban areas

PANEL A. Projected average disposable household income, number of households and average household size

Variable	Year 0	5	10	15	20
Average disposable household income (in LCUs) a/	302.7	304.0	324.2	353.4	393.1
Number of households (in thousands)	481.5	671.3	885.6	1 148.0	1 464.6
Average household size	6.20	6.06	6.02	5.83	5.56

PANEL B:. Estimates of the coefficients of linear consumption and savings functions of the demand system with endogenous savings

Commodity group/ savings	Adjusted intercept coefficient b/	Disposable income coefficient c/	Household size coefficient d/
Food	34.08062	0.33721	1.36859
Clothing	0.28452	0.06946	0.26599
Housing	2.24194	0.03978	-0.88636
Fuel and light	14.74116	0.01237	0.35948
Durables	-5.36740	0.12418	-1.59126
Transportation	0.09662	0.01320	-0.02436
Personal care	1.09131	0.02127	-0.03624
Recreation	4.90758	0.04781	-0.23879
Other services	-0.27590	0.05283	-0.56668
Savings	-51.79727	0.28188	1.34961

a/ Local currency units.
b/ From table 69, col. 7.
c/ From table 47, col. 3.
d/ From table 47, col. 4.

Table 58. Inputs for projecting household consumption and savings for rural areas

PANEL A. Projected average disposable household income, number of households and average household size

Variable	Year 0	5	10	15	20
Average disposable household income (in LCUs) a/	182.2	232.5	293.0	366.3	459.3
Number of households (in thousands)	989.3	968.1	970.1	991.2	1 022.2
Average household size	7.09	7.37	7.48	7.50	7.34

PANEL B. Estimates of the coefficients of linear consumption and savings functions of the demand system with endogenous savings

Commodity group/ savings	Adjusted intercept coefficient b/	Disposable income coefficient c/	Household size coefficient d/
Food	15.43033	0.34160	2.10492
Clothing	-4.29383	0.07514	0.43491
Housing	-3.43975	0.09228	-0.87302
Fuel and light	5.58571	0.02704	0.39781
Durables	-3.01791	0.06095	-0.01737
Transportation	-0.48090	0.02034	-0.11082
Personal care	1.30537	0.02325	-0.04822
Recreation	1.20612	0.02854	0.17195
Other services	-0.39484	0.03718	-0.11941
Savings	-11.23099	0.29368	-2.03719

a/ Local currency units.
b/ From table 70, col. 7.
c/ From table 48, col. 3.
d/ From table 48, col. 4.

average disposable household incomes and projected average household sizes for urban and rural areas. Table 59 illustrates the evaluation of linear consumption and savings functions for the urban areas for end of the projection interval 0-5.

In particular, the levels of average household consumption for each commodity group in the urban areas in year 5 (column 7), is obtained by adding to the adjusted urban intercept coefficient for the commodity group in question (column 2) the sum of two products. The first product is obtained as the estimate of the urban disposable household income coefficient for the commodity group (column 3), multiplied by the projected urban average disposable household income in year 5 (column 5). The second product is that of the estimate of the urban household size coefficient for the commodity group (column 4) and the projected urban average household size in year 5 (column 6).

For example, the level of average household consumption for food for the urban areas in year 5, 144.88612, is obtained as:

$$144.88612 = 34.08062 + [\ (0.33721)\ (304.0)\ ] + [\ (1.36859)\ (6.06))\ ],$$

where 34.08062 is the adjusted intercept coefficient for food, 0.33721 is the estimate of the household income coefficient in the urban consumption function for food and 304.0 is the projected urban level of average disposable household income in year 5. The estimate of the coefficient of average household size in the same function is 1.36859 while 6.06 is the projected average urban household size in year 5.

Average household savings for urban areas in year 5 is derived in a manner that is analogous to obtaining average household consumption levels for those areas. Thus, the level of average urban household savings in year 5, 42.07288 (the derivation of the figure is also illustrated in table 59), is obtained as follows:

$$42.07288 = -51.79727 + [\ (0.28188)\ (304.0)\ ] + [\ (1.34961)\ (6.06)\ ],$$

where -51.79727 is the adjusted intercept coefficient in the urban savings function, 0.28188 is the estimate of the urban disposable household income coefficient and 304.0 is the projected urban average disposable household income in year 5. The estimate of the coefficient of average household size is 1.34961, while 6.06 is the projected urban average household size in year 5.

Performing the calculations illustrated above for urban and rural areas for the relevant dates over the entire projection period produces the projected levels of average household consumption and savings for the two areas for the entire period. The levels obtained for urban and rural areas as part of this illustrative example are shown respectively in tables 60 and 61.

The higher levels of average household consumption in urban areas reflects the higher level of urban average disposable household income.

Table 59. Deriving levels of average household consumption by commodity group and average household savings for urban areas: end of projection interval 0-5

Commodity group/ savings	Estimates of the coefficients linear consumption and savings functions a/					
	Adjusted intercept coefficient	Dispos-able income coefficient	Household size coefficient	Average disposable household income in year 5 b/ (LCUs) c/	Average household size in year 5 b/	Projected average household consumption and savings in year 5 d/
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Food	34.08062	0.33721	1.36859	304.0	6.06	144.88611
Clothing	0.28452	0.06946	0.26599	304.0	6.06	23.01226
Housing	2.24194	0.03978	-0.88636	304.0	6.06	8.96372
Fuel and light	14.74116	0.01237	0.35948	304.0	6.06	20.68009
Durables	-5.36740	0.12418	-1.59126	304.0	6.06	22.74028
Transportation	0.09662	0.01320	-0.02436	304.0	6.06	3.96179
Personal care	1.09131	0.02127	-0.03624	304.0	6.06	7.33778
Recreation	4.90758	0.04781	-0.23879	304.0	6.06	17.99476
Other services	-0.27590	0.05283	-0.56668	304.0	6.06	12.35033
Savings	-51.79727	0.28188	1.34961	304.0	6.06	42.07288

a/ From table 57, panel B.
b/ From table 57, panel A.
c/ Local currency units.
d/ (col. 2) + (col. 3) . (col. 5) + (col. 4) . (col. 6).

Table 60. Projected levels of average household consumption by commodity group and average household savings for urban areas

(LCUs) a/

Commodity group/ savings	Year				
	0	5	10	15	20
Food	144.6	144.8	151.6	161.2	174.2
Clothing	22.9	23.0	24.4	26.3	29.0
Housing	8.7	8.9	9.8	11.1	12.9
Fuel and light	20.7	20.6	20.9	21.2	21.6
Durables	22.3	22.7	25.3	29.2	34.6
Transportation	3.9	3.9	4.2	4.6	5.1
Personal care	7.3	7.3	7.7	8.3	9.2
Recreation	17.8	17.9	18.9	20.4	22.3
Other services	12.2	12.3	13.4	15.0	17.3
Savings	41.8	42.0	47.7	55.6	66.5

a/ Local currency units.

Table 61. Projected levels of average household consumption by commodity group and average household savings for rural areas

(LCUs) a/

Commodity group/ savings	Year				
	0	5	10	15	20
Food	92.6	110.3	131.2	156.3	187.7
Clothing	12.4	16.3	20.9	26.4	33.4
Housing	7.1	11.5	17.0	23.8	32.5
Fuel and light	13.3	14.8	16.4	18.4	20.9
Durables	7.9	11.0	14.7	19.1	24.8
Transportation	2.4	3.4	4.6	6.1	8.0
Personal care	5.2	6.3	7.7	9.4	11.6
Recreation	7.6	9.1	10.8	12.9	15.5
Other services	5.5	7.3	9.6	12.3	15.8
Savings	27.8	42.0	59.5	81.0	108.7

a/ Local currency units.

(b) Levels of household consumption and savings

Projected levels of household consumption and savings in urban and rural areas can be obtained in a way analogous to that used to derive projected levels of household consumption and savings at the national level. In particular, those levels can be derived as products of projected levels of average household consumption and savings, on the one hand, and the projected numbers of households, on the other. Projected levels of household consumption and savings for urban and rural areas over the 20-year projection period are shown in tables 62 and 63.

Projected levels of household consumption and savings can be aggregated across locations to obtain levels of household consumption and savings for the entire country. The levels of consumption and savings for the country as a whole, which are obtained as part of this example, are indicated in table 64.

Levels of household consumption and savings obtained for urban and rural areas, as well as for the entire country for the 20-year projection period, are also shown in figures XVIII and XIX.

(c) Other results

As part of an urban-rural projection it is also possible to calculate a number of derived indicators, some of which can be obtained in the course of making a national projection. Those indicators include various household consumption and savings aggregates, indicators of the spending pattern of households and the various rates of growth of household consumption and savings. The results for the country as a whole also include the proportions of national household consumption and savings that are urban and rural. The results obtained for urban and rural areas and the entire country in the course of preparing this example are presented in tables 65 through 67, respectively. Those indicators (except the proportions urban and rural) can be calculated using the steps illustrated in connection with the national projection.

(i) Proportions of national household consumption urban and rural

The proportion of household consumption that is urban at the end of the projection interval is calculated as the ratio of household consumption in urban areas to household consumption for the date. For the end of the interval 0-5, the proportion of national household consumption that is urban, 0.49, is obtained as:

$$0.49 = 175.8 / 360.2; \qquad (45)$$

where 175.8 is household consumption in the urban areas and 360.2 is household consumption for the entire country in year 5 (see tables 63 and 65, respectively).

The proportion of national household consumption that is rural, 0.51, is calculated as a complement of the proportion urban:

Table 62. Projected levels of household consumption by commodity group and household savings for urban areas

(Millions of LCUs) a/

Commodity group	Year 0	5	10	15	20
Food	69.6	97.2	134.2	185.0	255.2
Clothing	11.0	15.4	21.6	30.2	42.5
Housing	4.2	6.0	8.6	12.7	18.9
Fuel and light	9.9	13.8	18.5	24.3	31.6
Durables	10.7	15.2	22.4	33.5	50.6
Transportation	1.8	2.6	3.7	5.3	7.5
Personal care	3.5	4.9	6.8	9.6	13.5
Recreation	8.6	12.0	16.7	23.4	32.7
Other services	5.8	8.2	11.9	17.3	25.3
Savings	20.1	28.2	42.2	63.9	97.4

a/ Local currency units.

Table 63. Projected levels of household consumption by commodity group and household savings for rural areas

(Millions of LCUs) a/

Commodity group/ savings	Year				
	0	5	10	15	20
Food	91.6	106.8	127.3	154.9	191.9
Clothing	12.3	15.8	20.3	26.2	34.1
Housing	7.1	11.2	16.5	23.6	33.2
Fuel and light	13.1	14.3	15.9	18.3	21.3
Durables	7.8	10.6	14.2	19.0	25.4
Transportation	2.4	3.3	4.5	6.0	8.2
Personal care	5.1	6.1	7.5	9.3	11.8
Recreation	7.5	8.8	10.5	12.8	15.9
Other services	5.4	7.1	9.3	12.2	16.1
Savings	27.5	40.7	57.8	80.3	111.1

a/ Local currency units.

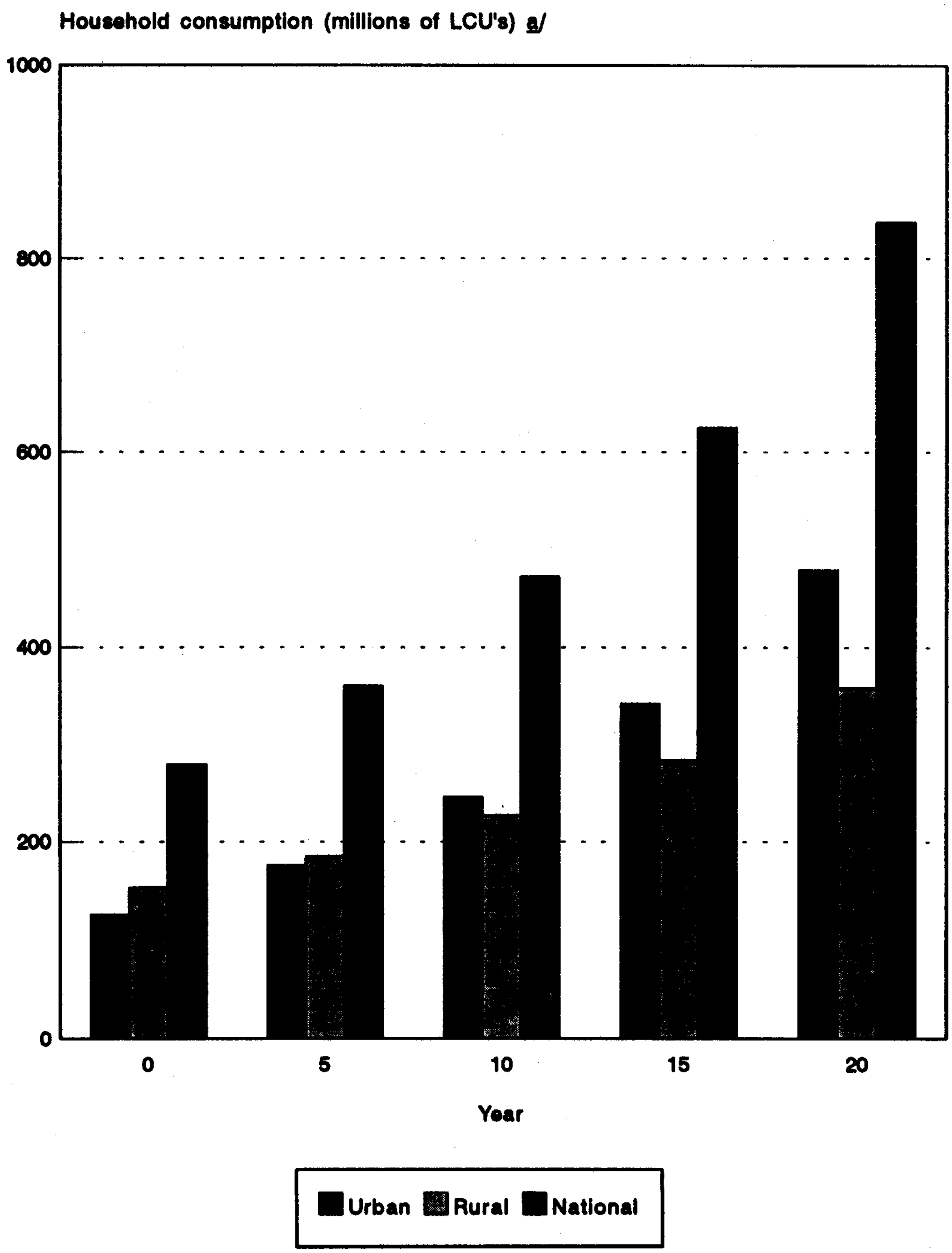
Table 64. Projected levels of household consumption by commodity group and household savings for the entire country

(Millions of LCUs) a/

Commodity group/ savings	Year				
	0	5	10	15	20
Food	161.2	204.1	261.6	340.0	447.1
Clothing	23.4	31.3	41.9	56.5	76.7
Housing	11.3	17.2	25.2	36.3	52.2
Fuel and light	23.1	28.2	34.5	42.6	53.0
Durables	18.6	25.9	36.6	52.5	76.0
Transportation	4.3	5.9	8.2	11.3	15.7
Personal care	8.6	11.0	14.4	19.0	25.4
Recreation	16.1	20.8	27.3	36.2	48.6
Other services	11.3	15.4	21.2	29.5	41.5
Savings	47.7	68.9	100.0	144.2	208.5

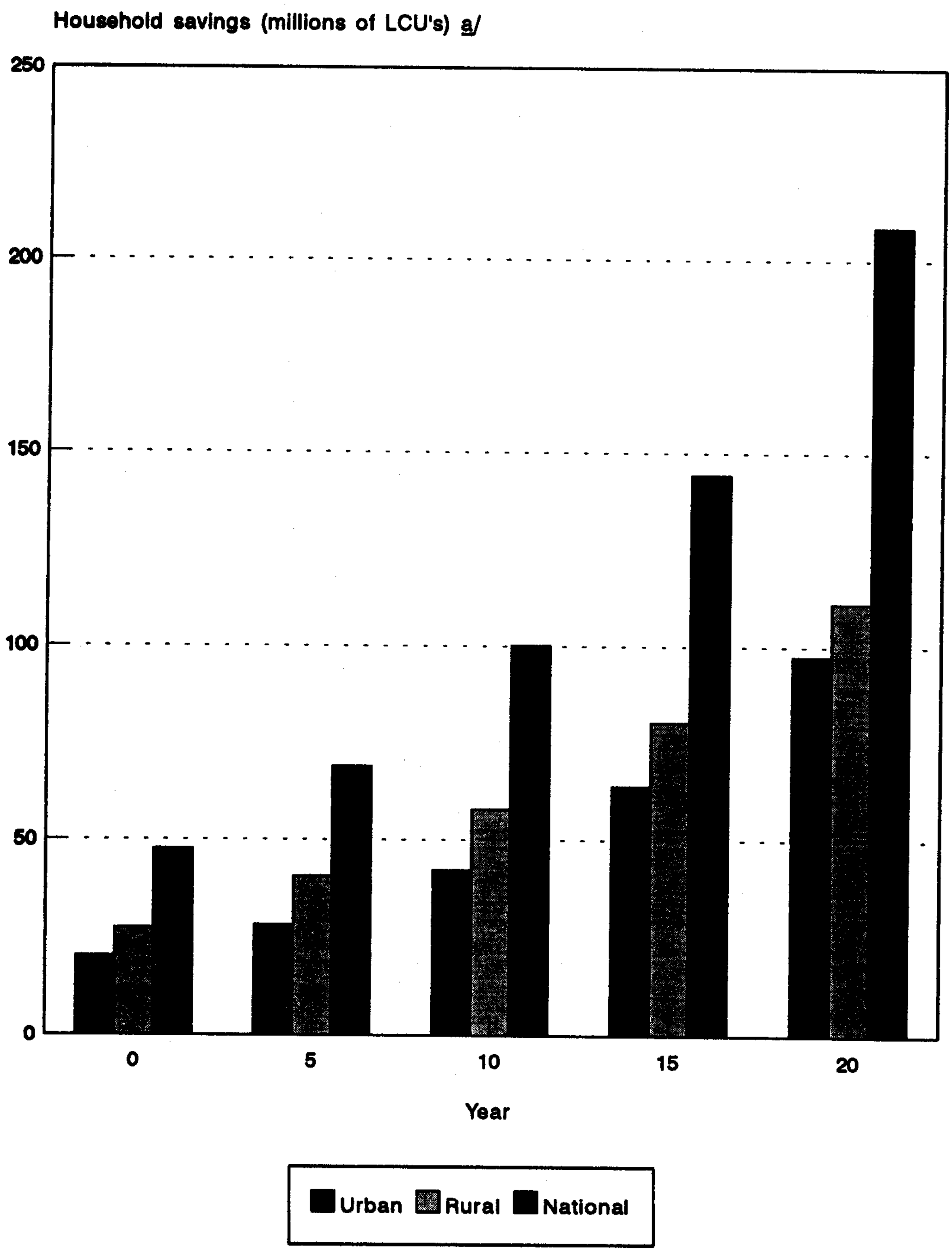
a/ Local currency units.

Figure XVIII. Household consumption: urban, rural and national



a/ Local currency units.

Figure XIX. Household savings: urban, rural and national



a/ Local currency units

Table 65. Household consumption and savings aggregates, indicators of the pattern of household spending and rates of household consumption and savings change for urban areas

Indicators	Year 0	5	10	15	20
Household consumption and savings aggregates (in millions of LCUs) a/					
Levels of household consumption and savings:					
Consumption	125.5	175.8	244.8	341.7	478.3
Food	69.6	97.2	134.2	185.0	255.2
Clothing	11.0	15.4	21.6	30.2	42.5
Other	44.8	63.1	88.9	126.3	180.5
Savings	20.1	28.2	42.2	63.9	97.4
Growth in household consumption and savings:					
Consumption		50.2	69.0	96.9	136.5
Food		27.6	37.0	50.7	70.1
Clothing		4.3	6.1	8.6	12.2
Other		18.2	25.8	37.4	54.1
Savings		8.0	14.0	21.6	33.4
Indicators of the household spending pattern					
Proportions of total disposable household income spent or saved:					
Food	0.47	0.47	0.46	0.45	0.44
Clothing	0.08	0.08	0.08	0.07	0.07
Other	0.30	0.30	0.30	0.31	0.31
Savings	0.13	0.13	0.14	0.15	0.16
Rates of growth of household consumption and savings:					
Consumption		6.96	6.84	6.89	6.95
Food		6.90	6.66	6.62	6.63
Clothing		6.92	6.94	6.98	7.04
Other		7.06	7.10	7.27	7.39
Savings		6.96	8.39	8.63	8.78

a/ Local currency units.

Table 66. Household consumption and savings aggregates, indicators of the pattern of household spending and rates of household consumption and savings change for rural areas

Indicators	Year 0	5	10	15	20
Household consumption and savings aggregates (in millions of LCUs) a/					
Levels of household consumption and savings:					
Consumption	152.7	184.3	226.4	282.7	358.3
Food	91.6	106.8	127.3	154.9	191.9
Clothing	12.3	15.8	20.3	26.2	34.1
Other	48.7	61.6	78.7	101.4	132.2
Savings	27.5	40.7	57.8	80.3	111.1
Growth in household consumption and savings:					
Consumption		31.6	42.0	56.2	75.6
Food		15.2	20.4	27.6	36.9
Clothing		3.5	4.4	5.9	7.8
Other		12.9	17.0	22.7	30.7
Savings		13.1	17.1	22.5	30.7
Indicators of the household spending pattern					
Proportions of total disposable household income spent or saved:					
Food	0.50	0.47	0.44	0.42	0.40
Clothing	0.07	0.07	0.07	0.07	0.07
Other	0.27	0.27	0.27	0.27	0.28
Savings	0.15	0.18	0.20	0.22	0.23
Rates of growth of household consumption and savings:					
Consumption		3.84	4.19	4.53	4.85
Food		3.12	3.57	4.00	4.37
Clothing		5.13	5.11	5.23	5.39
Other		4.80	5.00	5.20	5.44
Savings		8.12	7.26	6.81	6.69

a/ Local currency units.

Table 67. Household consumption and savings aggregates, indicators of the pattern of household spending and rates of household consumption and savings change for the entire country

Indicators	Year 0	5	10	15	20
Household consumption and savings aggregates (in millions of LCUs) a/					
Levels of household consumption and savings:					
Consumption	278.2	360.2	471.2	624.4	836.6
Food	161.2	204.1	261.6	340.0	447.1
Clothing	23.4	31.3	41.9	56.5	76.7
Other	93.6	124.7	167.6	227.8	312.7
Savings	47.7	68.9	100.0	144.2	208.5
Growth in household consumption and savings:					
Consumption		81.9	111.0	153.1	212.2
Food		42.8	57.5	78.4	107.0
Clothing		7.9	10.6	14.5	20.1
Other		31.1	42.8	60.1	84.9
Savings		21.2	31.1	44.2	64.2
Indicators of the household spending pattern					
Proportions of total disposable household income spent or saved:					
Food	0.49	0.47	0.45	0.44	0.42
Clothing	0.07	0.07	0.07	0.07	0.07
Other	0.28	0.29	0.29	0.29	0.29
Savings	0.14	0.16	0.17	0.18	0.19
Indicators of the distribution of consumption and savings:					
Proportions of the total consumption					
Urban	0.45	0.48	0.51	0.54	0.57
Rural	0.54	0.51	0.48	0.45	0.42
Proportions of savings					
Urban	0.42	0.40	0.42	0.44	0.46
Rural	0.57	0.59	0.57	0.55	0.53
Rates of growth of household consumption and savings:					
Consumption		5.29	5.52	5.79	6.02
Food		4.82	5.09	5.38	5.62
Clothing		5.99	6.03	6.14	6.29
Other		5.91	6.08	6.32	6.54
Savings		7.64	7.73	7.59	7.64

a/ Local currency units.

$$0.51 = 1 - 0.49; \tag{46}$$

where 0.49 is the proportion of national household consumption that is urban.

Proportions of household consumption that are urban and rural over the entire projection period are displayed in table 67 and illustrated in figure XX.

(ii) Proportions of national household savings urban and rural

The proportion of national household savings that is urban is calculated as the ratio of household savings in urban areas to household savings in the entire country. For the end of the interval 0-5, the proportion of national household savings that is urban, 0.41, is obtained as:

$$0.41 = 28.2 \ / \ 68.9; \tag{47}$$

where 28.2 is household savings in urban areas and 68.9 is household savings for the entire country in year 5 (tables 65 and 67).

The proportion of national household savings that is rural, 0.59, is calculated as a complement of the relevant proportion urban:

$$0.59 = 1 - 0.41; \tag{48}$$

where 0.41 is the proportion of national household savings that is urban.

Proportions of household savings that are urban and rural over the 20-year projection period are indicated in table 57 and in figure XXI.

The proportion of total savings accounted for by urban areas is projected to increase in spite of the more rapid projected growth in average household savings in rural areas, owing to the much more rapid expected growth in the number of urban households.

E. Summary

This chapter has described the method for preparing household consumption and savings projections that uses alternative per-household demand systems that respectively treat savings as exogenous or endogenous. The method can be used to make national or urban-rural projections. As part of the description of the method, the procedures that are based on alternative demand systems have been presented. In addition, the types of inputs required by the method have been described and methods for preparing those inputs were discussed. Lastly, an example of a national projection using log-linear consumption functions of the demand system with exogenous savings has been presented. Also, an example of an urban-rural projection using linear consumption and savings functions of the demand system with endogenous savings has been described. A complete listing of the outputs that can be generated by the method is shown in box 20.

Figure XX. Proportions of household consumption that are urban and rural

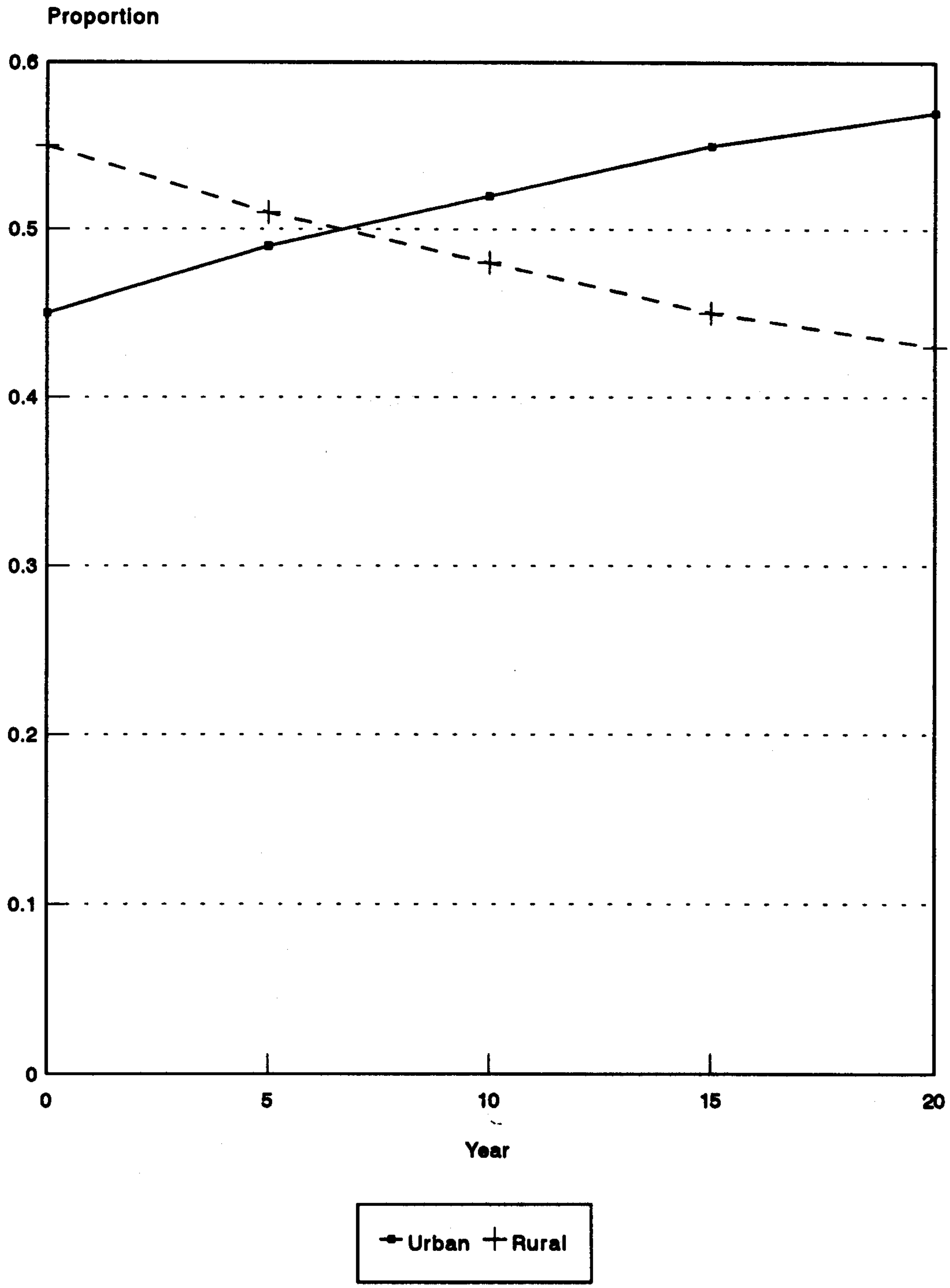
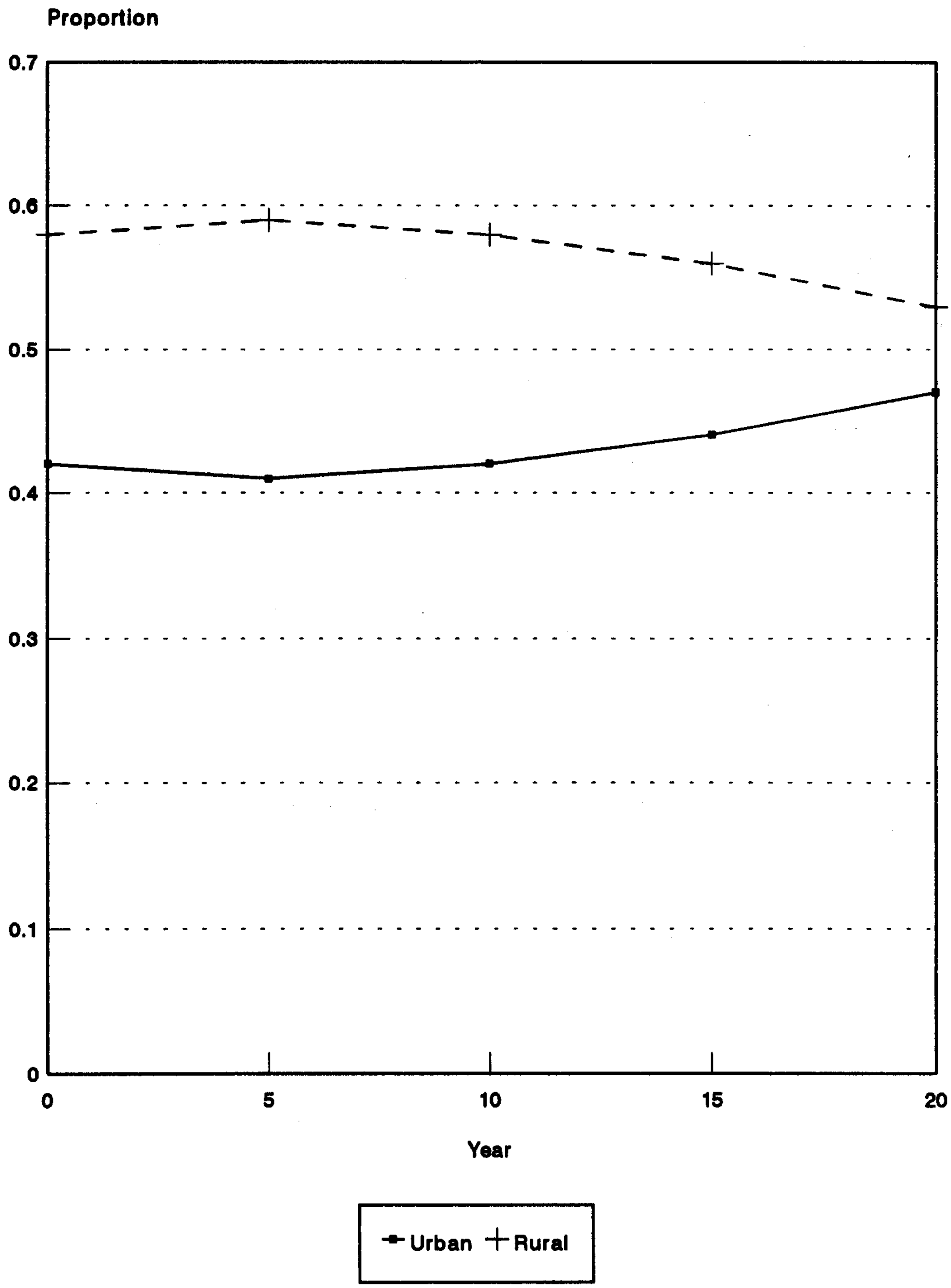


Figure XXI. Proportions of household savings that are urban and rural



Box 20

Outputs of the method for making household consumption and savings projections using per-household demand systems

1. Household consumption by commodity group and household savings (national or urban, rural and national)

2. Household consumption and savings aggregates (national or urban, rural and national)

Levels of household consumption and savings

Total consumption

Broad commodity groups

Savings

Growth in household consumption and savings

Total consumption

Broad commodity groups

Savings

3. Indicators of the spending pattern of households (national or urban, rural and national)
Proportions of disposable household income spent or saved

Broad commodity groups

Savings

4. Indicators of the rural-urban distribution of household consumption and savings (national only; if urban and rural household consumption and savings are being projected)

Proportions of total household consumption
Urban
Rural

Proportions of household savings
Urban
Rural

5. The rates of growth of household consumption and savings (national or urban, rural and national)

Total consumption
Broad commodity groups
Savings

F. Notation and equations

1. Indices, variables and special symbols

(a) List of indices

g = 1,...,G	are commodity groups
h = 1,...,H	are broad commodity groups
j	is the cluster of households
k = 1,2	are urban and rural locations
t	is the year of the projection period
t'	is the calendar year

(b) List of variables

ADHI(j)	is the average disposable household income in household cluster j
ADHI(t')	is the average disposable household income in year t'
ADHI(t+5)	is the average disposable household income at the end of the interval
AF(t+5)	is the adjustment factor applying to the preliminary levels of average household consumption by commodity group or average household savings at the end of the interval
AHC(g,j)	is the average household consumption of goods and services in commodity group g in household cluster j
AHC(g,t')	is the average household consumption of goods and services in commodity group g in year t'
AHC(g,t+5)	is the average household consumption of goods and services in commodity group g at the end of the interval
AHC*(g,t+5)	is the preliminary level of average household consumption of goods and services in commodity group g at the end of the interval

AHE(j)	is the mean average household expenditure in cluster j
AHE(t')	is the total per-household expenditure in year t'
AHE(t+5)	is the average household expenditure at the end of the interval
AHS(j)	is the average household size in household cluster j
AHS(t')	is the average household size in year t'
AHS(t+5)	is the average household size at the end of the interval
AHSV(j)	is the mean level of per-household savings in cluster j
AHSV(t')	is the level of per-household savings in year t'
AHSV(t+5)	is the average household savings at the end of the interval
AHSV*(t+5)	is the preliminary estimate of average household savings at the end of the interval
ASVR(t+5)	is the average savings ratio at the end of the interval
DHI(t+5)	is the disposable household income at the end of the interval
EGRHC	is the average annual exponential growth rate of household consumption for the interval
EGRHC(h)	is the average annual exponential growth rate of household consumption in broad commodity group h for the interval
EGRHSV	is the average annual exponential growth rate of household savings for the interval
GGRHC	is the average annual geometric growth rate of household consumption for the interval
GGRHC(h)	is the average annual geometric growth rate of household consumption in broad commodity group h for the interval
GGRHSV	is the average annual geometric growth rate of household savings for the interval

HC(g,t+5)	is the household consumption of goods and services in commodity group g at the end of the interval
HC(h,t+5)	is the household consumption of goods and services in broad commodity group h at the end of the interval
HC(k,t+5)	is the level of household consumption in location k at the end of the interval
HC(t+5)	is the household consumption at the end of the interval
HCGR	is the growth of household consumption during the interval
HCGR(h)	is the growth of household consumption in broad commodity group h during the interval
HCRUR(t+5)	is the proportion of national household consumption that is rural at the end of the interval
HCURB(t+5)	is the proportion of national household consumption that is urban at the end of the interval
HSV(k,t+5)	is household savings in location k at the end of the interval
HSV(t+5)	is household savings at the end of the interval
HSVGR	is the growth of household savings during the interval
HSVRUR(t+5)	is the proportion of national household savings that is rural at the end of the interval
HSVURB(t+5)	is the proportion of national household savings that is urban at the end of the interval
NH(t+5)	is the number of households at the end of the interval
PRHC(h,t+5)	is the proportion of disposable household income spent on consumption of goods and services in broad commodity group h at the end of the interval

PRHSV(t+5)	is the proportion of disposable household income saved at the end of the interval

(c) List of special symbols

A	is an aggregation procedure indicating the way household consumption levels by commodity groups are aggregated to obtain household consumption levels by broad commodity groups
a	is the intercept coefficient of the linear savings function in the demand system with endogenous savings. It is the slope coefficient in the multiplicative function.
a(g)	is the intercept coefficient of the linear consumption function for commodity group g. It is the slope coefficient for the multiplicative consumption functions.
a*	is the estimate of the intercept coefficient of the linear savings function in the demand system with endogenous savings. It is an estimate of the slope coefficient in the multiplicative function.
a*(g)	is the estimate of the intercept coefficient of the linear consumption function for commodity group g in the demand system. It is an estimate of the slope coefficient in the multiplicative function.
antiln	is the antilogarithm of the natural logarithm
b	is the partial coefficient of average disposable household income in the linear savings function in the demand system with endogenous savings. It is the exponent in the multiplicative function.
b(g)	is the partial coefficient of average household expenditure or average disposable household income in the linear consumption function for commodity group g. It is the exponent of average household expenditure in the multiplicative function.
b*	is the estimate of the partial coefficient of average disposable household income in the linear or savings function in the demand system with endogenous savings. It is an estimate of the exponent in the multiplicative function.

b*(g)	is the estimate of the partial coefficient of average household expenditure (or average disposable household income) in the linear consumption function for commodity group g. It is an estimate of the exponent in the multiplicative function.
c	is the partial coefficient of the household size variable in the linear or non-linear savings function in the demand system with endogenous savings
c(g)	is the partial coefficient of average household size in the linear consumption function for commodity group g. It is the exponent of average household size in the multiplicative function.
c*	is the estimate of the partial coefficient of average household size in the linear savings function in the demand system with endogenous savings. It is an estimate of the exponent in the multiplicative function.
c*(g)	is the estimate of the partial coefficient of average household size in the linear consumption function for commodity group g. It is an estimate of the exponent in the multiplicative function.
G	is the number of commodity groups
H	is the number of broad commodity groups
ln	is the natural logarithm
u(g,j)	is the random disturbance term for commodity group g in cluster j
u(j)	is the random disturbance term for cluster j
[lna(g)]*	is the estimate of the logarithm of the intercept coefficient of the log-linear consumption function for commodity group g
[lna]*	is the estimate of the logarithm of the intercept coefficient of the non-linear savings function in the demand system with endogenous savings

2. Equations

A. The technique

1. Overview

2. National level

(a) Procedure based on the demand system with exogenous savings

(i) Consumption functions

$$AHC(g,t') = a(g) + b(g) \cdot AHE(t') + c(g) \cdot AHS(t'); \qquad g = 1,\ldots,G \tag{1}$$

$$AHC(g,t') = a(g) \cdot AHE(t')^{b(g)} \cdot AHS(t')^{c(g)}; \qquad g = 1,\ldots,G \tag{2}$$

$$\ln AHC(g,t') = \ln a(g) + b(g) \cdot \ln AHE(t') + c(g) \cdot \ln AHS(t'); \qquad g = 1,\ldots,G \tag{3}$$

(ii) Average household consumption and savings

a. Average household expenditure

$$AHE(t+5) = ADHI(t+5) \cdot [\ 1- ASVR(t+5)\ ]; \tag{4}$$

b. Average household consumption by commodity group

$$AHC(g,t+5) = a^*(g) + b^*(g) \cdot AHE(t+5) + c^*(g) \cdot AHS(t+5); \qquad g = 1,\ldots,G \tag{5}$$

$$AHC^*(g,t+5) = a^*(g) \cdot AHE(t+5)^{b^*(g)} \cdot AHS(t+5)^{c^*(g)}; \qquad g = 1,\ldots,G \tag{6}$$

$$\ln AHC^*(g,t+5) = [\ln a(g)]^* + b^*(g) \cdot AHE(t+5) + c^*(g) \cdot AHS(t+5); \qquad g = 1,\ldots,G \tag{7}$$

$$AHC^*(g,t+5) = \text{antiln}[\ \ln AHC^*(g,t+5)\ ]; \tag{8}$$

$$g = 1,\ldots,G$$

c. Adjusted levels of average household consumption by commodity group

$$AF(t+5) = AHE(t+5) \,/\, [\ \sum_{g=1}^{G} AHC^*(g,t+5)\ ]; \tag{9}$$

$$AHC(g,t+5) = AHC^*(g,t+5) \cdot AF(t+5); \tag{10}$$

$$g = 1,\ldots,G$$

d. Average household savings

$$AHSV(t+5) = ADHI(t+5) - AHE(t+5); \tag{11}$$

(iii) Household consumption and savings

$$HC(g,t+5) = AHC(g,t+5) \cdot NH(t+5); \tag{12}$$

$$g = 1,\ldots,G$$

$$HSV(t+5) = AHSV(t+5) \cdot NH(t+5); \tag{13}$$

(iv) Other results

a. Household consumption and savings aggregates

i. Total household consumption

$$HC(t+5) = \sum_{g=1}^{G} HC(g,t+5); \tag{14}$$

b. Household consumption by broad commodity groups

$$HC(h,t+5) = A\ [\ HC(g,t+5)\ ]; \tag{15}$$

$$h = 1,\ldots,H$$

i. Growth in total household consumption

HCGR = HC(t+5) - HC(t); (16)

ii. Growth of household consumption by broad commodity groups

HCGR(h) = HC(h,t+5) - HC(h,t); (17)

iii. Growth in household savings

HSVGR = HSV(t+5) - HSV(t); (18)

b. Indicators of the spending patterns of households

i. Disposable household income

$$DHI(t+5) = ADHI(t+5) \cdot NH(t+5); \quad (19)$$

ii. Proportions of disposable household income spent on goods and services by broad commodity groups

$$PRHC(h,t+5) = HC(h,t+5) \; / \; DHI(t+5); \quad (20)$$

$$h = 1,\ldots,H$$

b. Proportion of total disposable income saved

PRHSV(t+5) = HSV(t+5) / DHI(t+5); (21)

c. Rates of growth of household consumption and savings

i. The rate of growth of household consumption

$$GGRHC = [\; (\; HC(t+5) \; / \; HC(t) \;)^{1/5} - 1 \;] \cdot 100; \quad (22)$$

$$EGRHC = [\; \ln \; (\; HC(t+5)/HC(t) \;) \; / \; 5 \;] \cdot 100; \quad (23)$$

ii. <u>Rates of growth of household consumption by broad commodity groups</u>

$$GGRHC(h) = [(HC(h,t+5)/HC(h,t))^{1/5} - 1] \cdot 100; \qquad (24)$$

$$h = 1,\ldots,H$$

$$EGRHC(h) = [\ln (HC(h,t+5)/HC(h,t)) / 5] \cdot 100; \qquad (25)$$

$$h = 1,\ldots,H$$

iii. <u>The rate of growth of household savings</u>

$$GGRHSV = [(HSV(t+5)/HSV(t))^{1/5} - 1] \cdot 100; \qquad (26)$$

$$EGRHSV = [\ln (HSV(t+5)/HSV(t)) / 5] \cdot 100; \qquad (27)$$

(b) <u>Procedure based on the demand system with endogenous savings</u>

(i) <u>Consumption functions</u>

$$AHC(g,t') = a(g) + b(g) \cdot ADHI(t') + c(g) \cdot AHS(t'); \qquad (28)$$

$$g = 1,\ldots,G$$

$$AHC(g,t') = a(g) \cdot ADHI(t')^{b(g)} \cdot AHS(t')^{c(g)}; \qquad (29)$$

$$g = 1,\ldots,G$$

$$\ln AHC(g,t') = \ln a(g) + b(g) \cdot \ln ADHI(t') + c(g) \cdot \ln AHS(t'); \qquad (30)$$

$$g = 1,\ldots,G$$

(ii) <u>Savings function</u>

$$AHSV(t') = a \bullet b \cdot ADHI(t') \bullet c \cdot AHS(t'); \qquad (31)$$

$$AHSV(t') = a + ADHI(t')^{b} + AHS(t')^{c}; \qquad (32)$$

$$\ln AHSV(t') = \ln a + b \cdot \ln ADHI(t') + c \cdot \ln AHS(t'); \tag{33}$$

(iii) Average household consumption and savings

a. Levels of per-household consumption by commodity group

$$AHC(g,t+5) = a^*(g) + b^*(g) \cdot ADHI(t+5) + c^*(g) \cdot AHS(t+5); \quad g = 1,\ldots,G \tag{34}$$

$$AHC^*(g,t+5) = a^*(g) \cdot ADHI(t+5)^{b^*(g)} \cdot AHS(t+5)^{c^*(g)}; \quad g = 1,\ldots,G \tag{35}$$

$$\ln AHC^*(g,t+5) = [\ln a(g)]^* + b^*(g) \cdot ADHI(t+5) + c^*(g) \cdot AHS(t+5); \quad g = 1,\ldots,G \tag{36}$$

$$AHC^*(g,t+5) = \text{antiln}[\ \ln AHC^*(g,t+5)\ ]; \quad g = 1,\ldots,G \tag{37}$$

b. The level of per-household savings

$$AHSV(t+5) = a^* + b^* \cdot ADHI(t+5) + c^* \cdot AHS(t+5); \tag{38}$$

$$AHSV^*(t+5) = a^* \cdot ADHI(t+5)^{b^*} \cdot AHS(t+5)^{c^*}; \tag{39}$$

$$\ln AHSV^*(t+5) = [\ln a]^* + b^* \cdot ADHI(t+5) + c^* \cdot AHS(t+5); \tag{40}$$

$$AHSV^*(t+5) = \text{antiln}[\ \ln AHSV^*(t+5)\ ]; \tag{41}$$

c. Levels of average household consumption by commodity group and average household savings

$$AF(t+5) = ADHI(t+5) \Big/ \left[\ \sum_{g=1}^{G} AHC^*(g,t+5) + AHSV^*(t+5)\ \right] \tag{42}$$

$$AHC(g,t+5) = AHC^*(g,t+5) \cdot AF(t+5); \qquad g = 1,\ldots,G \tag{43}$$

$$AHSV(t+5) = AHSV^*(t+5) \cdot AF(t+5); \tag{44}$$

2. Urban-rural level

(a) Procedure based on the demand systems with exogenous savings

i. Consumption functions

ii. Levels of average household consumption and savings

iii. Levels of household consumption and savings

iv. Other results

a. Proportions of national household consumption that are urban or rural

$$HCURB(t+5) = HC(1,t+5) \;/\; HC(t+5); \tag{45}$$

$$HCRUR(t+5) = 1 - HCURB(t+5); \tag{46}$$

b. Proportions of national household savings that are urban or rural

$$HSVURB(t+5) = HSV(1,t+5) \;/\; HSV(t+5); \tag{47}$$

$$HSVRUR(t+5) = 1 - HSVURB(t+5); \tag{48}$$

(b) Procedure based on the demand system with endogenous savings

i. Consumption and savings functions

ii. Levels of average household consumption and savings

iii. Levels of household consumption and savings and other results

B. The inputs

1. Types of inputs required

2. Preparation of the inputs

(a) Assumptions on the average savings ratio

(b) Estimates of functions of alternative demand systems

(i) Cross-sectional data

(ii) Procedures to estimate alternative demand systems

a. Demand system with exogenous savings

$$AHC(g,j) = a(g) + b(g) \cdot AHE(j) + c(g) \cdot AHS(j) + u(g,j); \quad g = 1,\ldots,G \tag{49}$$

$$\ln AHC(g,j) = \ln a(g) + b(g) \cdot \ln AHE(j) + c(g) \cdot \ln AHS(j) + u(g,j); \quad g = 1,\ldots,G \tag{50}$$

$$a^*(g) = \text{antiln}\ [\ln a(g)]^*; \quad g = 1, \ldots, G \tag{51}$$

b. Demand system with endogenous savings

i. Consumption functions

$$AHC(g,j) = a(g) + b(g) \cdot ADHI(j) + c(g) \cdot AHS(j) + u(g,j); \quad g = 1,\ldots,G \tag{52}$$

$$\ln AHC(g,j) = \ln a(g) + b(g) \cdot \ln ADHI(j) + c(g) \cdot \ln AHS(j) + u(j); \quad g = 1,\ldots,G \tag{53}$$

$$a^*(g) = \text{antiln}\ [\ln a(g)]^*; \quad g = 1, \ldots, G \tag{54}$$

ii. Savings function

$$AHSV(j) = a + b \cdot ADHI(j) + c \cdot AHS(j) + u(j); \tag{55}$$

$$\ln AHSV(j) = \ln a + b \cdot \ln ADHI(j) + c \cdot \ln AHS(j) + u(j); \tag{56}$$

$$a^{*} = \text{antiln}\ [\ln a]^{*}; \tag{57}$$

Notes

1/ Consumption functions built into the Kelley model (Kelley, 1969), which refer to urban and rural areas, express average per-family demands for various commodities as functions of the total per-family consumption expenditure and average family size.

2/ Where the projection of household consumption and savings is prepared using the demand system with exogenous savings, the proportion of disposable income saved at the end of a given projection interval equals the level of the average savings ratio assumed for that date.

3/ Consumption functions built into the Bachue-Philippines model (Rodgers, 1978), which are for urban and rural areas, express average per-household consumption for the various commodity groups as functions of average total per-household expenditure and average numbers of children and adults in the household. Savings functions of the Bachue-Philippines model, which are also for urban and rural areas, make average per-household savings a function of average per-household disposable income and average numbers of children and adults in the household.

4/ The projected number of households used as an input into illustrative projections are expressed in units of one thousand households. The products of the levels of per-household consumption and savings, on the one hand, and the number of households in thousands, on the other, are divided by one thousand. As a result, levels of household consumption and savings and of various household consumption and savings aggregates in these illustrative examples are given in millions of local currency units.

5/ Numbers rounded to nearest decimal.

Annex

PROCEDURES TO CALIBRATE PER-HOUSEHOLD DEMAND SYSTEMS WITH EXOGENOUS AND ENDOGENOUS SAVINGS

The user of the method may wish to adjust the estimated functions so that they will accurately project levels of average household consumption and, where appropriate, levels of average household savings for a given historical year or time period using the observations for explanatory variables for that year or period. Depending on the demand system selected, those variables would be average household expenditure or average disposable household income, as well as average household size. These adjustments, which are normally referred to as calibration, may be employed, for example, where household consumption (and savings) projections need to be consistent with household consumption (and savings) data coming from the national accounts or a social accounting matrix for a given year or time period.

Calibrating consumption and savings functions may involve adjustments in estimates of the intercept coefficients of the functions, or in estimates of the partial coefficients or both. Since adjustments in the intercept coefficients are more straightforward than those in the partial coefficients, calibration may often be restricted to intercepts. Moreover, in the case of linear functions, one may wish to restrict calibration to estimates of the intercept coefficients so that the adding-up property that those coefficients possess is retained. Therefore, this annex describes how the intercept coefficients of the functions of alternative per-household demand systems can be calibrated by first describing calibration procedures and then selectively illustrating their application.

A. The procedure

The principles of adjusting intercept coefficients of consumption or savings functions are the same irrespective of whether those functions are linear, multiplicative or log-linear. The steps use the estimates of the partial coefficients of the functions, as well as observations on levels of average household consumption or average household savings, and observations on explanatory variables for the selected year or time period. Depending on the demand system used, the explanatory variables may be average household expenditure or average disposable household income and average household size. The actual steps involved in adjusting the intercepts vary, however, depending on the type of functions estimated and used in the projections, as well as whether those functions are for the entire country or for urban and rural areas.

1. National level

This section initially describes procedures as they apply to functions estimated for the entire country, first to those of the demand system with exogenous savings and then to those of the demand system with endogenous savings. Subsequently, procedures applicable to the urban-rural level are be explained.

(a) Demand system with exogenous savings

The procedure used to obtain adjusted intercepts of consumption functions of the demand system with exogenous savings will vary depending on whether the functions are linear, multiplicative or log-linear.

Linear. In the case of linear functions, the adjustments in the intercept coefficients can be obtained using the relevant observations for a given year as follows:

$$[a*(g)]' = AHC(g,t') - [\ b*(g) \cdot AHE(t') + c*(g) \cdot AHS(t')\ ]; \qquad (1)$$

$$g = 1,\ldots,G,$$

where:

$g = 1,\ldots,G$	are commodity groups,
G	is the number of commodity groups,
t'	is the given calendar year,
AHC(g,t')	is the observed average household consumption for commodity group g in year t',
AHE(t')	is the observed average household expenditure in year t',
AHS(t')	is the observed average household size in year t',
[a*(g)]'	is the adjusted intercept coefficient of the linear consumption function for commodity group g in the demand system with exogenous savings,
b*(g)	is the estimate of the partial coefficient of the average household expenditure in the linear consumption function for commodity group g in the demand system with exogenous savings, and
c*(g)	is the estimate of the partial coefficient of the household size variable in the linear consumption function for commodity group g in the demand system with exogenous savings.

Multiplicative. In the case of multiplicative functions having the multiplicative form, adjusted intercepts can be obtained as follows:

$$[a*(g)]' = AHC(g,t') \ /\ [\ AHE(t')^{b*(g)} \cdot AHS(t')^{c*(g)}\ ]; \qquad (2)$$

$$g = 1,\ldots,G,$$

where:

[a*(g)]'	is the adjusted slope coefficient of the multiplicative consumption function for commodity group g in the demand system with exogenous savings,
b*(g)	is the estimate of the exponent of the average household expenditure in the multiplicative consumption function for commodity group g in the demand system with exogenous savings, and
c*(g)	is the estimate of the exponent of average household size in the multiplicative consumption function for commodity group g in the demand system with exogenous savings.

Log-linear. If adjusted intercepts of log-linear functions are needed, they can be obtained as follows:

$$[[\ln a(g)]^*]' = \ln AHC(t') - [\ b^*(g) \cdot \ln AHE(t') + c^*(g) \cdot \ln AHS(t')\ ]; \quad (3)$$

$$g = 1,\ldots,G,$$

where:

ln	is the natural logarithm, and
[[lna(g)]*]'	is the adjusted logarithm of the intercept coefficient of the log-linear consumption function for commodity group g in the demand system with exogenous savings.

If the user of the method wishes to perform adjustments in intercept coefficients using data for a few or several years rather than a single year, the adjustments can also be made using relevant expressions shown in equations (1) through (3). In that instance, the observed levels of average household consumption by commodity group and average household expenditure and average household size would be mean values of the observations for those variables for several years centred on one particular year, t'.

(b) Demand system with endogenous savings

Initially, the procedure to calibrate consumption functions of the demand system with endogenous savings is described. Then, the calibration procedure applicable to the savings functions of this system is discussed.

(i) Consumption functions

The procedure for calculating adjusted intercept coefficients of consumption functions of the demand system with endogenous savings will depend on the specification of those functions.

Linear. In the case of linear consumption functions, the adjustments in the intercept coefficients can be obtained as follows:

$$[a^*(g)]' = AHC(g,t') - [\ b^*(g) \cdot ADHI(t') + c^*(g) \cdot AHS(t')\ ]; \qquad (4)$$

$$g = 1,\ldots,G,$$

where:

ADHI(t')	is the observed average household disposable household income in year t',
[a*(g)]'	is the adjusted intercept coefficient of the linear consumption function for commodity group g in the demand system with endogenous savings,
b*(g)	is the estimate of the partial coefficient of average disposable household income in the linear consumption function for commodity group g in the demand system with endogenous savings, and
c*(g)	is the estimate of the partial coefficient of average household size in the linear consumption function for commodity group g in the demand system with endogenous savings.

Multiplicative. In the case of consumption functions having the multiplicative form, adjusted intercepts can be obtained as:

$$[a^*(g)]' = AHC(g,t') \ / \ [\ ADHI(t')^{b^*(g)} \cdot AHS(t')^{c^*(g)}\ ]; \qquad (5)$$

$$g = 1,\ldots,G,$$

where:

[a*(g)]'	is the adjusted slope coefficient of the non-linear consumption function for commodity group g in the demand system with endogenous savings,
b*(g)	is the estimate of the exponent of average disposable income in the multiplicative consumption function for commodity group g in the demand system with endogenous savings, and
c*(g)	is the estimate of the exponent of average household size in the multiplicative consumption function for commodity group g in the demand system with endogenous savings.

Log-linear. If adjusted intercepts of log-linear consumption functions are needed, they can be obtained as follows:

$$[[\ln a(g)]^*]' = \ln AHC(t') - [\ b^*(g) \cdot \ln ADHI(t') + c^*(g) \cdot \ln AHS(t')\ ]; \quad g = 1,\ldots,G, \tag{6}$$

where:

$[[\ln a(g)]^*]'$ is the adjusted logarithm of the intercept coefficient of the log-linear consumption function for commodity group g in the demand system with endogenous savings.

(ii) Savings functions

The procedure to obtain the adjusted intercept of the savings function of the demand system with endogenous savings is analogous to that of deriving adjusted intercept coefficients of the consumption functions of this system.

Linear. In the case of the linear savings function, the adjustment in the intercept coefficient can be obtained as follows:

$$[a^*]' = AHSV(t') - [\ b^* \cdot ADHI(t') + c^* \cdot AHS(t')\ ]; \tag{7}$$

where:

$AHSV(t')$ is the observed average household savings in year t',

$[a^*]'$ is the adjusted intercept coefficient of the linear savings function in the demand system with endogenous savings,

b^* is the estimate of the partial coefficient of average disposable income in the linear savings function in the demand system with endogenous savings, and

c^* is the estimate of the partial coefficient of average household size in the linear savings function in the demand system with endogenous savings.

Multiplicative. In the case of a savings function that has the multiplicative form, the adjusted intercept can be obtained as:

$$[a^*]' = AHSV(t') \ /\ [\ ADHI(t')^{b^*} \cdot AHS(t')^{c^*}\ ]; \tag{8}$$

where:

[a*]' is the adjusted slope coefficient of the non-linear savings function in the demand system with endogenous savings,

b* is the estimate of the exponent of average disposable income in the multiplicative savings function in the demand system with endogenous savings, and

c* is the estimate of the exponent of average household size in the multiplicative savings function in the demand system with endogenous savings.

Log-linear. If the adjusted intercept of the log-linear savings function is required, it can be obtained as follows:

$$[[\ln a]^*]' = \ln AHC(t') - [\ b^* \cdot \ln ADHI(t') + c^* \cdot \ln AHS(t')\ ]; \qquad (9)$$

where:

[[lna]*]' is the adjusted logarithm of the intercept coefficient of the log-linear savings function in the demand system with endogenous savings.

To adjust the intercept coefficients of the consumption and savings functions of the demand system with endogenous savings using data for a few or several years rather than a single year, it is possible to use relevant expressions shown in equations (4) through (9). In that instance, the relevant observations would be mean values of the observations for levels of average household consumption and average household savings along with observations for average household disposable income and average household size.

2. Urban-rural level

After estimating the functions of the demand system chosen to prepare projections for urban and rural areas, the intercept coefficients of those functions could be adjusted. In doing so, it would be necessary to use the estimates of the partial coefficients of the functions along with observations on levels of average household consumption by commodity group (and levels of average household savings, where appropriate), as well as observations on the relevant explanatory variables for a given year or time period. Depending on the type of the demand system chosen, the calculations of adjustments would involve only consumption functions or both consumption and savings functions.

(a) Demand system with exogenous savings

The procedure suitable for calibrating consumption functions of the demand system with exogenous savings for urban and rural areas would include steps that are urban-rural equivalents of those described above, using equations (1) through (3).

(b) Demand system with endogenous savings

The procedure appropriate for calibrating consumption and savings functions of the demand system with endogenous savings for urban and rural areas would be an urban-rural counterpart of the procedure described above, using equations (4) through (9).

B. Illustrative examples of calibration

The examples presented below do not attempt to exhaustively illustrate the procedure for calibrating functions of alternative demand systems for the entire country and urban and rural areas. Rather they show how to calibrate the functions that were employed in chapter X in order to illustrate their use in preparing household consumption and savings projections. In particular, the first example shows how to adjust the intercept coefficients for log-linear consumption functions of the demand system with exogenous savings for the entire country. The second example indicates the way to adjust intercepts for linear consumption and savings functions of the demand system with endogenous savings for urban and rural areas.

1. National level

This example indicates how to calibrate the estimates of the log-linear consumption functions shown in table 37 (chapter X) using, among other things, the estimated partial coefficients of those functions. Also, used in this example are hypothetical mean values of average household consumption, along with hypothetical values of average household expenditure and average household size. It is assumed that those values refer to a year that precedes by two years the initial year of the projection (year 0) and is therefore referred to as year -2. (The values of the relevant variables may refer to any suitable year or a longer period preceding the initial year.)

Table 68 illustrates the calculation of adjusted intercepts of the functions in question. The adjusted intercept coefficient (column 7) for each commodity group is obtained as the difference between the logarithm of the observed level of average household consumption in year -2 (column 6) and the sum of two products. The first product is obtained by multiplying the estimated average household expenditure coefficient for the commodity group in question (column 2) by the logarithm of the average household expenditure in year -2 (column 4). The second product is the result of multiplying the average household size coefficient for the commodity group (column 3) by the logarithm of the average household size in year -2 (column 5).

Thus, the adjusted intercept in the function for food, 0.08171, is obtained as follows:

$$0.08171 = \ln(103.9) - [(0.85094) \cdot (\ln(177.5)) + (0.08103) \cdot (\ln(6.75))], \quad (2)$$

Table 68. Computing adjusted intercept coefficients for selected log-linear consumption functions of the demand system with exogenous savings for the entire country using data for a selected year

Commodity group	Estimates of partial coefficients: Total expenditure coefficient a/	Estimates of partial coefficients: Household size coefficient b/	Average per-household total expenditure in year -2 c/ (in LCUs) e/	Average household size in year -2 c/	Average household consumption in year -2 c/	Adjusted intercept coefficient d/
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Food	0.85094	0.08103	177.5	6.75	103.9	0.08171
Clothing	1.33373	0.05102	177.5	6.75	14.7	-4.31692
Housing	1.74544	-0.65227	177.5	6.75	6.6	-5.90697
Fuel and light	0.46408	0.12863	177.5	6.75	15.1	0.06561
Durables	2.08854	-0.30735	177.5	6.75	11.5	-7.78724
Transportation	1.07696	0.13423	177.5	6.75	2.7	-4.84061
Personal care	1.06207	-0.06628	177.5	6.75	5.6	-3.65109
Recreation	1.22101	-0.03213	177.5	6.75	10.3	-3.93007
Other services	1.50331	-0.06563	177.5	6.75	7.1	-5.70018

a/ From table 37, col. 3.
b/ From table 37, col. 4.
c/ Referred to in text.
d/ (ln(col. 6)) - ((col. 2) . (ln(col. 4)) + (col. 3) . (ln(col. 5)).
e/ Local currency units.

where 103.9 is the level of average household consumption of food in year -2, while 0.85094 is the estimate of the average household expenditure coefficient for food and 177.5 is the average household expenditure in year -2; 0.08103 is the estimate of the average household size coefficient for food and 6.75 is the average household size in year -2.

1. Urban-rural level

This example shows how to calibrate estimates of linear consumption and savings functions of the demand system with endogenous savings for urban and rural areas, which were shown in tables 47 and 48 (chapter X). To derive adjusted intercepts for these functions, the estimates of the partial coefficients of those functions will be used along with the hypothetical values of the levels of average household consumption and savings and the hypothetical values of average household disposable income and average household size for year/-2.

Tables 69 and 70 illustrate calculations of the adjusted intercepts for the functions in question. The adjusted intercept coefficient (column 7) for each commodity group or savings for either location is obtained as the difference between the average household consumption for the group for year -2 or average household savings for the same year in that location (column 6) and the sum of two products. The first product is obtained by multiplying the estimated average disposable household income coefficient for the commodity group in question (or savings) (column 2) by the mean value of the average disposable household income in year -2 in the location in question (column 4). The second product is the result of multiplying the average household size coefficient for the commodity group concerned (or savings) (column 3) by the value of the average household size in year -2 (column 5).

For example, the adjusted intercept coefficient in the consumption function for food in the urban areas, 34.08062, is obtained as follows:

$$34.08062 = 146.3 - [\ (0.33721\ ) \cdot (307.3) + (1.36859) \cdot (6.28)\ ],$$

where 146.3 is the average urban household consumption in year -2, while 0.33721 is the estimate of the average disposable household income coefficient for food and 307.3 is the mean value of the average urban disposable household income in year -2; 1.36859 is the estimate of the average household size coefficient for food for the urban areas and 6.28 is the average urban household size in year -2.

C. Notation and equations

1. Indices, variables and special symbols

(a) List of indices

$g = 1,\ldots,G$	are commodity groups
t'	is the given calendar year

Table 69. Computing adjusted intercept coefficients for selected linear consumption and savings functions of the demand system with endogenous savings for urban areas using data for a selected year

Commodity group/ savings	Estimates of partial coefficients: Disposable income coefficient a/	Estimates of partial coefficients: Household size coefficient b/	Average disposable household income in year -2 c/	Average household size in year -2 c/	Average household consumption and savings in year -2 c/	Adjusted intercept coefficient d/
			(in LCUs) e/			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Food	0.33721	1.36859	307.3	6.28	146.3	34.08062
Clothing	0.06946	0.26599	307.3	6.28	23.3	0.28452
Housing	0.03978	-0.88636	307.3	6.28	8.9	2.24194
Fuel and light	0.01237	0.35948	307.3	6.28	20.8	14.74116
Durables	0.12418	-1.59126	307.3	6.28	22.8	-5.36740
Transportation	0.01320	-0.02436	307.3	6.28	4.0	0.09662
Personal care	0.02127	-0.03624	307.3	6.28	7.4	1.09131
Recreation	0.04781	-0.23879	307.3	6.28	18.1	4.90758
Other services	0.05283	-0.56668	307.3	6.28	12.4	-0.27590
Savings	0.28188	1.34961	307.3	6.28	43.3	-51.79727

a/ From table 47, col. 3.
b/ From table 47, col. 4.
c/ Referred to in text.
d/ (col. 6) - ((col. 2) . (col. 4) + col. 3) . (col. 5)).
e/ Local currency units.

Table 70. Computing adjusted intercept coefficients for selected linear consumption and savings functions of the demand system with endogenous savings for rural areas using data for a selected year

Commodity group/ savings	Estimates of partial coefficients: Disposable income coefficient a/	Estimates of partial coefficients: Household size coefficient b/	Average disposable household income in year -2 c/ (in LCUs) e/	Average household size in year -2 c/	Average household consumption and savings in year -2 c/	Adjusted intercept coefficient d/
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Food	0.34160	2.10492	164.7	6.94	86.3	15.43033
Clothing	0.07514	0.43491	164.7	6.94	11.1	-4.29383
Housing	0.09228	-0.87302	164.7	6.94	5.7	-3.43975
Fuel and light	0.02704	0.39781	164.7	6.94	12.8	5.58571
Durables	0.06095	-0.01737	164.7	6.94	6.9	-3.01791
Transportation	0.02034	-0.11082	164.7	6.94	2.1	-0.48090
Personal care	0.02325	-0.04822	164.7	6.94	4.8	1.30537
Recreation	0.02854	0.17195	164.7	6.94	7.1	1.20612
Other services	0.03718	-0.11941	164.7	6.94	4.9	-0.39484
Savings	0.29368	-2.03719	164.7	6.94	23.0	-11.23099

a/ From table 48, col. 3.
b/ From table 48, col. 4.
c/ Referred to in text.
d/ (col. 6) - ((col. 2) . (col. 4) + (col. 3) . (col. 5)).
e/ Local currency units.

(b) List of variables

AHS(t')	is the observed average household size in year t'
AHC(g,t')	is the observed average household consumption in commodity group g in year t'
ADHI(t')	is the observed average disposable household income in year t'
AHSV(t')	is the observed average household savings in year t'
AHE(t')	is the observed average household expenditure in year t'

(c) Special symbols

b*	is the estimate of the partial coefficient of average disposable household income in the linear savings function in the demand system with endogenous savings. It is the estimate of the exponent in the multiplicative savings function.
b*(g)	is the estimate of the partial coefficient of the average household expenditure (or average disposable household income) in the consumption function for commodity group g. In the multiplicative functions it is an estimate of the exponent.
e*	is the estimate of the partial coefficient of average household size in the linear savings function. It is the estimate of the exponent of average household size in the multiplicative functions.
c*(g)	is the estimate of the partial coefficient of average household size in the linear consumption function for commodity group g. In the multiplicative function it is an estimate of the exponent.
G	is the number of commodity groups
ln	is the natural logarithm
[a*(g)]'	is the adjusted intercept coefficient of the linear consumption function for commodity group g. In the multiplicative function it is the adjusted coefficient.

[a*]' is the adjusted intercept coefficient of the linear savings function in the demand system with endogenous savings. It is the adjusted slope coefficient in the multiplicative function.

[[lna(g)]*]' is the adjusted logarithm of the intercept coefficient of the log-linear consumption function for commodity group g

[[lna]*]' is the adjusted logarithm of the intercept coefficient of the non-linear savings function in the demand system with endogenous savings

2. List of equations

The procedure

1. National level

(a) Demand system with exogenous savings

$$[a*(g)]' = AHC(g,t') - [\ b*(g) \cdot AHE(t') + c*(g) \cdot AHS(t')\ ]; \quad (1)$$

$$g = 1,\ldots,G$$

$$[a*(g)]' = AHC(g,t') / [\ AHE(t')^{b*(g)} \cdot AHS(t')^{c*(g)}\ ]; \quad (2)$$

$$g = 1,\ldots,G$$

$$[[lna(g)]*]' = lnAHC(t') - [\ b*(g) \cdot lnAHE(t') + c*(g) \cdot lnAHS(t')\ ]; \quad (3)$$

$$g = 1,\ldots,G$$

(b) Demand system with endogenous savings

(i) Consumption functions

$$[a*(g)]' = AHC(g,t') - [\ b*(g) \cdot ADHI(t') + c*(g) \cdot AHS(t')\ ]; \quad (4)$$

$$g = 1,\ldots,G$$

$$[a*(g)]' = AHC(g,t') / [\ ADHI(t')^{b*(g)} \cdot AHS(t')^{c*(g)}\ ]; \quad (5)$$

$$g = 1,\ldots,G$$

$$[[lna(g)]*]' = lnAHC(t') - [\ b*(g) \cdot lnADHI(t') + \quad (6)$$

$$c*(g) \cdot lnAHS(t')\ ];$$

$$g = 1,\ldots,G$$

(ii) Savings functions

$$[a*]' = AHSV(t') - [\ b* \cdot ADHI(t') + c* \cdot AHS(t')\ ]; \qquad (7)$$

$$[a*]' = AHSV(t') \ / \ [\ ADHI(t')^{b*} \cdot AHS(t')^{c*}\ ]; \qquad (8)$$

$$[[\ln a]*]' = \ln AHC(t') - [\ b* \cdot \ln ADHI(t') + c* \cdot \ln AHS(t')\ ]; \qquad (9)$$

2. Urban-rural level

(a) Demand system with exogenous savings

(b) Demand system with endogenous savings

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XI. MAKING PROJECTIONS OF HOUSEHOLD CONSUMPTION AND SAVINGS USING LINEAR EXPENDITURE SYSTEMS

A. Introduction

This chapter describes a technique for making projections of household consumption and savings at the national or urban-rural level employing either of two alternative linear expenditure systems.[1] One system is the linear expenditure system (Stone, 1954), which will be referred to as LES. The other is the extended linear expenditure system (Lluch and others, 1977), which will be referred to as ELES. These two demand systems are briefly described in annexes I and II.

Both LES and ELES postulate that household spending decisions are made on a per capita basis. In particular, LES assumes that decisions relating to the allocation of household resources available for consumption among different commodities is a function of the per capita household total expenditure and commodity prices faced by the household. ELES postulates that household decisions relating to the allocation of total household resources among alternative commodities, as well as household savings, depends on per capita disposable household income and commodity prices.

This chapter will describe variants of LES and ELES which are based on the assumption of fixed commodity prices. They can be used in preparing projections of household consumption and savings in situations where relative prices (box 21) remain unchanged. As indicated in annexes I and II, LES and ELES, under the assumption of fixed prices, are special formulations of the demand systems, which in their general form allow for the effects of both household resources and commodity prices in determining the consumption and savings behaviour of the household.

Like the demand systems described earlier (chap. X), the LES and ELES demand systems differ from each other in the way they treat household savings. In LES, total household expenditure is exogenous and so are household savings. Therefore, when LES is used to project household consumption and savings, the inputs must include assumptions on the average savings ratio. In ELES, total household expenditure and household savings are both endogenous (although the sum of expenditure and savings is exogenous). Thus, if a projection is made using ELES, household savings are obtained in the course of the projection.

Box 21

Glossary

<u>General equilibrium model</u>

A type of quantitative economic model that considers an economic system as a whole and involves the simultaneous determination of all prices and quantities of all goods and services in the system.

<u>Proxy</u> (variable)

A variable used in regression analysis to represent a theoretically more satisfactory variable in cases where either data are not available on the latter or the latter is unobservable (e. g., "desired" level of consumption).

<u>Relative price</u>

A price of a commodity expressed in terms of the quantity of some other commodity that has to be given up. Thus, if all prices were to increase at the same rate, absolute prices would rise but relative prices would remain unchanged.

The assumption of fixed relative prices is useful in many planning contexts. Because assumptions on changes in relative prices over time are normally very speculative, in most cases, relative prices should be projected in the context of a multisectoral <u>general equilibrium model</u>. Therefore, projections of household consumption and/or savings are generally prepared using the assumption of fixed relative prices.[2/]

The assumption of fixed relative prices, a seeming weakness of this method, may actually be a strength because it enables the user to prepare projections without having to make speculative assumptions on future trends in those prices. If, however, major shifts in relative prices are expected, (e.g., over longer time periods), variants of LES and ELES that assume variable prices are recommended.

Another reason for exercising caution in preparing long-term projections with this method is that for certain commodity groups there might be a systematic relationship (positive or negative) between the size of the coefficients of LES or ELES expenditure functions, on the one hand, and the level of per capita total household expenditure or per capita disposable household income, on the other (Lluch and others, 1977). Therefore, if major increases in per capita household expenditure or per capita disposable income are anticipated over the long run, it may be prudent to restrict projections to the medium run in order to avoid biases in projections that could otherwise result from the fact that a fixed set of partial coefficients of the expenditure functions are used over the entire projection period.

A variety of factors, other than income and prices, may have an important influence on consumer behaviour. Among such factors are the size and composition of households, age of the household head, location of residence and socio-economic class (or group) of household. In spite of the potential significance of each of those factors, this method explicitly takes into account only the effect of the location of residence. The differences among urban and rural consumption and savings patterns can be explicitly taken into account by preparing separate projections for urban and rural locations. The influence of the other factors cannot be taken into account explicitly owing to the fact that expenditure functions of LES and ELES do not include measures of those factors or their *proxies* as explanatory variables.

Unlike the functions described in chapter X, which can have linear or non-linear specifications, the functions of the LES and ELES demand systems must be linear. As a result, those functions possess the adding-up property, which ensures that the projected levels of per capita consumption for each commodity group will addup to the level of per capita total expenditures.

The LES and ELES expenditure functions can be estimated using time series or cross-section data. However, owing to the limited availability of time series information in many developing countries, planners in those countries may have no choice but to use cross-section data. This may be an advantage or a disadvantage, depending on whether or not one wishes to make the assumption of constant relative prices.

B. The technique

This section will describe in general terms the technique for projecting consumption using the LES demand system and consumption and savings using the ELES demand system. After presenting an overview, the technique for making a national projection will be described. Finally, the technique for making urban and rural projections will be presented.

1. Overview

This overview will enumerate the inputs required to apply the method, indicate the type of outputs that can be generated and outline the computational steps involved in preparing household consumption and savings projections. These steps are basically the same for both national level and rural-urban projections.

(a) Inputs

To project household consumption and savings, the following inputs are required:

(i) Projected per capita disposable household income;
(ii) Projected population size;
(iii) Estimates of the coefficients of the expenditure functions by commodity group.

In addition, if the projection is to be based on LES, the inputs should also include:

(iv) Assumptions on the average household savings ratio.

The inputs are listed in box 22.

If a national projection is sought, those inputs should refer to the entire country. If a projection for urban and rural areas is desired, corresponding inputs would need to be provided for urban and rural locations.

This method will be described in the context of preparing quinquennial projections. In view of this, projections of per capita disposable household income and population size for dates five years apart would be needed. In addition, if the projection is to utilize assumptions on the average savings ratio, those assumptions should refer to those same dates. Given appropriate annual inputs, however, the technique could also be used for preparing annual projections.

(b) Outputs

For national as well as urban-rural projections, the method can be used to generate the following outputs:

(i) Levels of per capita household consumption by commodity group, and per capita household savings;

(ii) Levels of household consumption by commodity group and household savings;

(iii) Various household consumption and savings aggregates, such as the level of total household consumption and levels of household consumption by broad commodity group;

(iv) Indicators of the spending pattern of households, such as proportions of total disposable household income spent on commodities of different groups or saved;

(v) Rates of change of household consumption or savings, including that of total household consumption and savings.

Box 22

Inputs for preparing projections of household consumption
and savings using the linear expenditure system
or the extended linear expenditure system

1. Per capita disposable household income (national or urban and rural)

2. Population size (national or urban and rural)

3. Estimates of expenditure functions (national or urban and and rural)

either

Coefficients of expenditure functions of the linear expenditure system

or

Coefficients of expenditure functions of the extended linear expenditure system

4. Assumptions on the average household savings ratio (national or urban and rural; if the linear expenditure system is used)

If the technique is used to prepare projections for urban and rural areas, the results would include all those listed under (i) through (v), for urban and rural areas separately as well as for the entire country. In addition, they would include indicators of the urban-rural distribution of household consumption and savings. The types of outputs that can be produced with this method are presented in box 23.

(c) Computational steps

For any given projection date, the first step in making the projection is to calculate levels of per capita household consumption by commodity group and per capita household savings. If household savings are exogenous, those levels are obtained for a particular date as follows: first, the level of per capita total household expenditure is obtained as a product of the per capita disposable household income and the complement of the assumed average savings ratio for that date; secondly, the levels of household consumption by commodity group are

Box 23

Types of outputs derived from projections of household consumption and savings using the linear expenditure system or the extended linear expenditure system

1. Levels of per capita household consumption by commodity group and per capita household savings (national or urban, rural and national)

2. Levels of household consumption by commodity group and household savings (national or urban, rural and national)

3. Household consumption and savings aggregates (national or urban,rural and national)

   Levels of total household consumption, household consumption by broad commodity group and household savings

   Growth in total household consumption, household consumption by broad commodity group and household savings

4. Indicators of the spending pattern of households (national or urban, rural and national)

   Proportions of disposable household income spent on goods and services in broad commodity groups or saved

5. Indicators of the urban-rural distribution of total household consumption and savings (national only, if urban and rural household consumption and savings are being projected)

   Proportions of total household consumption and savings in different locations

6. Rates of growth of household consumption and savings (national or urban, rural and national)

   Rates of growth in total household consumption, household consumption by broad commodity groups and household savings

obtained by evaluating the LES expenditure functions using the per capita total expenditure obtained for that date. Finally, projected per capita savings are calculated as the difference between per capita disposable household income and per capita total household expenditure.

If household savings are endogenous, those results are obtained as follows. First, the levels of per capita household consumption by commodity group are obtained by evaluating the ELES expenditure functions using the projected level of per capita disposable household income. Projected per capita savings are obtained as the difference between per capita disposable household income and the sum of the projected levels of per capita consumption for different commodity groups.

This method can be used to calculate other results, including levels of household consumption by commodity group and the level of total household savings. Those levels can be obtained by multiplying the projected population size by the levels of per capita household consumption (disaggregated by commodity group) and per capita household savings, respectively. The method also includes steps to obtain various aggregates, such as the level of total household consumption, indicators of the spending pattern of households and rates of increase of various household consumption and savings aggregates.

2. National level

This section will describe two closely related procedures for projecting household consumption and savings at the national level. It will first describe a procedure that uses the linear expenditure system, which requires assumptions on the average household savings ratio. It will then introduce a procedure that employs the extended linear expenditure system, in which household savings are endogenous.

(a) Procedure based on the linear expenditure system

This section will initially introduce expenditure functions of the linear expenditure system. Then it will describe the steps required to derive levels of per capita household consumption by commodity group and the level of per capita household savings. The section will also describe the steps needed to derive other results. A summary of those steps is shown in box 24 and some steps are indicated in figure XXII.

(i) Expenditure functions

The linear expenditure system postulates that the level of per capita household consumption for each commodity group is a linear function of the level of per capita total household expenditure. Therefore, this system consists of the following functions:

$$PCC(g,t') = a(g) + b(g) \cdot PCTHE(t'); \qquad (1)$$

$$g = 1,\ldots,G,$$

Box 24

Computational steps to project household consumption and savings at the national level using the linear expenditure system

The steps used to project household consumption and savings at the national level over a five-year projection interval with the linear expenditure system are as follows:

1. For the end of the projection interval, compute per capita total household expenditure as a product of per capita disposable household income and the complement of the average household savings ratio.

2. Derive projected levels of per capita household consumption by commodity group at the end of the interval by evaluating empirically estimated expenditure functions using the projected level of per capita total household expenditure.

3. Derive the level of per capita household savings as the difference between the per capita disposable household income and the per capita total expenditure obtained in step 1.

4. Calculate levels of household consumption for each commodity group and the level of household savings as the product of the population size multiplied by the levels of per capita household consumption obtained in step 2 and the level of per capita household savings derived in step 3, respectively.

5. Calculate various household consumption and savings aggregates, such as total household consumption and the increase in total household consumption.

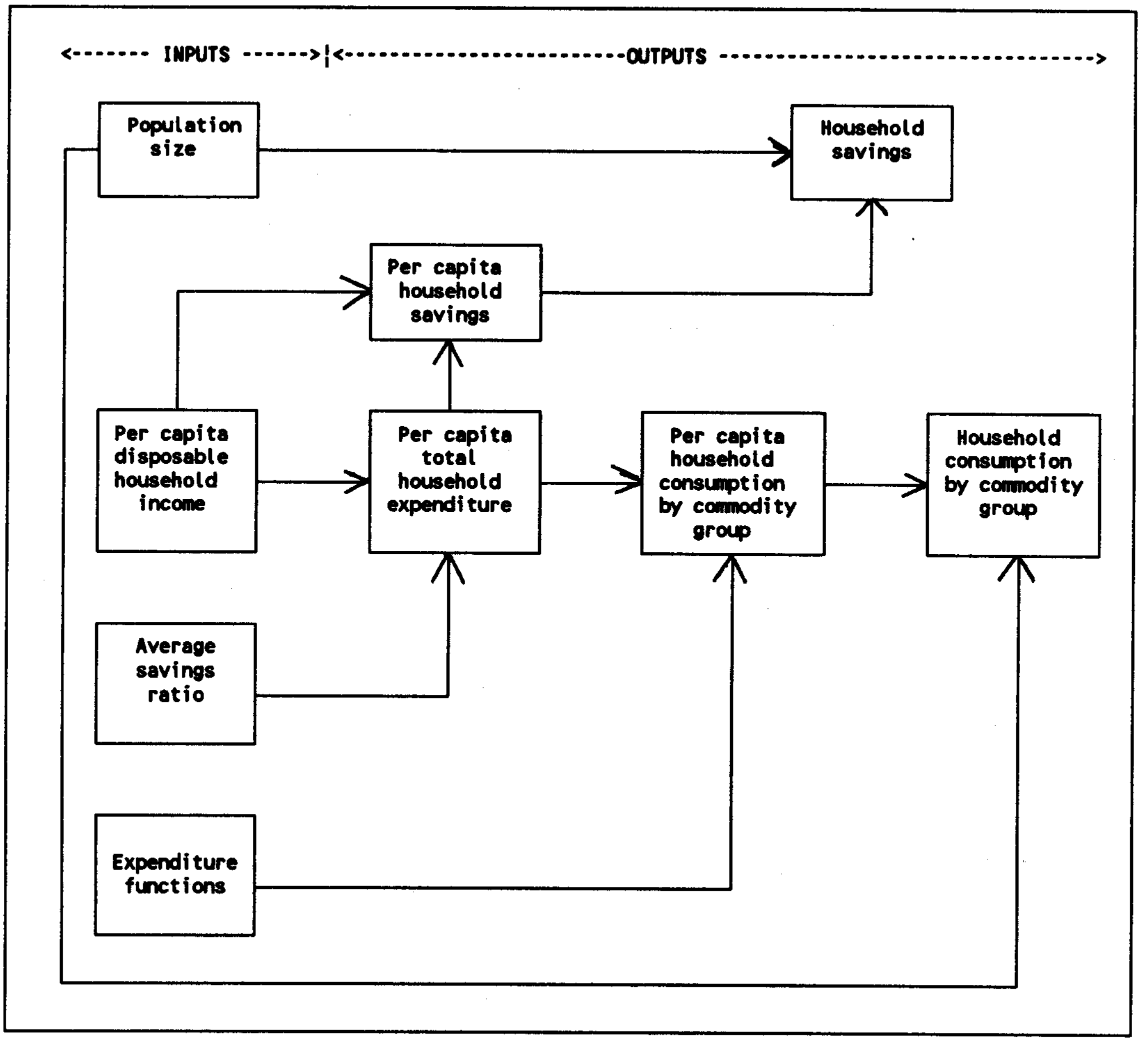
6. Derive indicators of the spending pattern of households, such as the proportions of household disposable income spent on various goods and services or saved.

7. Obtain rates of growth of household consumption and savings.

where:

$g = 1,\ldots,G$	are commodity groups,
G	is the number of commodity groups,
t'	is the calendar year,

Figure XXII. Steps to project household consumption and savings at the national level using linear expenditure system



PCC(g,t')	is the level of per capita consumption of goods and services in commodity group g in year t',
PCTHE(t')	is the level of per capita total household expenditure in year t',
a(g)	is the intercept coefficient of the expenditure function for commodity group g in the linear expenditure system, and
b(g)	is the partial coefficient of per capita total household expenditure in the expenditure function for commodity group g in the linear expenditure system.

The partial coefficients in the expenditure functions shown in equation (1), b(g)'s, are marginal budget shares or marginal propensities to consume out of total expenditure. The sum of those coefficients over all commodity groups equals one.

(ii) Levels of per capita household consumption and savings

To obtain the levels of per capita household consumption by commodity group and the level of per capita household savings, it is initially necessary to calculate the level of per capita total household expenditure. This figure is used to calculate per capita consumption by commodity group and per capita savings.

a. Level of per capita total household expenditure

The level of per capita total household expenditure can be derived for a given projection date as the product of the level of per capita disposable household income and the complement of the assumed average savings ratio for that date. Thus, for (t+5), the end of the projection interval (t to t+5), the level of per capita total household expenditure is:

$$PCTHE(t+5) = PCDHI(t+5) \cdot [\ 1 - ASVR(t+5)\ ], \qquad (2)$$

where:

t	is the base year of the projection period,
PCTHE(t+5)	is the level of per capita total household expenditure at the end of the interval,
PCDHI(t+5)	is the level of per capita disposable household income at the end of the interval, and
ASVR(t+5)	is the average household savings ratio at the end of the interval.

b. Levels of per capita household consumption by commodity group

Once the level of per capita total household expenditure has been calculated, levels of per capita household consumption by commodity group can be projected using estimates of the coefficients of the expenditure functions as follows:

$$PCC(g,t+5) = a^*(g) + b^*(g) \cdot PCTHE(t+5); \qquad g = 1,\ldots,G, \tag{3}$$

where:

PCC(g,t+5)	is the level of per capita household consumption of goods and services in commodity group g at the end of the interval,
a*(g)	is the estimate of the intercept coefficient of the expenditure function for commodity group g in the linear expenditure system, and
b*(g)	is the estimate of the partial coefficient of per capita total household expenditure in the expenditure function for commodity group g in the linear expenditure system.

c. Level of per capita household savings

After the level of per capita total household expenditure has been derived as indicated in equation (2), the level of per capita household savings can be obtained as the difference between the levels of per capita disposable income and per capita total expenditure. Thus, for the end of the projection interval (t to t+5):

$$PCSV(t+5) = PCDHI(t+5) - PCTHE(t+5), \tag{4}$$

where:

PCSV(t+5)	is the level of per capita household savings at the end of the interval.

(iii) Levels of household consumption by commodity group and household savings

Given the projected levels of per capita household consumption in each commodity group and the level of per capita household savings, projected levels of household consumption in each commodity group and the projected level of savings can be obtained by multiplying the population size by the levels of per capita household consumption and the level of savings, respectively.

a. Household consumption by commodity group

For each commodity group, the levels of household consumption at the end of the projection interval (t to t+5) can be obtained as follows:

$$HC(g,t+5) = PCC(g,t+5) \cdot POP(t+5); \qquad g = 1,...,G, \tag{5}$$

where:

HC(g,t+5) is the level of household consumption of goods and services in commodity group g at the end of the interval, and

POP(t+5) is the population size at the end of the interval.

b. Household savings

The level of household savings at the end of the projection interval can be obtained in an analogous way:

$$HSV(t+5) = PCSV(t+5) \cdot POP(t+5), \tag{6}$$

where:

HSV(t+5) is the level of household savings at the end of the interval.

(iv) Other results[3/]

Once the levels of household consumption by commodity group and levels of household savings are projected for the end of a given interval, several derived indicators can be calculated. These indicators include various aggregates of household consumption and savings, indicators of the spending pattern of households and rates of change of household consumption and savings.

a. Household consumption and savings aggregates

The level of total household consumption is a key aggregate that can be calculated from the projected levels of household consumption by commodity group. Using the same results, it is also possible to obtain the levels of household consumption by broad commodity groups, such as food and clothing. Once the total and broad-commodity-group levels of household consumption are obtained for different dates five years apart, increases in those totals over the intervening projection intervals can be calculated. In addition, one can calculate increases in household savings for those projection intervals.

i. Total household consumption

Total household consumption can be obtained by aggregating the levels of household consumption classified by commodity group. For the end of the projection interval (t to t+5) this total can be obtained as follows:

$$HC(t+5) = \sum_{g=1}^{G} HC(g,t+5), \tag{7}$$

where:

HC(t+5)	is the level of total household consumption at the end of the interval.

ii. Household consumption by broad commodity groups

If the projection of household consumption and savings involves many narrowly defined commodity groups, projected household consumption levels disaggregated by those groups can be reaggregated into levels of consumption for a relatively small number of broader groups. The rules of aggregation used in deriving household consumption levels by broad groups may vary from one application of the method to another depending on the primary commodity groups used in the projection. In this description of the method, this aggregation will be considered in general terms, and it will be illustrated as part of the projection examples in section D.

In particular, the levels of household consumption for broad commodity groups at the end of the given projection interval (t to t+5) can be obtained as follows:

$$HC(h,t+5) = T\ [\ HC(g,t+5)\ ]; \tag{8}$$

$$h = 1,\ldots,H,$$

where:

h = 1,...,H	are broad commodity groups,
H	is the number of broad commodity groups,
HC(h,t+5)	is the level of household consumption of goods and services in broad commodity group h at the end of the interval, and
T	is a transformation indicating the way household consumption levels by commodity groups are aggregated to obtain household consumption levels by broad commodity groups.

iii. Growth in total household consumption

The growth in total household consumption over the projection interval equals the difference between the levels of total household consumption at the end and at the beginning of the interval:

$$HCG = HC(t+5) - HC(t); \tag{9}$$

where:

HCG is the growth of total household consumption during the interval.

iv. Growth of household consumption by broad commodity groups

The increases in household consumption in various broad commodity groups over the projection interval are obtained as follows:

$$HCG(h) = HC(h,t+5) - HC(h,t); \quad h = 1,\ldots,H, \tag{10}$$

where:

HCG(h) is the growth of household consumption in broad commodity group h over the interval.

v. Growth in household savings

The growth in household savings over the projection interval equals the difference between household savings at the end and at the beginning of the interval:

$$HSVG = HSV(t+5) - HSV(t); \tag{11}$$

where:

HSVG is the growth of household savings during the interval.

b. Indicators of the spending pattern of households

Once the various household consumption aggregates are obtained, it is further possible to derive the proportions of disposable household income that are either spent on goods and services in various broad commodity groups or saved.

i. Disposable household income

To calculate those proportions, it is first necessary to obtain the level of disposable household income as the product of per capita disposable household income and population size. For the end of the projection interval, disposable household income can be obtained as follows:

$$DHI(t+5) = PCDHI(t+5) \cdot POP(t+5); \tag{12}$$

where:

DHI(t+5) is the disposable household income at the end of the interval.

ii. Proportions of disposable household income spent on goods and services in broad commodity groups

Proportions of disposable household income that are spent on goods and services in different broad commodity groups can be obtained by dividing the levels of household consumption in broad groups by the level of disposable household income. For the end of the projection interval, those proportions can be obtained as follows:

$$PRDHIC(h,t+5) = HC(h,t+5) \ / \ DHI(t+5); \qquad (13)$$

$$h = 1,\ldots,H,$$

where:

PRDHIC(h,t+5) is the proportion of disposable household income spent on consumption of goods and services in broad commodity group h at the end of the interval.

iii. Proportion of disposable household income saved

The proportion of disposable household income saved can be obtained as the level of household savings divided by the level of disposable household income. For the end of the projection interval, this proportion is obtained as follows:

$$PRDHISV(t+5) = HSV(t+5) \ / \ DHI(t+5); \qquad (14)$$

where:

PRDHISV(t+5) is the proportion of disposable household income saved at the end of the interval.[4]

c. Rates of growth of household consumption and savings

As part of the household consumption and savings projection, it is also possible to compute average annual rates of growth of household consumption -- total and by broad commodity groups. It is also possible to compute average annual rates of growth of household savings.

i. Rate of growth of total household consumption

The average annual rate of growth of total household consumption over a given projection interval can be computed from the total household consumption at the beginning and the end of the interval.

Geometric growth rates. If it is assumed that growth in household consumption occurs over discrete intervals, then the percentage growth rate can be obtained using the formula for a geometric growth rate:

$$GGRHC = [\ (\ HC(t+5)/HC(t)\ )^{1/5} - 1\ ] \cdot 100; \qquad (15)$$

where:

GGRHC — is the average annual geometric growth rate of total household consumption for the interval.

Exponential growth rates. Alternatively, if the planner treats growth as continuous, then the percentage growth rate of total household consumption should be calculated using the formula for an exponential growth rate:

$$EGRHC = [\ \ln(\ HC(t+5)/HC(t)\ )\ /\ 5\ ] \cdot 100; \qquad (16)$$

where:

EGRHC — is the average annual exponential growth rate of total household consumption for the interval.

ii. Rates of growth of household consumption by broad commodity groups

Geometric growth rates. If it is assumed that growth of household consumption is discrete, percentage rates of increase of household consumption by broad commodity groups can be obtained as follows:

$$GGRHC(h) = [\ (\ HC(h,t+5)/HC(h,t)\ )^{1/5} - 1\ ] \cdot 100; \qquad (17)$$

$$h = 1,\ldots,H,$$

where:

GGRHC(h) — is the average annual geometric growth rate of household consumption in broad commodity group h for the interval.

Exponential growth rates. If growth is assumed to be continuous, then the percentage rates of growth of household consumption by broad groups would be calculated using the following formula:

$$EGRHC(h) = [\ \ln(\ HC(h,t+5)/HC(h,t)\ )\ /\ 5\ ] \cdot 100; \qquad (18)$$

$$h = 1,\ldots,H,$$

where:

EGRHC(h) — is the average annual exponential growth rate of household consumption in broad commodity group h for the interval.

iii. Rate of growth of household savings

Geometric growth rate. If it is assumed that growth in household savings occurs over discrete intervals, the percentage growth rate can be obtained using the formula for calculating a geometric growth rate:

$$GGRHSV = [(HSV(t+5)/HSV(t)^{1/5} - 1] \cdot 100; \tag{19}$$

where:

GGRHSV — is the average annual geometric growth rate of household savings for the interval.

Exponential growth rate. Alternatively, if it is assumed that growth is continuous, then the percentage rate of growth of household savings can be calculated as follows:

$$EGRHSV = [\ln (HSV(t+5)/HSV(t)) / 5] \cdot 100; \tag{20}$$

where:

EGRHSV — is the average annual exponential growth rate of household savings for the interval.

This completes the description of the procedure to project household consumption and savings at the national level using the linear expenditure system. The next section will describe the procedure to project household consumption and savings using the extended linear expenditure system.

(b) Procedure based on the extended linear expenditure system

This section will initially describe expenditure functions of the extended linear expenditure system. Then it will describe the steps needed to derive levels of per capita household consumption by commodity group and the level of per capita household savings. The section will also outline the steps needed to derive other results for a given projection date or interval. A summary of those steps is shown in box 25 and some of those steps are indicated in figure XXIII.

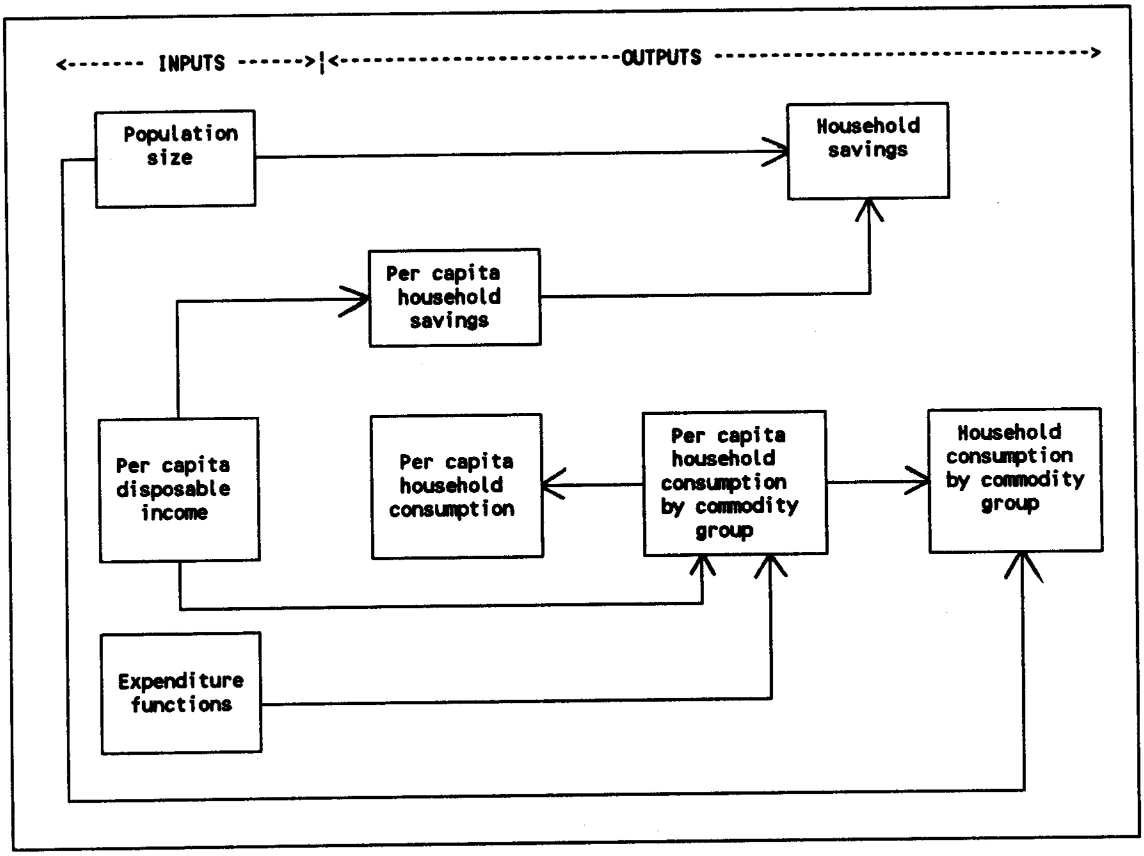
(i) Expenditure functions

The extended linear expenditure system postulates that the level of per capita household consumption for each commodity group is a linear function of the level of per capita disposable household income. Therefore, the system consists of the following functions:

$$PCC(g,t') = a(g) + b(g) \cdot PCDHI(t'); \tag{21}$$

$$g = 1,\ldots,G,$$

Figure XXIII. Steps to project household consumption and savings at the national level using the extended linear expenditure system



where:

PCDHI(t')	is the level of per capita disposable household income in year t',
a(g)	is the intercept coefficient of the expenditure function for commodity group g in the extended linear expenditure system, and
b(g)	is the partial coefficient of per capita disposable household income in the expenditure function for commodity group g in the extended linear expenditure system.

The partial coefficients in the expenditure functions shown in equation (21), b(g)'s, are marginal propensities to consume out of disposable income. The sum of those coefficients equals the aggregate marginal propensity to consume. That is, this sum indicates the proportion of each additional unit of disposable income that is devoted to household consumption.

(ii) Levels of per capita household consumption and savings

In deriving levels of per capita consumption and savings, it is possible first to obtain the levels of per capita consumption by commodity group. These levels can then be aggregated to yield per capita total household consumption, which, when subtracted from per capita disposable household income, yields per capita household savings.

a. Levels of per capita household consumption by commodity group

The levels of per capita household consumption by commodity group can be projected for the end of the projection interval using estimates of the expenditure functions of the extended linear expenditure system as follows:

$$PCC(g,t+5) = a^*(g) + b^*(g) \cdot PCDHI(t+5); \qquad g = 1,\ldots,G, \tag{22}$$

where:

a*(g)	is the estimate of the intercept coefficient of the expenditure function for commodity group g in the extended linear expenditure system, and
b*(g)	is the estimate of the partial coefficient of per capita disposable household income in the expenditure function for commodity group g in the extended linear expenditure system.

b. Level of per capita total household consumption

Per capita total household consumption can be obtained as the sum of the projected levels of per capita household consumption by commodity group:

$$PCC(t+5) = \sum_{g=1}^{G} PCC(g,t+5); \tag{23}$$

Box 25

Computational steps to project household consumption and savings at the national level using the extended linear expenditure system

The steps used to project household consumption and savings at the national level over a five-year projection interval with the extended linear expenditure system are as follows:

1. Derive projected levels of per capita household consumption by commodity group at the of the interval by evaluating empirically estimated expenditure functions using the projected level of per capita disposable household income for that date.

2. Derive the level of per capita household savings as the difference between the per capita disposable household income and the sum of projected levels of per capita consumption by commodity group.

3. Calculate levels of household consumption for each commodity group and the level of household savings as the product of population size multiplied by the levels of per capita household consumption derived in step 1 and household savings obtained in step 2, respectively.

4. Calculate various household consumption and savings aggregates, such as total household consumption and the increase in total household consumption.

5. Derive indicators of the spending pattern of households, such as proportions of household disposable income spent on various goods and services or saved.

6. Obtain rates of growth of household consumption and savings, such as the rate of growth of total household consumption.

where:

PCC(t+5)	is the level of per capita total household consumption at the end of the interval.

c. Level of per capita household savings

The level of per capita household savings can be obtained as the difference between the level of per capita disposable household income and the level of per capita total consumption. Thus, for the end of the projection interval (t to t+5):

$$PCSV(t+5) = PCDHI(t+5) - PCC(t+5); \quad (24)$$

(iii) Levels of household consumption and savings and other results

Given the projected levels of per capita household consumption and savings, the levels of household consumption by commodity group and household savings may be obtained using the steps indicated in equations (5) and (6).

Other results, which include household consumption and savings aggregates, indicators of the spending pattern of households and rates of changes of household consumption and savings, can be obtained by means of the steps indicated in equations (7) through (20).

3. Urban-rural level

The previous section dealt with projections of per capita consumption and savings at the national level. This section will discuss procedures for projecting household consumption and savings for urban and rural areas separately. It will first describe the procedure based on the linear expenditure system. Then, it will outline the procedure that uses the extended linear expenditure system.

(a) Procedure based on the linear expenditure system

The procedure for making urban and rural projections of household consumption and savings based on the linear expenditure system is an urban-rural equivalent of the procedure for preparing the national projections.

(i) Expenditure functions

The expenditure functions of the linear expenditure system used by the procedure are urban-rural equivalents of the functions shown in equation (1).

(ii) Levels of per capita household consumption and savings

The steps used by this procedure to project levels of per capita household consumption and per capita household savings for the two areas are urban-rural equivalents of the steps indicated in equations (2) through (4).

(iii) Levels of household consumption and savings

Levels of household consumption and savings for urban and rural areas can be derived from projected levels of per capita household consumption and savings for those areas by means of calculations that are urban-rural equivalents of the steps shown in equations (5) and (6).

(iv) <u>Other results</u>

The various indicators discussed in connection with the national projections can also be computed as part of an urban-rural projection. Those indicators are calculated for urban and rural areas and for the entire country, using steps analogous to those indicated by equations (7) through (20). In addition, indicators of the distribution of total household consumption and total household savings by residential location -- proportions urban and rural -- can be calculated.

a. <u>Proportions of total household consumption that are urban and rural</u>

The proportion of total household consumption at the end of the projection interval that is urban can be computed by dividing the level of total household consumption in urban areas (k=1) by the level of total household consumption for the entire country:

PRHCURB(t+5) = HC(1,t+5) / HC(t+5); (25)

where:

k = 1,2	are urban and rural locations,
PRHCURB(t+5)	is the proportion of total household consumption that is urban at the end of the interval, and
HC(k,t+5)	is the total household consumption in location k at the end of the interval.

The proportion of total household consumption that is rural can be found as a complement of the proportion urban:

PRHCRUR(t+5) = 1 - PRHCURB(t+5); (26)

where:

PRHCRUR(t+5)	is the proportion of total household consumption that is rural at the end of the interval.

b. <u>Proportions of household savings that are urban and rural</u>

The proportion of household savings that is urban at the end of the projection interval can be computed by dividing the level of household savings in urban areas (k=1) by the level of household savings for the entire country:

PRHSVURB(t+5) = HSV(1,t+5) / HSV(t+5); (27)

where:

PRHSVURB(t+5)	is the proportion of household savings that is urban at the end of the interval, and
HSV(k,t+5)	is the level of household savings in location k at the end of the interval.

The proportion of household savings that is rural can be derived as a complement of the relevant proportion that is urban:

$$PRHSVRUR(t+5) = 1 - PRHSVURB(t+5); \tag{28}$$

where:

PRHSVRUR(t+5)	is the proportion of household savings that is rural at the end of the interval.

(b) <u>Procedure based on the extended linear expenditure system</u>

The procedure for projecting urban and rural household consumption and savings using the extended linear expenditure system is the urban-rural counterpart of the procedure using the national-level extended linear expenditure system.

(i) <u>Expenditure functions</u>

The expenditure functions of this system are urban-rural equivalents of the functions shown in equation (21).

(ii) <u>Levels of per capita household consumption and savings</u>

The steps employed by this procedure to obtain levels of per capita consumption and savings are urban-rural counterparts of the steps shown in equations (22) through (24).

(iii) <u>Levels of household consumption and savings and other results</u>

To derive levels of household consumption by commodity group and household savings, as well as other results, this procedure uses steps that are identical to the corresponding steps of the procedure for making urban-rural projections with the linear expenditure system.

C. Inputs

This section will initially list the types of inputs required by the method and then describe how they can be prepared. In particular, it will show how assumptions on the average savings ratio are prepared. It will also describe how estimates of the expenditure functions of alternate demand systems are prepared and illustrate the calibration of empirically estimated functions.

1. Types of inputs required

To project household consumption and savings using one of the two per capita expenditure systems the following inputs are required:

(i) Projected per capita disposable household income;
(ii) Projected population size;
(iii) Estimates of the coefficients of the expenditure function for each commodity group.

In addition, if the procedure being used is based on the linear expenditure system, the inputs must also include:
(iv) Assumptions on the average household savings ratio.

Depending on whether one wishes to make a national projection or a projection for urban and rural areas, the inputs will be for the entire country or for urban and rural areas.

2. Preparation of inputs

To apply the method, projections of per capita disposable household income are required. These projections can be prepared by the method based on the social accounting matrix, which was described in chapter IX. Also, projections of population size are needed. These can be made using the cohort component method, as described in chapter II.

In addition, the coefficients of the expenditure functions by commodity group need to be estimated. If the projection procedure used is based on the linear expenditure system, the estimates of the coefficients need to be supplemented by assumptions on the average household savings ratio. (Such assumptions are not needed to apply the extended linear expenditure system, which treats household savings endogenously.)

In this section, the preparation of assumptions on future levels of the average household savings ratio will be considered. This will be followed by a discussion relating to the estimation of coefficients of expenditure functions and a brief discussion of techniques for the calibration of empirically estimated functions.

(a) Assumptions on the average household savings ratio

To prepare assumptions on future levels of the average household savings ratio, it is initially necessary to select the level (or levels) of This savings ratio for the base year of the projection. As a rule, this will require recent information on household income and savings. However, such information may not be included in the data set used to estimate expenditure functions of the linear expenditure system since LES would typically be used in situations where reliable information on disposable household income and savings was not available.

The household income and savings data that are needed to select the level of the average household savings ratio for a national projection may come from the national accounts or a social accounting matrix. The data required to select levels of the savings ratio for the urban-rural projection would normally come from a social accounting matrix, which includes household income and savings disaggregated by urban-rural location. Generally, the national accounts would not contain this type of information disaggregated by location.

Whichever data source is used, the average household savings ratio for a recent year can be obtained as a ratio of the level of household savings to that of disposable household income for the entire country or a given area. The savings ratio can then be used as a basis for deciding on the average savings ratio for the base year of the projection. It would be of limited value, however, for making assumptions on the savings ratio for other dates over the projection period. Those assumptions should be made by taking into account the likely future changes in per capita disposable household income, as well as changes in other factors that may have an effect on the household savings behaviour.

In making assumptions on the average savings ratio for dates 5, 10 or more years following the initial year of projection, it is important to consider projected changes in the level of per capita disposable household income over the period for which the assumptions are to be made. For example, if per capita disposable income were projected to increase over time, the assumptions on future average household savings ratios must take that into account. All other things being equal, the more rapid the projected increase in the per capita disposable household income, the more likely it is that the average savings ratio will increase over the projection period. This would be true if the income elasticity of savings were greater than unity, as is often the case in developing countries. Other factors, such as household size and changes in household composition, may have an effect on savings behaviour. For example, reduced young-age dependency in the household may increase the household's propensity to save (Mason and others, 1987a). Evidence relating to the impact of the increase in old-age dependency on household savings is less conclusive, but suggests that among certain categories of households the increase in the proportion of household members who are elderly tends to depress savings. Moreover, in certain countries, there is a clear-cut inverse-U-shaped relationship between the age of the household head and the household's propensity to save (Mason and others, 1987b). Where shifts in the household composition are considered likely, assumptions on future trends in the average household savings ratio may take their likely impact into account.

(b) <u>Estimates of expenditure functions of alternative expenditure systems</u>

Estimates of the coefficients of the expenditure functions of the LES and ELES systems can be prepared using standard methods of regression analysis, such as ordinary least squares (OLS). Depending on the area for which the projection is intended (national or urban-rural), the estimates of the functions would refer to the entire country or urban and rural areas separately. The estimation procedure could use time series information or cross-section data. In the majority of developing countries, however, only cross-section data would be available and, therefore, only this type of data will be considered below.

(i) Cross-section data

Cross-section data that could be used to estimate the expenditure functions of the linear expenditure system typically come from a household budget survey. Such a survey normally includes information on expenditures for various consumption goods and services, quantities of various products consumed from the household's own production, and estimates of total household expenditure. The survey data should also include, at the minimum, information on household size. This type of data would make it possible to derive observations on levels of per capita household consumption expenditures for the various groups of commodities and the level of per capita total household expenditure, which would suffice for the estimation of expenditure functions of this demand system.

To estimate expenditure functions of the extended linear expenditure system, the requisite data should come from a household income and expenditure survey. Besides information collected in a typical household budget survey, the household income and expenditure survey should include data on disposable household income. Information collected in such a survey would provide a sufficient basis for deriving observations on the level of per capita household consumption for the various commodity groups and the level of per capita disposable household income; such observations would be required to estimate functions of this demand system. Box 19 in chapter X discusses in greater detail the data needed in estimating the two demand systems and outlines their preparation for analysis.

If the income data collected in a household income and expenditure survey are inadequate or unreliable, it would not be warranted to use the extended linear expenditure system for projecting consumption and savings. In such an instance, it would be better to use those data to estimate the linear expenditure system, that is, expenditure functions with per capita total household expenditure as the explanatory variable.

(ii) Procedures to estimate alternative expenditure systems

This section will first describe procedures used to estimate the coefficients of the LES and ELES demand systems at the national level and then describe procedures for estimating the coefficients of those systems at the urban-rural level.

a. National level

In describing estimation procedures applicable at the national level, those used to estimate expenditure functions of the linear expenditure system will be presented first.

i. Linear expenditure system

To estimate the coefficients of expenditure functions of the linear expenditure system, it is necessary to rewrite the functions shown in equation (1) and to add a random disturbance term to each to obtain the following:

$$PCC(g,j) = a(g) + b(g) \cdot PCTHE(j) + u(g,j); \qquad (29)$$

$$g = 1,\ldots,G,$$

where:

j	is the cluster of households,[5]
PCC(g,j)	is the mean level of per capita household consumption of goods and services in commodity group g in household cluster j,
PCTHE(j)	is the mean level of per capita total household expenditure in household cluster j,
u(g,j)	is the random disturbance term for commodity group g in household cluster j.

The functions shown in equation (29) can be estimated using various regression techniques, such as ordinary least squares (OLS), using cross-section information on levels of per capita consumption by commodity group and the level of per capita total household expenditure.

ii. Extended linear expenditure system

To derive estimates of expenditure functions of this demand system, it would be necessary to rewrite the functions shown in equation (21) and add random disturbance terms to obtain:

$$PCC(g,j) = a(g) + b(g) \cdot PCDHI(j) + u(g,j); \qquad (30)$$

$$g = 1,\ldots,G,$$

where:

PCDHI(j)	is the mean level of per capita disposable household income in household cluster j.

The functions shown in equation (30) could be estimated using a regression technique, such as OLS, using cross-section information on per capita consumption by commodity group and per capita disposable household income.

b. Urban-rural level

The demand systems that can be used to make urban-rural projections of household consumption and savings are urban-rural counterparts of the national-level linear expenditure systems. Hence, procedures to estimate the former systems are urban-rural equivalents of the procedures for estimating the national-level demand systems.

i. Linear expenditure system

Expenditure functions of the linear expenditure system for urban and rural areas can be estimated using an urban-rural equivalent of equation (29).

ii. Extended linear expenditure system

Expenditure functions of the extended linear expenditure system for urban and rural areas can be estimated using an urban-rural counterpart of equation (30).

(iii) Illustrative estimation

This section will illustrate procedures for estimating alternative demand systems, using two sets of cross-section data for clusters of households. The first part of this section will illustrate procedures to be used at the national level. The second part will illustrate procedures to be used at the urban-rural level.

a. National level

First, the estimation of national-level expenditure functions of the linear expenditure system will be illustrated. Then, the estimation of expenditure functions of the extended linear expenditure system will be described.

i. Linear expenditure system

To obtain estimates of the coefficients of the expenditure functions of the linear expenditure system, it is necessary to estimate the expenditure functions indicated in equation (29). The functions can be estimated from a data set such as that which is partially illustrated in table 71. The table (which is presented for illustrative purposes only) contains a small portion of a set of observations on the relevant variables for 363 clusters (of which 227 are urban and 136 are rural). The observations are on mean levels of per capita consumption by commodity group and mean levels of per capita total household expenditure. If the OLS regression technique is applied to the complete data set, a part of which is illustrated in table 71, the results will be those shown in table 72.

The results shown in table 72 are largely satisfactory as a basis for making projections of household consumption. All of the estimated partial coefficients of per capita household expenditure (column 3), which signify the proportions of total expenditure going to various commodity groups, are positive, as one would expect. Moreover (as indicated by t-statistics), the estimates of the partial coefficients are all statistically significant at the 0.01 level.

The coefficients of determination, R^2's (column 4), vary between a high of 0.874 (for food) and a low of 0.159 (for transportation). Overall, their values are relatively high, which is mainly due to the fact that the observations used to estimate the functions are averages for clusters of households, most of which consist of four to eight households. If observations for individual households

Table 71. Illustrative data required to estimate expenditure functions of the linear expenditure system

Household cluster	Commodity group									Total expenditure	Location
	Food	Clothing	Housing	Fuel and light	Durables	Trans-portation	Personal care	Rec-reation	Services		
1	15.06	0.97	1.56	0.50	0.98	0.12	0.57	0.83	0.64	21.23	Rural
2	10.35	1.38	0.05	0.70	0.13	0.14	0.22	1.29	0.62	14.88	Urban
3	25.75	1.97	0.18	4.38	4.51	0.90	2.90	8.84	1.78	51.20	Rural
4	15.51	4.19	1.31	1.96	4.81	0.43	0.86	2.23	2.85	34.15	Urban
5	18.48	1.67	0.00	3.49	1.60	0.82	0.78	1.37	1.10	29.30	Rural
6	13.27	2.16	0.00	3.23	0.87	0.63	0.36	1.15	0.30	21.97	Urban
7	13.33	1.20	0.00	4.82	1.72	0.20	0.76	1.93	0.15	24.12	Rural
8	11.82	1.61	2.36	2.84	0.92	0.18	0.49	1.85	0.46	22.52	Urban
9	20.14	1.95	0.00	3.12	0.67	0.09	0.49	1.29	1.00	28.74	Rural
10	12.96	0.68	0.23	1.13	0.49	0.62	0.23	0.46	0.29	17.09	Urban

Table 72. Estimates of the coefficients of expenditure functions of the linear expenditure system for the entire country a/

Commodity group	Coefficients		
	Intercept	Total expenditure b/	R-square
(1)	(2)	(3)	(4)
Food	1.33676	0.52404	0.874
		49.94)	
Clothing	0.23368	0.07371	0.599
		(23.22)	
Housing	-0.51392	0.05472	0.188
		(9.14)	
Fuel and light	1.01641	0.04882	0.372
		(14.63)	
Durables	-1.78524	0.13690	0.555
		(21.21)	
Transportation	0.12202	0.01033	0.159
		(8.27)	
Personal care	-0.01881	0.03095	0.529
		(20.12)	
Recreation	-0.14517	0.06829	0.568
		(21.77)	
Other services	-0.24570	0.05223	0.281
		(11.87)	

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

were used, the R^2's would have been much lower. In view of the relatively low R^2's for commodity groups such as housing and transportation, the forecast errors for those functions could be fairly high.

ii. The extended linear expenditure system

To obtain estimates of the coefficients of expenditure functions of the extended linear expenditure system at the national level, it would be necessary to estimate the functions indicated in equation (30). These functions can be estimated using a data set such as the one presented in part in table 73, which includes observations on mean levels of per capita household consumption by commodity groups and mean levels of per capita disposable household income. A part of such a data set for 363 clusters of households is presented in table 73. If the OLS regression technique is applied to the data illustrated in table 73, the results will be those shown in table 74.

The results shown in table 74 are somewhat less satisfactory as the basis for making projections than those obtained for the linear expenditure system (table 72). The estimates of all partial coefficients of per capita disposable household income (column 3) are positive, as expected, and all are statistically significant at the 0.01 level. However, the coefficients of determination (column 4), which vary between a high of 0.796 (for food) and a low of 0.155 (for housing) are on the average lower than those obtained by estimating the linear expenditure system. This may be due to the fact that it is more difficult to accurately measure the disposable income of a household than its total expenditure.

b. Urban-rural level

The estimation of the expenditure functions of the linear expenditure system and the extended linear expenditure system for urban and rural areas will be illustrated in this section. The data sets to be used will be those employed earlier to estimate the national-level expenditure functions of these two demand systems.

i. Linear expenditure system

To derive estimates of the expenditure functions of the linear expenditure system at the urban-rural level, it is necessary to estimate functions that are urban-rural equivalents of those indicated in equation (29). If the OLS regression method is employed along with the data for urban household clusters, which were partially illustrated in table 71, in order to estimate expenditure functions for the urban areas, the results will be those shown in table 75. The use of the same method with the data for rural household clusters, which are also partially shown in table 71, yields results presented in table 76.

For the most part, those results would be a satisfactory basis for projecting household consumption for urban and rural areas. The estimated partial coefficients of per capita total household expenditure (column 3) are positive and statistically significant at the 0.01 level in both tables. The R^2's (column 4) vary roughly within the same range as in the case of the

Table 73. Illustrative data required to estimate expenditure functions of the extended linear expenditure system

Household cluster	Commodity group									Disposable income	Location
	Food	Clothing	Housing	Fuel and light	Durables	Trans portation	Personal care	Rec-reation	Services		
1	15.06	0.97	1.56	0.50	0.98	0.12	0.57	0.83	0.64	54.01	Rural
2	10.35	1.38	0.05	0.70	0.13	0.14	0.22	1.29	0.62	21.38	Urban
3	25.75	1.97	0.18	4.38	4.51	0.90	2.90	8.84	1.78	54.05	Rural
4	15.51	4.19	1.31	1.96	4.81	0.43	0.86	2.23	2.85	39.98	Urban
5	18.48	1.67	0.00	3.49	1.60	0.82	0.78	1.37	1.10	33.66	Rural
6	13.27	2.16	0.00	3.23	0.87	0.63	0.36	1.15	0.30	27.50	Urban
7	13.33	1.20	0.00	4.82	1.72	0.20	0.76	1.93	0.15	28.02	Rural
8	11.82	1.61	2.36	2.84	0.92	0.18	0.49	1.85	0.46	25.22	Urban
9	20.14	1.95	0.00	3.12	0.67	0.09	0.49	1.29	1.00	29.18	Rural
10	12.96	0.68	0.23	1.13	0.49	0.62	0.23	0.46	0.29	24.74	Urban

Table 74. Estimates of the coefficients of expenditure functions of the of the extended linear expenditure system for the entire country a/

Commodity group	Coefficients		R-square
	Intercept	Disposable income b/	
(1)	(2)	(3)	(4)
Food	1.36077	0.45794 (37.56)	0.796
Clothing	0.19331	0.06566 (21.76)	0.567
Housing	-0.42820	0.04543 (8.13)	0.155
Fuel and light	1.08470	0.04077 (12.73)	0.310
Durables	-1.80769	0.12045 (19.49)	0.513
Transportation	-0.06711	0.01062 (9.52)	0.201
Personal care	-0.00237	0.02661 (17.77)	0.467
Recreation	-0.12022	0.05905 (19.25)	0.507
Other services	-0.35136	0.04874 (12.20)	0.292

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 75. Estimates of the coefficients of expenditure functions of the linear expenditure system for urban areas a/

Commodity group	Coefficients		
	Intercept	Total expenditure b/	R-square
(1)	(2)	(3)	(4)
Food	2.58648	0.46537 (40.66)	0.880
Clothing	0.32526	0.07566 (20.75)	0.657
Housing	-0.84614	0.06412 (9.78)	0.298
Fuel and light	0.98829	0.04853 (11.52)	0.371
Durables	-2.33920	0.16270 (18.20)	0.596
Transportation	0.11803	0.01118 (7.24)	0.189
Personal care	-0.04373	0.02946 (22.88)	0.699
Recreation	-0.29012	0.07819 (21.92)	0.681
Other services	-0.49887	0.06478 (10.06)	0.310

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 76. Estimates of the coefficients of expenditure functions of the linear expenditure system for rural areas a/

Commodity group	Coefficients		
	Intercept	Total expenditure b/	R-square
(1)	(2)	(3)	(4)
Food	-0.92037	0.65546 (42.40)	0.930
Clothing	-0.21438	0.06440 (10.84)	0.467
Housing	-0.05875	0.03856 (3.18)	0.070
Fuel and light	1.02948	0.05075 (8.82)	0.367
Durables	-0.78941	0.07925 (12.43)	0.536
Transportation	0.14453	0.00793 (3.59)	0.088
Personal care	-0.03589	0.03637 (10.22)	0.438
Recreation	0.18884	0.04369 (8.10)	0.329
Other services	0.22718	0.02358 (6.13)	0.219

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

national-level expenditure functions of the linear expenditure system, except for the rural functions for housing and transportation, which are below 0.10.

ii. Extended linear expenditure system

If urban-rural projections of household consumption and savings are to be prepared using the extended linear expenditure system, it will be necessary to estimate urban-rural equivalents of the expenditure functions indicated in equation (30). If those urban-rural functions are estimated with the OLS regression method using the means of the relevant variables for urban and rural household clusters shown in table 73, the results will be those shown in tables 77 and 78.

The results shown in those tables provide a less satisfactory basis for making projections of household consumption and savings than those shown in tables 75 and 76. The coefficients of the disposable income variable (column 3) are all positive and highly significant. However, the coefficients of determination (column 4), which vary between a high of 0.838 (for food in the rural areas) and a low of 0.072 (for housing in those same areas), are on the average lower than those obtained in estimating the expenditure functions of the linear expenditure system.

(c) Calibration of the empirically estimated functions

After obtaining satisfactory estimates of the relevant functions of the chosen demand system, the planner will sometimes desire to make special adjustments in the estimated intercept coefficients. (Adjustments in the estimated partial coefficients would not be desirable in view of the fact that they would alter the coefficients in such a way that the adjusted partial coefficients would no longer add up to one in the case of the linear expenditure system or to the estimated aggregate marginal propensity to consume in the case of the extended linear expenditure system.)

The adjustments, which are normally referred to as "calibration", ensure that once adjusted, the functions are capable of precisely reproducing the levels of per capita household consumption by commodity group for a particular year or group of years given the values of explanatory variables for that year or group of years. If left unadjusted, the functions will be capable of producing mean levels of per capita household consumption by commodity group for the year to which data used in estimating the functions refer, using the average levels of explanatory variables for the year. The calibration procedures for expenditure functions of the two demand systems are described in annex III.

This completes the section on preparation of the projection inputs. The following section will illustrate how the procedures described in this chapter can be used to project household consumption and savings.

D. Illustrative examples of projections

This section will present two examples illustrating the use of the two linear expenditure systems in projecting household consumption and savings. The

Table 77. Estimates of the coefficients of expenditure functions of the extended linear expenditure system for urban areas a/

Commodity group	Coefficients		R-square
	Intercept	Disposable income b/	
(1)	(2)	(3)	(4)
Food	2.51964	0.41002 (30.45)	0.805
Clothing	0.32563	0.06637 (18.19)	0.595
Housing	-0.66433	0.05144 (8.10)	0.226
Fuel and light	1.09616	0.03972 (9.65)	0.293
Durables	-2.38226	0.14387 (16.53)	0.548
Transportation	0.03763	0.01193 (8.74)	0.254
Personal care	-0.04583	0.02590 (19.86)	0.637
Recreation	-0.27931	0.06831 (18.85)	0.612
Other services	-0.65838	0.06105 (10.39)	0.324

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

Table 78. Estimates of the coefficients of expenditure functions of the extended linear expenditure system for rural areas a/

Commodity group	Coefficients		R-square
	Intercept	Disposable income b/	
(1)	(2)	(3)	(4)
Food	-0.69831	0.56330 (26.29)	0.838
Clothing	0.12400	0.05910 (11.11)	0.479
Housing	-0.10949	0.03527 (3.22)	0.072
Fuel and light	1.04888	0.04354 (8.11)	0.329
Durables	-0.79580	0.06922 (11.53)	0.498
Transportation	0.12197	0.00766 (3.85)	0.100
Personal care	0.00746	0.03022 (8.85)	0.369
Recreation	0.23438	0.03652 (7.22)	0.280
Other services	0.18381	0.02199 (6.36)	0.232

a/ Estimated by ordinary least squares (OLS).
b/ t values are shown in parentheses.

first example will show how to prepare a national projection using a procedure based on the linear expenditure system. The second example will illustrate the preparation of an urban-rural projection employing a procedure based on the extended linear expenditure system. These examples will indicate how the relevant calculations are made for the projection interval 0-5. In addition, they will provide complete projection results for a 20-year period.

1. National projection

The calculations presented in this example will be based on the inputs contained in table 79, panel A, which shows projected levels of per capita disposable household income and projected population size for dates five years apart, starting with the initial year of the projection, which is denoted as year 0. Also shown in the panel are assumptions on the average household savings ratio for those same dates. The calculation will also use the coefficients of the expenditure functions of the linear expenditure system shown in panel B. The slope coefficients are those presented in table 72. The intercept coefficients were adjusted as explained in annex III and shown in table 96.

(a) Levels of per capita household consumption and savings

To project per capita household consumption and savings, it is initially necessary to calculate per capita total expenditure. The next steps would be to project the levels of per capita household consumption by commodity group and per capita household savings.

(i) Per capita total household expenditure

The level of per capita total household expenditure for a given date can be obtained as a product of the per capita disposable household income and the complement of the assumed average household savings ratio. Thus, per capita total expenditure for the end of the projection interval 0-5, 33.7, can be obtained as follows:

$$33.7 = (39.7) [1 - 0.15]; \qquad (2)$$

where 39.7 is the per capita disposable household income for year 5 and 0.15 is the average household savings ratio for the same date.

(ii) Levels of per capita household consumption by commodity group

To derive levels of per capita household consumption by commodity group for a given date using the linear expenditure system, one should evaluate the estimates of the expenditure functions using the per capita total household expenditure for that date. The projection of per capita household consumption is illustrated in table 80. In particular, the level of per capita household consumption for each commodity group in year 5 (column 5) is obtained by adding the adjusted intercept coefficient for the commodity group (column 2) to a number which is the product of the estimate of the per capita total household

Table 79. Inputs for projecting household consumption and savings for the entire country using the linear expenditure system

PANEL A: Projected household income and population size along with assumptions on household savings

Variable	Year 0	5	10	15	20
Per capita disposable household income (LCUs) a/	33.8	39.7	47.1	56.6	69.7
Population size (in thousands)	10 000.0	11 210.4	12 619.0	14 159.4	15 675.6
Average savings ratio	0.14	0.15	0.16	0.17	0.18

PANEL B: Estimates of the coefficients of expenditure functions of the linear expenditure system

Commodity group	Adjusted intercept coefficient b/	Total expenditure coefficient c/
Food	1.60774	0.52404
Clothing	0.24142	0.07371
Housing	-0.45913	0.05472
Fuel and light	0.95603	0.04882
Durables	-1.90047	0.13690
Transportation	0.12832	0.01033
Personal care	0.01601	0.03095
Recreation	-0.26602	0.06829
Other services	-0.32364	0.05223

a/ Local currency units.
b/ From table 95, col. 5.
c/ From table 72, col. 3.

Table 80. Deriving levels of per capita household consumption by commodity group entire country, year 5

Commodity group	Estimates of the coefficients of expenditure functions a/: Adjusted intercept coefficient	Total expenditure coefficient	Per capita total expenditure b/ (LCUs d/)	Projected level of per capita household consumption c/ (LCUs d/)
(1)	(2)	(3)	(4)	(5)
Food	1.60774	0.52404	33.7	19.2
Clothing	0.24142	0.07371	33.7	2.7
Housing	-0.45913	0.05472	33.7	1.3
Fuel and light	0.95603	0.04882	33.7	2.6
Durables	-1.90047	0.13690	33.7	2.7
Transportation	0.12832	0.01033	33.7	0.4
Personal care	0.01601	0.03095	33.7	1.0
Recreation	-0.26602	0.06829	33.7	2.0
Other services	-0.32364	0.05223	33.7	1.4
Total		1.00000		33.7

a/ From table 79, panel B.
b/ Calculation illustrated in text.
c/ (Col. 2) + (col. 3) . (col. 4).
d/ Local currency units.

expenditure coefficient for a commodity group (column 3) and the level of per capita total household expenditure in year 5 (column 4).

For example, the level of per capita household consumption for food in year 5, 19.3, is obtained as:

$$19.3 = 1.60775 + (0.52404)\ (33.7); \tag{3}$$

where 1.60775 is the adjusted intercept coefficient for food; 0.52404 is the estimate of the total expenditure coefficient for food and 33.7 is the projected level of per capita total expenditure in year 5.

(iii) Level of per capita household savings

After the projected per capita disposable household income and per capita total household expenditure have been calculated, the level of per capita household savings can be obtained as the difference between the two. Thus, the per capita household savings for the end of the projection interval 0-5, 6.0, is:

$$6.0 = 39.7 - 33.7; \tag{4}$$

where 39.7 is the per capita disposable household income and 33.7 is the per capita total household expenditure for year 5.

If the calculations illustrated above are performed for the relevant dates over the entire projection period, the result will be the projected levels of per capita household consumption and savings for the entire period. The levels obtained as part of this illustrative example are shown in table 81.

(b) Levels of household consumption by commodity group and levels of household savings

Once the projected levels of per capita household consumption and savings are obtained, the levels of household consumption for each commodity group and the levels of household savings can be calculated by multiplying the per capita levels by the population size.

(i) Household consumption by commodity group

For example, household consumption of food at the end of the projection interval 0-5, 216.3, can be calculated as:

$$216.3 = (19.3)\ (11{,}210.4), \tag{5}$$

where 19.3 is the projected level of per capita consumption of food and 11,210.4 is the projected population size in year 5.

(ii) Household savings

The level of household savings at the end of the interval 0-5, 66.8, can be obtained as:

Table 81. Projected levels of per capita household consumption by commodity group and per capita household savings

(LCUs) a/

Commodity group/ savings	Year				
	0	5	10	15	20
Food	16.8	19.2	22.3	26.2	31.5
Clothing	2.3	2.7	3.1	3.7	4.4
Housing	1.1	1.3	1.7	2.1	2.6
Fuel and light	2.3	2.6	2.8	3.2	3.7
Durables	2.0	2.7	3.5	4.5	5.9
Transportation	0.4	0.4	0.5	0.6	0.7
Personal care	0.9	1.0	1.2	1.4	1.7
Recreation	1.7	2.0	2.4	2.9	3.6
Other services	1.1	1.4	1.7	2.1	2.6
Total expenditure	29.0	33.7	39.5	46.9	57.1
Savings	4.7	5.9	7.5	9.6	12.5
Disposable income	33.8	39.7	47.1	56.6	69.7

a/ Local currency units.

$$66.8 = (6.0)\ (11{,}210.4), \tag{6}$$

where 6.0 is the level of per capita savings in year 5.

These calculations can be performed for the relevant dates over the entire projection period to obtain the levels of household consumption and savings for the period, as shown in table 82.

(c) Other results[6]

Other results that may be useful in planning can be obtained as part of this projection. They include various household consumption and savings aggregates, indicators of the spending pattern of households and rates of growth of household consumption and savings.[7]

(i) Household consumption and savings aggregates

Aggregates that can be derived from the consumption and savings projections include total household consumption along with the levels of household consumption in various broad commodity groups. They also include increases in total household consumption, increases in household consumption by broad commodity groups and increases in household savings over the intervening intervals.

a. Total household consumption

Total household consumption at the end of a given projection interval is obtained by aggregating the projected levels of household consumption by commodity group. Thus, total household consumption in year 5, 378.3, is computed by adding the projected levels of household consumption in the various commodity groups. This number is shown in table 83 (in the column corresponding to year 5) along with other results derived for the entire 20-year projection period. The change in total household consumption over this period is indicated in figure XXIV.

Also shown in table 83 and figure XXIV are levels and changes in household savings over the 20-year projection period.

b. Household consumption by broad commodity groups

Household consumption in broad commodity groups can be obtained by aggregating projected household consumption for the various primary commodity groups, such as those ranging from food to other services, using appropriate aggregation rules. To illustrate this aggregation, it will be assumed that there are three broad groups: "food", "clothing" and "other", the first two of which are identical to the first two primary commodity groups, while the third is an aggregation of the primary commodity groups ranging from housing to other services.

Therefore, household consumption of "food" in year 5, 216.3, is obtained as:

$$216.3 = 216.3; \tag{8}$$

Table 82. Projected levels of household consumption by commodity group and household savings

(Thousands of LCUs) a/

Commodity group/ savings	Year				
	0	5	10	15	20
Food	168405	216265	281920	371347	494704
Clothing	23840	30590	39847	52449	69823
Housing	11314	15553	21525	29897	41827
Fuel and light	23751	29185	36438	46011	58725
Durables	20789	30483	44366	64153	92861
Transportation	4285	5346	6776	8688	11266
Personal care	9156	11887	15654	20814	27980
Recreation	17190	22851	30737	41658	57012
Other services	11945	16130	21992	30159	41720
Total expenditure	290680	378294	499258	665180	895923
Savings	47320	66757	95096	136241	196666
Disposable income	338000	445052	594354	801422	1 092589

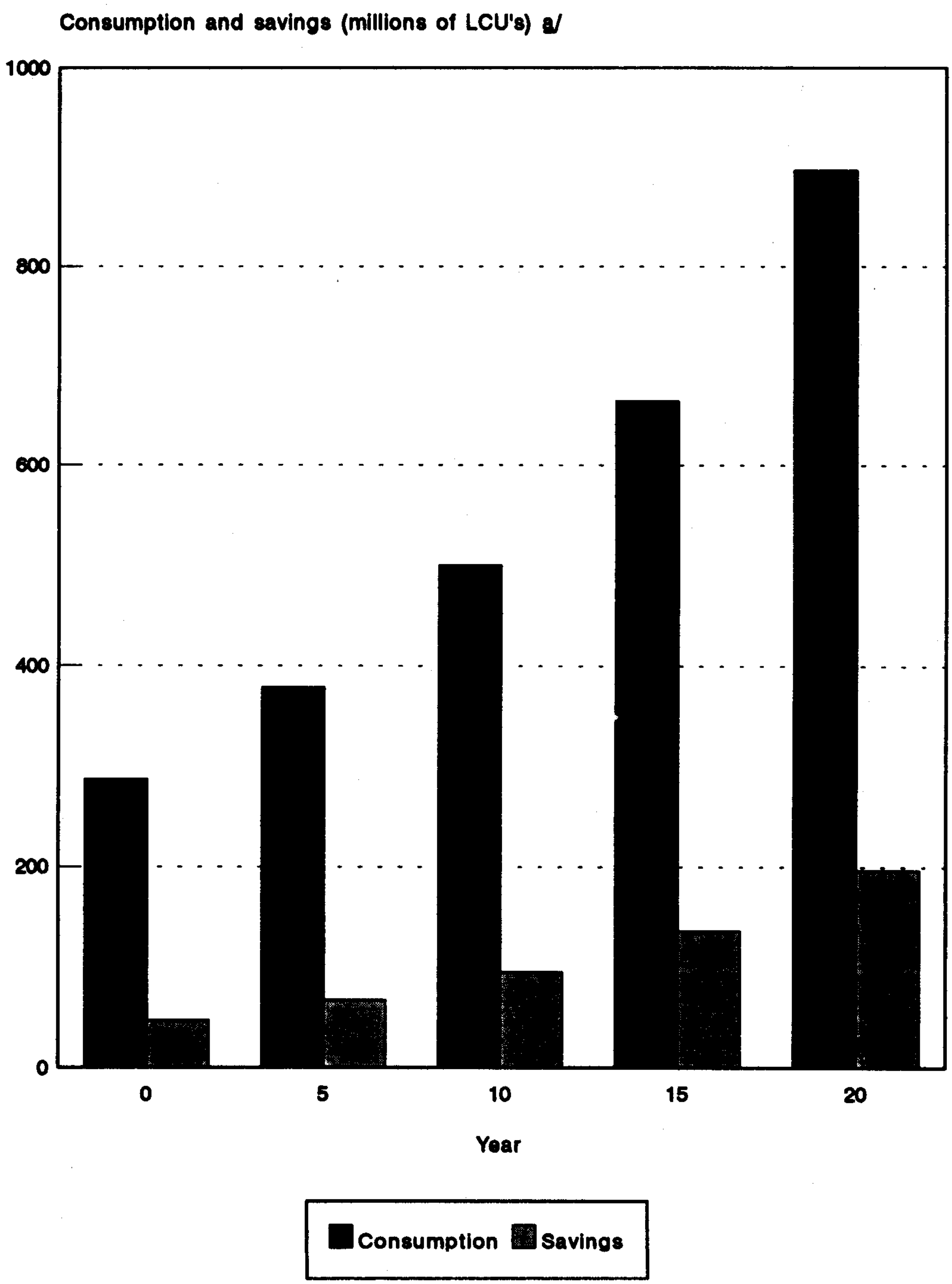
a/ Local currency units.

Table 83. Household consumption and savings aggregates, indicators of the pattern of household spending and rates of household consumption and savings change for the entire country

Indicators	Year 0	5	10	15	20
Household consumption and savings aggregates (in millions LCUs) a/					
Levels of household consumption and savings:					
Total consumption	290.7	378.3	499.3	665.2	895.9
Food	168.4	216.3	281.9	371.3	494.7
Clothing	23.8	30.6	39.8	52.4	69.8
Other	98.4	131.4	177.5	241.4.	331.4
Savings	47.3	66.8	95.1	136.2	196.7
Growth in household consumption and savings:					
Total consumption		87.6	121.0	165.9	230.7
Food		47.9	65.7	89.4	123.4
Clothing		6.8	9.3	12.6	17.4
Other		33.0	46.1	63.9	90.0
Savings		19.4	28.3	41.1	60.4
Indicators of the household spending pattern					
Proportions of disposable household income spent or saved					
Food	0.50	0.49	0.47	0.46	0.45
Clothing	0.07	0.07	0.07	0.07	0.06
Other	0.29	0.30	0.30	0.30	0.30
Savings	0.14	0.15	0.16	0.17	0.18
Rates of growth of household consumption and savings					
Total consumption		5.41	5.71	5.91	6.14
Food		5.13	5.45	5.66	5.90
Clothing		5.11	5.43	5.65	5.89
Other		5.95	6.19	6.34	6.54
Savings		7.13	7.33	7.46	7.62

a/ Local currency units.

Figure XXIV. Total household consumption and savings



a/ Local currency units.

where 216.3 on the right-hand side is the projected level of household consumption of food for year 5.

Household consumption of "clothing" in year 5, 30.6, is obtained as:

$$30.6 = 30.6; \tag{8}$$

where 30.6 on the right-hand side is the projected level of household consumption of clothing in year 5.

Household consumption of "other" goods and services in year 5, 131.4, is obtained as:

$$131.4 = 15.6 + 29.2 + 30.5 + 5.3 + 11.9 + 22.9 + 16.1; \tag{8}$$

where the numbers on the right-hand side, 15.6 through 16.1, are respectively projected levels of household consumption of housing through that of other services in year 5.

Household consumption by broad commodity groups obtained for the different dates over the projection period is shown in table 83 and presented in figure XXV.

c. Growth in total household consumption

The growth in total household consumption over a given projection interval equals the difference between total household consumption at the end of the interval and total household consumption at its beginning. For the interval 0-5, the growth in total household consumption, 91.9, is obtained as:

$$91.9 = 378.3 - 286.4; \tag{9}$$

where 286.4 and 378.3 are, respectively, total household consumption at the beginning and the end of the interval (shown in columns corresponding to years 0 and 5, respectively, in table 83).

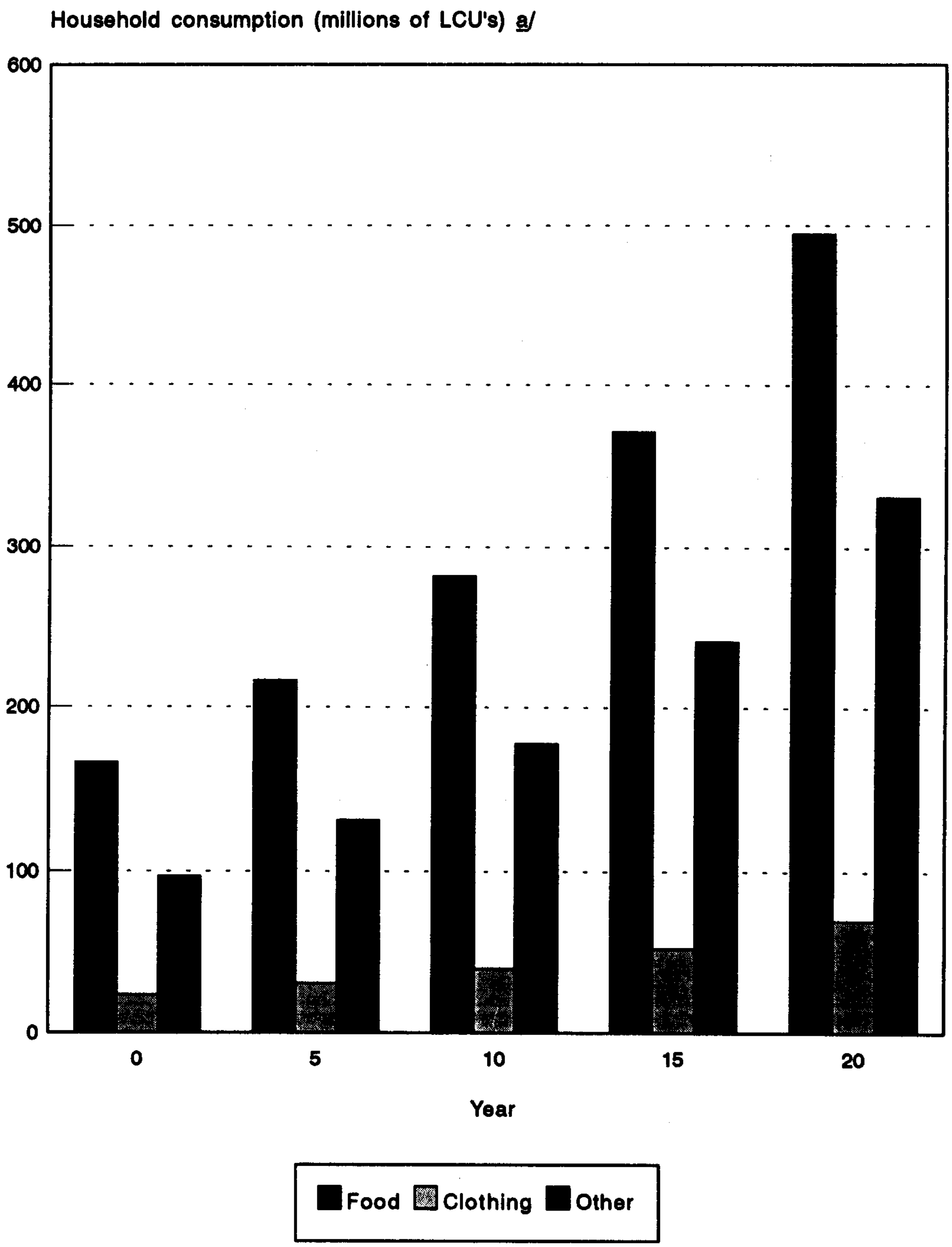
d. Growth in household consumption by broad commodity groups

The increase in household consumption in each broad commodity group over a projection interval is obtained as the difference between the levels of household consumption in that group at the end and the beginning of the interval. For example, for the interval 0-5, the growth of household consumption of food, 50.1, is:

$$50.1 = 216.3 - 166.2; \tag{10}$$

where 166.2 and 216.3 are, respectively, the levels of household consumption of food in years 0 and 5.

Figure XXV. Household connsumption by broad groups
(food, clothing and other)



a/ Local currency units.

e. Growth in household savings

The growth in household savings over a given interval can be obtained as he difference between household savings at the end of the interval and household savings at its beginning. For the interval 0-5, the growth in household savings, 20.1, is:

$$20.1 = 66.8 - 46.6; \tag{11}$$

where 46.6 and 66.8 are, respectively, household savings at the beginning and the end of the interval (see columns corresponding to years 0 and 5).

(ii) Indicators of spending pattern of household

To obtain proportions of disposable income that are spent on various commodities and saved, it is initially necessary to obtain disposable household income.

a. Disposable household income

Disposable household income for the end of a given projection interval can be obtained as a product of the per capita disposable household income and the population size at that date. Thus, disposable household income for the end of the interval 0-5, 445.1, is obtained as follows:

$$445.1 = (39.7) \cdot (11{,}210.4); \tag{12}$$

where 39.7 is the per capita disposable household income in year 5 and 11,210.4 is the population size in that year.

b. Proportions of disposable household income spent on goods and services in broad commodity groups

For the end of a given interval, the proportion of disposable household income spent on goods and services in each broad commodity group can be obtained as the level of household consumption of goods and services in a given broad commodity group, divided by the level of disposable household income. Thus, the proportion of household disposable income spent on food at the end of the interval 0-5, 0.49, is:

$$0.49 = 216.3 / 445.1; \tag{13}$$

where 216.3 is the level of household consumption of food and 445.1 is the disposable household income in year 5.

c. Proportion of disposable household income saved

The proportion of disposable household income saved at a given date can be obtained by dividing the level of household savings by disposable household income at that date. Thus, for the end of the projection interval 0-5, this proportion, 0.15, is obtained as follows:

$$0.15 = 66.8 / 445.1; \qquad (14)$$

where 66.8 is the level of household savings in year 5.

The proportions of disposable household income spent on goods and services in broad commodity groups and the proportion saved for the various dates are presented in table 83. The proportions obtained for the initial and the terminal year of the 20-year projection period are illustrated in figure XXVI.

(iii) Rates of growth of household consumption and savings

Rates of growth of household consumption can be calculated for total household consumption and for household consumption by broad commodity groups. It is also possible to compute rates of growth of household savings. These growth rates can be computed using either the geometric growth rate or the exponential growth rate depending on the treatment of time.

a. Rate of growth of total household consumption

i. Geometric growth

If growth in household consumption is assumed to occur over discrete intervals, the average annual growth rate of total household consumption for a given interval is obtained using the geometric growth rate formula. For the projection interval 0-5, this annual growth rate, 5.72 per cent (table 83), is obtained as follows:

$$5.72 = [\ (378.3/286.4)^{1/5} - 1\ ] \cdot 100; \qquad (15)$$

where 286.4 and 378.3 are the levels of total household consumption in years 0 and 5, respectively, and 5 is the length of the interval.

Rates of growth of total household consumption over the 20-year projection period that were computed using the geometric growth rate formula are shown in figure XXVII.

ii. Exponential growth

If the planner assumes that growth in household consumption is continuous, the average annual growth rate of total household consumption for a given interval is obtained by substituting the same data as above in the exponential growth rate formula. For the projection interval 0-5, this annual growth rate, 5.57 per cent, is obtained as follows:

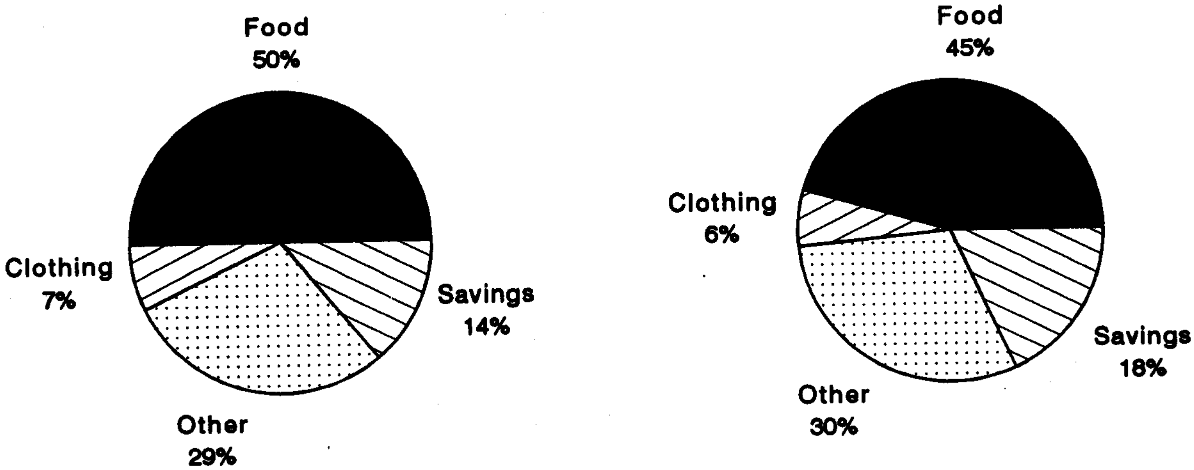
$$5.57 = [\ \ln (378.3/286.4) / 5\ ] \cdot 100; \qquad (16)$$

b. Rates of growth of household consumption by broad commodity groups

i. Geometric growth

Assuming discrete growth, the rates of increase in household consumption

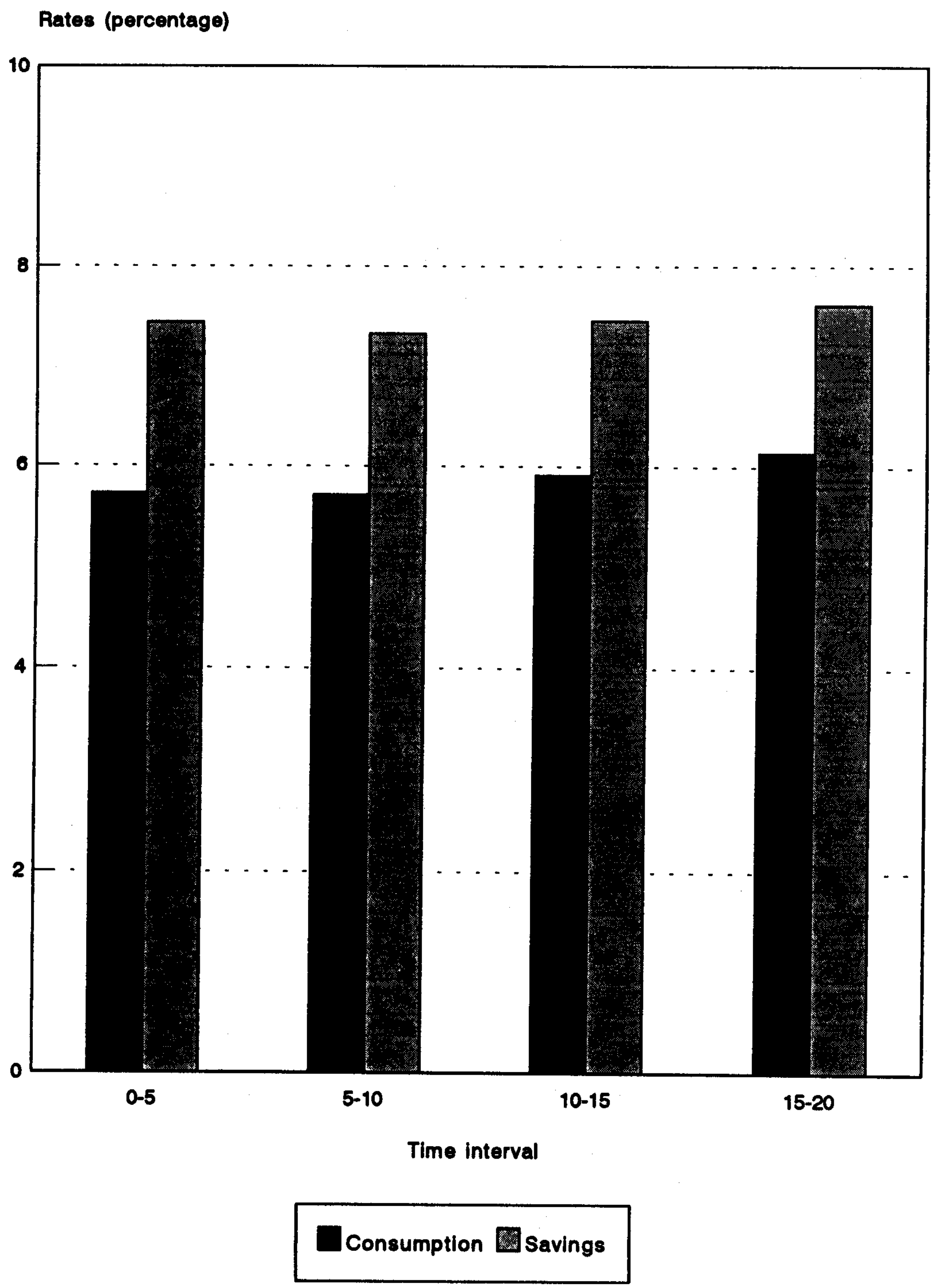
Figure XXVI. Proportions of disposable household income spent or saved in the initial and the terminal year



Year 0

Year 20

Figure XXVII. Rates of growth of total household consumption and savings



by broad commodity groups can be obtained in a way analogous to that used to calculate the rate of growth of total household consumption. Thus, the rate of increase of household consumption of food for the interval 0-5, 5.41 per cent, is calculated as follows:

$$5.41 = [\ (216.3/166.2)^{1/5} - 1\ ] \cdot 100; \qquad (17)$$

where 166.2 and 216.3 are the levels of household consumption of food in years 0 and 5, respectively.

Geometric rates of growth of household consumption by broad commodity groups over the 20-year projection interval are shown in figure XXVIII.

ii. Exponential growth

If continuous growth is assumed, rates of growth of household consumption by broad groups can be calculated using the exponential growth rate formula. The calculations can be performed by steps indicated by equation (18).

c. Rate of growth of household savings

i. Geometric growth

Assuming that household savings grow over discrete intervals, the average annual growth rate of household savings for a given interval is obtained by means of the geometric growth rate formula. For the projection interval 0-5, this annual growth rate, 7.44 per cent (table 83), is obtained as follows:

$$7.44 = [\ (66.8/46.6\ )^{1/5} - 1\ ] \cdot 100; \qquad (19)$$

where 46.6 and 66.8 are the levels of household savings in years 0 and 5, respectively.

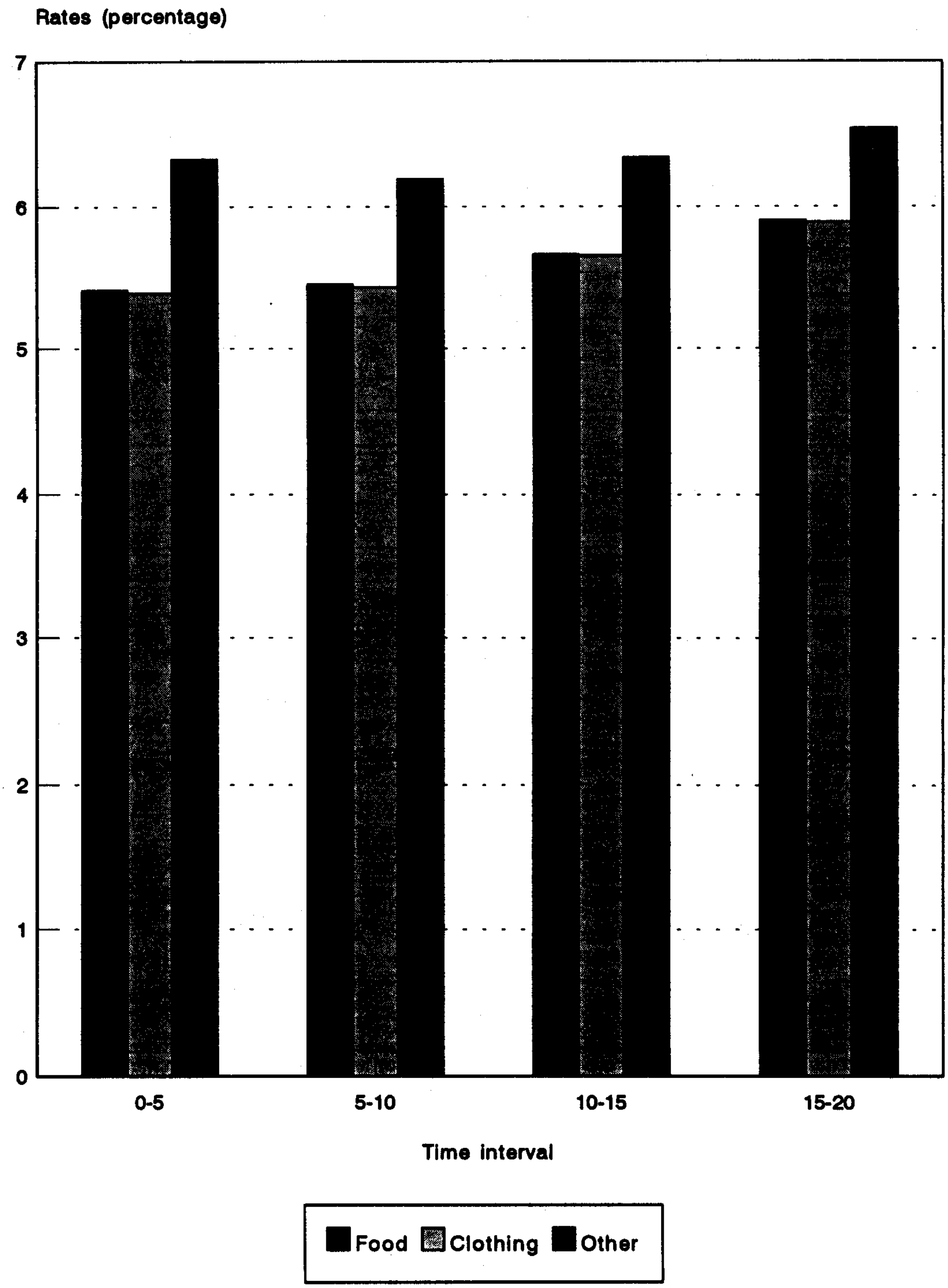
Rates of growth of household savings over the entire projection period that were computed using the geometric growth rate formula are shown in figure XXVII.

ii. Exponential growth

Assuming that growth in household savings is continuous, the average annual growth rate of household savings for a given interval can be obtained by substituting the same data as above in the exponential growth rate formula. For the projection interval 0-5, this annual growth rate, 7.20 per cent, is obtained as follows:

$$7.20 = [\ \ln (66.8/46.6)\ /\ 5\ ] \cdot 100; \qquad (20)$$

Figure XXVIII. Rates of growth of household consumption by broad commodity groups



2. Urban-rural projection

The previous section illustrated the procedure for projecting household consumption and savings at the national level, based on the linear expenditure system. The present example will illustrate the procedure for preparing an urban-rural projection of household consumption and savings, based on the extended linear expenditure system.

The inputs for urban and rural areas are shown in tables 84 and 85, respectively. These inputs include projected levels of per capita disposable household income and projected population sizes for urban and rural areas. The tables also show estimates of the slope coefficients of expenditure functions of the extended linear expenditure system for urban and rural areas, which were taken from tables 77 and 78. The adjusted intercepts of those functions, which are also shown in tables 84 and 85, have been obtained as described in annex III and shown in tables 96 and 97.

The example will focus on the calculations that are unique to the steps based on the extended linear expenditure system and projections for urban and rural areas.

(a) Levels of per capita household consumption and savings

The first step involved in projecting levels of per capita household consumption and savings using the procedure based on the extended linear expenditure system is to derive projected levels of per capita household consumption by commodity group.

(i) Levels of per capita household consumption by commodity group

Projecting the levels of per capita consumption for urban and rural areas for a given date involves evaluating expenditure functions for the various commodity groups for those areas using projected levels of per capita disposable income for urban and rural areas for the date in question. As illustrated in table 86, per capita consumption in the urban areas for the end of the projection interval 0-5, for each commodity group in the urban areas (column 5), is obtained by adding the adjusted urban intercept coefficient (column 2) to a number which is the product of the estimated urban disposable income coefficient (column 3) and the projected per capita urban disposable income (column 4).

For example, the level of per capita consumption of food for the urban areas in year 5, 23.8, is obtained as:

$$23.8 = 3.23772 + (0.41002)\ (50.2),$$

where 3.23772 is the adjusted intercept coefficient in the function for food for the urban areas; 0.41002 is the estimate of the household income coefficient in the urban expenditure function for food and 50.2 is the projected urban per capita disposable household income in year 5.

Table 84. Inputs for projecting household consumption and savings for urban areas using the extended linear expenditure system

Panel A. Projected per capita disposable household income and population size

Variable	Year 0	5	10	15	20
Per capita disposable household income (LCUs) a/	48.9	50.2	53.8	60.6	70.7
Population size (thousands)	2 983.4	4 067.0	5 334.3	6 697.3	8 140.9

Panel B. Estimates of the coefficients of expenditure functions of the extended linear expenditure system

Commodity group	Adjusted intercept coefficient b/	Disposable income coefficient c/
Food	3.23772	0.41002
Clothing	0.46251	0.06637
Housing	-1.09695	0.05144
Fuel and light	1.36650	0.03972
Durables	-3.40955	0.14387
Transportation	0.05627	0.01193
Personal care	-0.08729	0.02590
Recreation	-0.46241	0.06831
Other services	-1.01718	0.06105

a/ Local currency units.
b/ From table 96, col. 5.
c/ From table 77, col. 3.

Table 85. Inputs for projecting household consumption and savings for rural areas using the extended linear expenditure system

Panel A. Projected per capita disposable household income and population size

Variable	Year 0	5	10	15	20
Per capita disposable household income (LCUs) a/	25.7	31.6	39.2	48.8	62.6
Population size (thousands)	7 016.6	7 130.6	7 258.0	7 433.5	7 503.1

Panel B. Estimates of the coefficients of expenditure functions of the extended linear expenditure system

Commodity group	Adjusted intercept coefficient b/	Disposable income coefficient c/
Food	-0.91710	0.56330
Clothing	0.19755	0.05910
Housing	-0.01696	0.03527
Fuel and light	0.80679	0.04354
Durables	-0.65259	0.06922
Transportation	0.11822	0.00766
Personal care	-0.02712	0.03022
Recreation	0.15338	0.03652
Other services	0.18817	0.02199

a/ Local currency units.
b/ From table 97, col. 5.
c/ From table 78, col. 3.

Table 86. Deriving levels of per capita household consumption by commodity group for urban areas: end of projection interval 0-5

Commodity group	Estimates of the coefficients of expenditure functions a/ Adjusted intercept coefficient	Disposable income coefficient	Estimates of the coefficients Per capita disposable income in year 5 b/ (LCUs) d/	Projected level of per capita household consumption in year 5 c/ (LCUs) d/
(1)	(2)	(3)	(4)	(5)
Food	3.23772	0.41002	50.2	23.8
Clothing	0.46251	0.06637	50.2	3.8
Housing	-1.09695	0.05144	50.2	1.5
Fuel and light	1.36650	0.03972	50.2	3.4
Durables	-3.40955	0.14387	50.2	3.8
Transportation	0.05627	0.01193	50.2	0.7
Personal care	-0.08729	0.02590	50.2	1.2
Recreation	-0.46241	0.06831	50.2	3.0
Other services	-1.01718	0.06105	50.2	2.0
Total		0.87861		43.2

a/ From table 84, panel B.
b/ From table 84, panel A.
c/ (Col. 2) + (col. 3) . (col. 4).
d/ Local currency units.

(ii) Level of per capita total household consumption

Given the projected levels of per capita consumption by commodity groups, the level of per capita total household consumption can be obtained as the sum of those projected levels. Thus, for the end of the projection interval 0-5, the level of per capita total household consumption in the urban areas, 43.2, is obtained as:

$$43.2 = 23.8 + 3.8 + 1.5 + 3.4 + 3.8 + 0.7 + 1.2 + 3.0 + 2.0,$$

where the numbers on the right-hand side are the projected levels of per capita household consumption for the urban areas in year 5 (column 5, table 86).

(iii) Level of per capita household savings

Given the projected level of per capita total household consumption by commodity group for each area, the projected per capita household savings can be obtained as the difference between the projected per capita disposable household income and the projected per capita total household consumption.

Thus, the level of per capita household savings for the urban areas in year 5, 7.0, is obtained as:

$$7.0 = 50.2 - 43.2,$$

where 50.2 is the level of per capita disposable household income in year 5 and 43.2 is the level of per capita total consumption in that year.

Performing the calculations illustrated above for urban and rural areas for the relevant dates over the entire projection period produces the projected levels of per capita household consumption and savings for the two areas for the entire period. The per capita levels obtained for urban and rural areas as part of this illustrative example are shown respectively in tables 87 and 88.

(iv) Levels of household consumption and savings

Projected levels of household consumption and savings in urban and rural areas for a given projection date can be obtained in a way that is analogous to that used to derive projected levels of household consumption and savings at the national level. In particular, those levels in either area can be derived as products of the projected levels of per capita consumption and savings, on the one hand, and the projected population size, on the other. Projected levels of household consumption and savings for urban and rural areas over the 20-year projection period are shown in tables 89 and 90.

Projected levels of household consumption and savings can be aggregated across locations to obtain levels of household consumption and savings for the entire country. The levels of consumption and savings, which are obtained as part of this example, are indicated in table 91.

Table 87. Projected levels of per capita household consumption by commodity group and per capita household savings for urban areas

(LCUs) a/

Commodity group/ savings	Year 0	5	10	15	20
Food	23.2	23.8	25.2	28.0	32.2
Clothing	3.7	3.7	4.0	4.4	5.2
Housing	1.4	1.4	1.6	2.0	2.5
Fuel and light	3.3	3.3	3.5	3.7	4.2
Durables	3.6	3.8	4.3	5.3	6.8
Transportation	0.6	0.6	0.6	0.7	0.8
Personal care	1.1	1.2	1.3	1.4	1.7
Recreation	2.8	2.9	3.2	3.6	4.4
Other services	1.9	2.0	2.2	2.6	3.3
Total consumption	42.0	43.1	46.3	52.2	61.2
Savings	6.8	7.0	7.4	8.3	9.5
Disposable income	48.9	50.2	53.8	60.6	70.7

a/ Local currency units.

Table 88. Projected levels of per capita household consumption by commodity group and per capita household savings for rural areas

(LCUs) a/

Commodity group/ savings	Year				
	0	5	10	15	20
Food	13.55	16.88	21.16	26.57	34.35
Clothing	1.71	2.06	2.51	3.08	3.90
Housing	0.88	1.09	1.36	1.70	2.19
Fuel and light	1.92	2.18	2.51	2.93	3.53
Durables	1.12	1.53	2.06	2.72	3.68
Transportation	0.31	0.36	0.41	0.49	0.60
Personal care	0.74	0.92	1.15	1.44	1.86
Recreation	1.09	1.30	1.58	1.93	2.44
Other services	0.75	0.88	1.05	1.26	1.56
Total consumption	22.1	27.2	33.8	42.1	54.1
Savings	3.57	4.35	5.37	6.64	8.49
Disposable income	25.7	31.6	39.2	48.8	62.6

a/ Local currency units.

Table 89. Projected levels of household consumption by commodity group and household savings for urban areas

(Millions of LCUs) a/

Commodity group/ savings	Year				
	0	5	10	15	20
Food	69.4	96.8	134.9	188.0	262.3
Clothing	11.0	15.4	21.5	30.0	4209
Housing	4.2	6.0	8.9	13.5	20.7
Fuel and light	9.8	13.6	18.6	25.2	3409
Durables	10.8	15.5	23.1	35.5	55.0
Transportation	1.9	2.6	3.7	5.2	7.3
Personal care	3.5	4.9	6.9	9.9	14.2
Recreation	8.5	12.0	17.1	24.6	35.6
Other services	5.8	8.3	12.0	17.9	26.9
Total consumption	125.3	175.5	247.0	350.2	497.9
Savings	20.5	28.6	39.9	55.6	77.6
Disposable income	145.8	204.1	286.9	405.8	575.6

a/ Local currency units.

Table 90. Projected levels of household consumption by commodity group and household savings for rural areas

(Millions of LCUs) a/

Commodity group/ savings	Year				
	0	5	10	15	20
Food	95.1	120.3	153.6	197.5	257.7
Clothing	12.0	14.7	18.2	22.9	29.2
Housing	6.2	7.8	9.9	12.6	16.4
Fuel and light	13.5	15.5	18.2	21.7	26.5
Durables	7.9	10.9	14.9	20.2	27.6
Transportation	2.2	2.5	3.0	3.6	4.5
Personal care	5.2	6.6	8.4	10.7	14.0
Recreation	7.6	9.3	11.5	14.3	18.3
Other services	5.2	6.2	7.6	9.3	11.7
Total consumption	155.2	194.2	245.5	313.3	406.0
Savings	25.0	31.0	38.9	49.4	63.7
Disposable income	180.3	225.3	284.5	362.7	469.7

a/ Local currency units.

Table 91. Projected levels of household consumption by commodity group and household savings for the entire country

(Millions of LCUs) a/

Commodity group/ savings	Year				
	0	5	10	15	20
Food	164.6	217.2	288.5	385.6	520.0
Clothing	23.1	30.1	39.7	52.9	71.2
Housing	10.4	13.8	18.8	26.1	37.1
Fuel and light	23.3	29.2	36.9	47.0	60.4
Durables	18.7	26.4	38.0	55.8	82.6
Transportation	4.1	5.2	6.7	8.8	11.8
Personal care	8.7	11.5	15.3	20.6	28.1
Recreation	16.2	21.3	28.6	39.0	53.8
Other services	11.1	14.6	19.7	27.3	38.5
Total consumption	280.6	369.7	492.6	663.5	903.9
Savings	45.6	59.7	78.8	105.0	141.2
Disposable income	326.2	429.4	571.4	768.6	1 045.2

a/ Local currency units.

(b) Other results

In the course of making an urban-rural projection one can also calculate a number of derived indicators, using steps that are identical to those employed in the national projection, which are, however, performed for urban and rural areas and the entire country. Those indicators include various household consumption and savings aggregates, indicators of the spending pattern of households and the various rates of growth of household consumption and savings. Furthermore, the results for the country as a whole also include proportions of household consumption and savings that are urban and rural. The results obtained for urban and rural areas and the entire country are presented in tables 92 through 94, respectively. These indicators, except for the proportions urban and rural, can be calculated using the steps illustrated in connection with the national projection.

Levels of total household consumption and savings for urban and rural areas, as well as the entire country, which were obtained for the 20-year projection period, are shown, respectively, in figures XXIX and XXX.

(i) Proportions of total household consumption that are urban and rural

The proportion of total household consumption that is urban at the end of the projection interval is calculated by dividing the total household consumption in the urban areas by the total household consumption for the entire country for the date. For the end of the interval 0-5, the proportion of total household consumption that is urban, 0.47, is obtained as:

$$0.47 = 175.5/369.8; \tag{25}$$

where 175.5 is the total household consumption in the urban areas and 369.8 is the total household consumption for the entire country in year 5 (shown in tables 92 and 94, respectively).

The proportion of total household consumption that is rural, 0.53, is calculated as a complement of the proportion urban:

$$0.53 = 1 - 0.47; \tag{26}$$

where 0.47 is the proportion of total household consumption that is urban.

The proportions of household consumption that are urban and rural, obtained for the 20-year projection period, are indicated in table 94 and figure XXXI.

(ii) Proportions of household savings that are urban and rural

The proportion of household savings that is urban is calculated by dividing the household savings in the urban areas by the household savings in

Table 92. Household consumption and savings aggregates, indicators of the pattern of household spending and rates of household consumption and savings change for urban areas

Indicators	Year 0	5	10	15	20
Household consumption and savings aggregates (millions of LCUs) a/					
Levels of household consumption and savings					
Total consumption	125.3	175.5	247.0	350.2	497.9
Food	69.4	96.8	134.9	188.0	262.3
Clothing	11.0	15.4	21.5	30.0	41.9
Other	44.8	63.2	90.6	132.0	193.6
Savings	20.5	28.6	39.9	55.6	77.6
Growth in household consumption and savings					
Total consumption		50.1	71.5	103.1	147.7
Food		27.4	38.0	53.1	74.2
Clothing		4.3	6.0	8.5	11.9
Other		18.4	27.4	41.4	61.5
Savings		8.1	11.2	15.7	21.9
Indicators of the household spending pattern					
Proportions of disposable household income spent or saved					
Food	0.47	0.47	0.47	0.46	0.45
Clothing	7.58	7.55	7.49	7.40	7.29
Other	0.30	0.30	0.31	0.32	0.33
Savings	0.14	0.14	0.13	0.13	0.13
Rates of growth of household consumption and savings					
Total consumption		6.96	7.07	7.22	7.29
Food		6.87	6.85	6.86	6.88
Clothing		6.88	6.87	6.89	6.91
Other		7.12	7.47	7.82	7.94
Savings		6.87	6.85	6.86	6.88

a/ Local currency units.

Table 93. Household consumption and savings aggregates, indicators of the pattern of household spending and rates of household consumption and savings change for rural areas

Indicators	Year 0	5	10	15	20
Household consumption and savings aggregates (millions of LCUs) a/					
Levels of household consumption and savings					
Total consumption	155.2	194.2	245.5	313.3	406.0
Food	95.1	120.3	153.6	197.5	257.6
Clothing	12.0	14.7	18.2	22.9	29.2
Other	48.0	59.1	73.6	92.9	119.0
Savings	25.0	31.0	38.9	49.4	63.6
Growth in household consumption and savings					
Total consumption		38.9	51.2	67.7	92.6
Food		25.2	33.2	43.9	60.1
Clothing		2.6	3.5	4.6	6.3
Other		11.0	14.5	19.2	26.1
Savings		6.0	7.9	10.4	14.2
Indicators of the household spending pattern					
Proportions of disposable household income spent or saved					
Food	0.52	0.53	0.53	0.54	0.54
Clothing	6.67	6.53	6.41	6.31	6.22
Other	0.26	0.26	0.25	0.25	0.25
Savings	0.13	0.13	0.13	0.13	0.13
Rates of growth of household consumption and savings					
Total consumption		4.58	4.79	4.99	5.31
Food		4.81	4.99	5.15	5.46
Clothing		4.10	4.38	4.65	5.00
Other		4.22	4.49	4.74	5.09
Savings		4.39	4.63	4.86	5.19

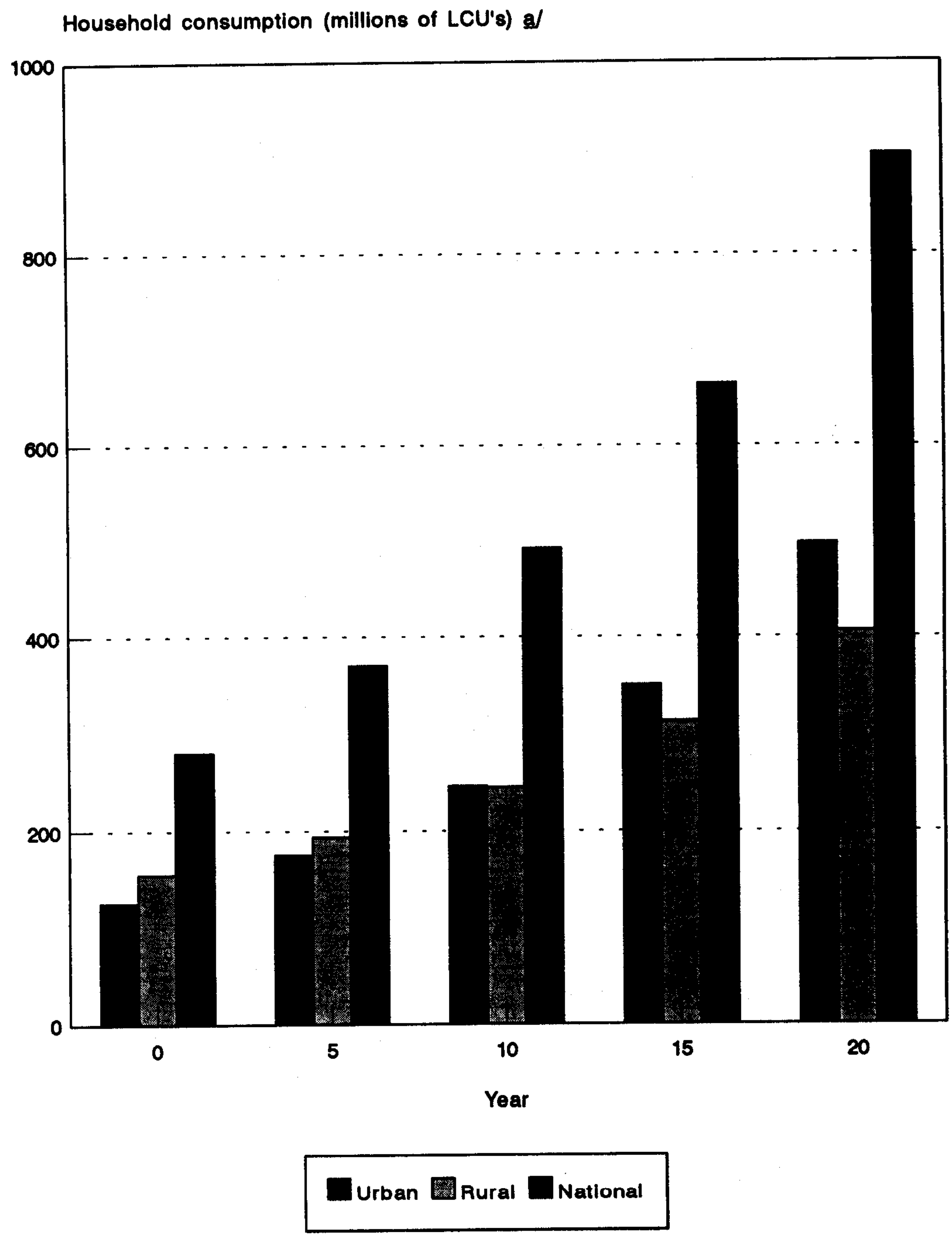
a/ Local currency units.

Table 94. Household consumption and savings aggregates, indicators of the pattern of household spending and rates of household consumption and savings change for the entire country

Indicators	Year 0	5	10	15	20
Household consumption and savings aggregates (millions of LCUs) a/					
Levels of household consumption and savings					
Total consumption	280.6	369.7	492.6	663.5	903.9
Food	164.6	217.2	288.5	385.6	520.0
Clothing	23.1	30.1	39.7	52.9	71.2
Other	92.8	122.3	164.3	224.9	312.7
Savings	45.6	59.7	78.8	105.0	141.2
Growth in household consumption and savings					
Total consumption		89.1	122.8	170.9	240.4
Food		52.6	71.2	97.0	134.4
Clothing		7.0	9.6	13.1	18.2
Other		29.4	41.9	60.6	87.7
Savings		14.1	19.1	26.1	36.2
Indicators of the household spending pattern					
Proportions of disposable household income spent or saved					
Food	0.50	0.50	0.50	0.50	0.49
Clothing	7.08	7.02	6.95	6.88	6.81
Other	0.28	0.28	0.28	0.29	0.29
Savings	0.13	0.13	0.13	0.13	0.13
Indicators of the urban-rural distiribution of total household consumption and savings					
Proportions of total consumption					
Urban	0.44	0.47	0.50	0.52	0.55
Rural	0.55	0.52	0.49	0.47	0.44
Proportions of savings					
Urban	0.45	0.47	0.50	0.52	0.54
Rural	0.54	0.52	0.49	0.47	0.45
Rates of growth of household consumption and savings					
Total consumption		5.67	5.90	6.13	6.37
Food		5.70	5.83	5.97	6.16
Clothing		5.47	5.68	5.89	6.10
Other		5.66	6.07	6.48	6.80
Savings		5.54	5.72	5.89	6.10

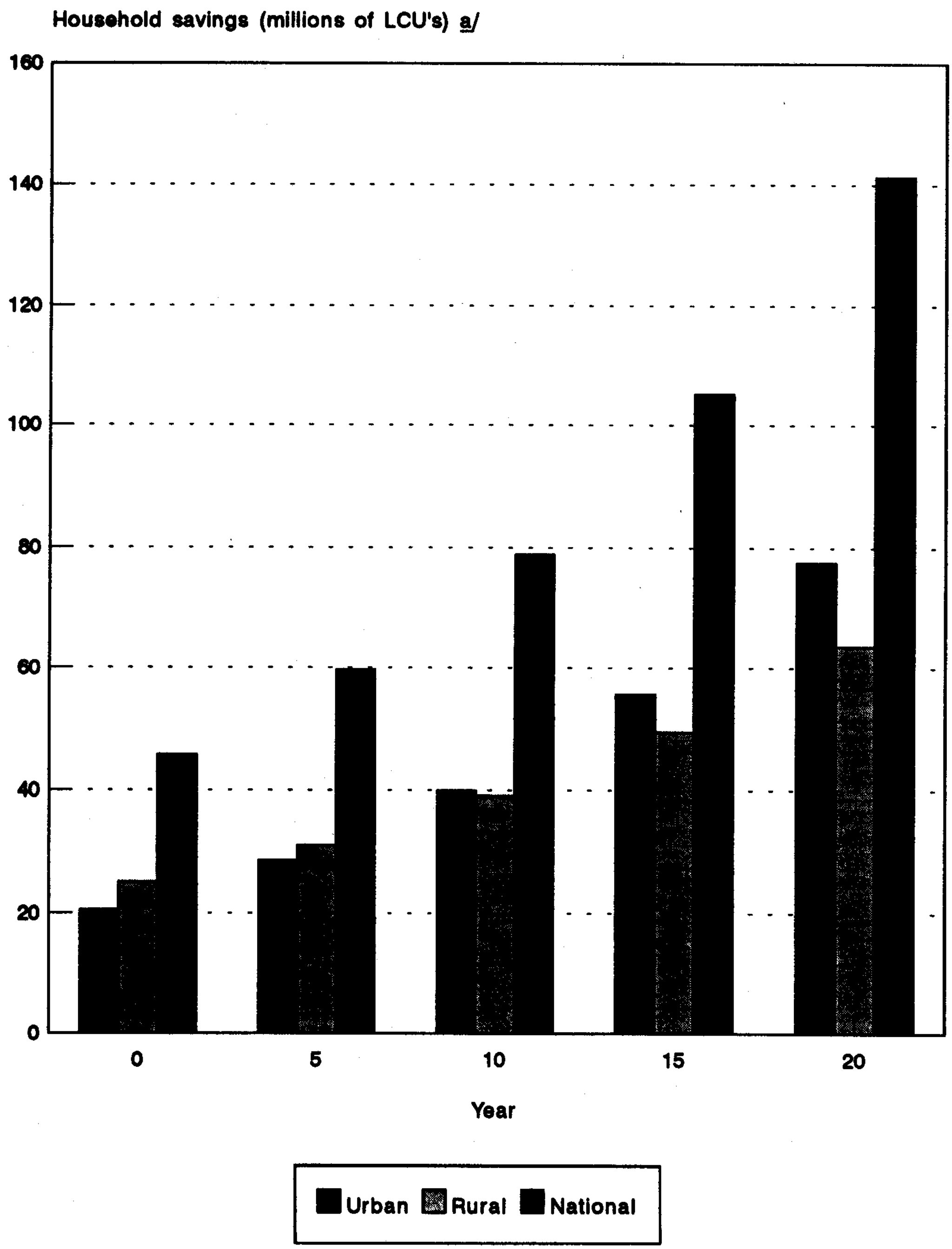
a/ Local currency units.

Figure XXIX. Total household consumption: urban, rural and national



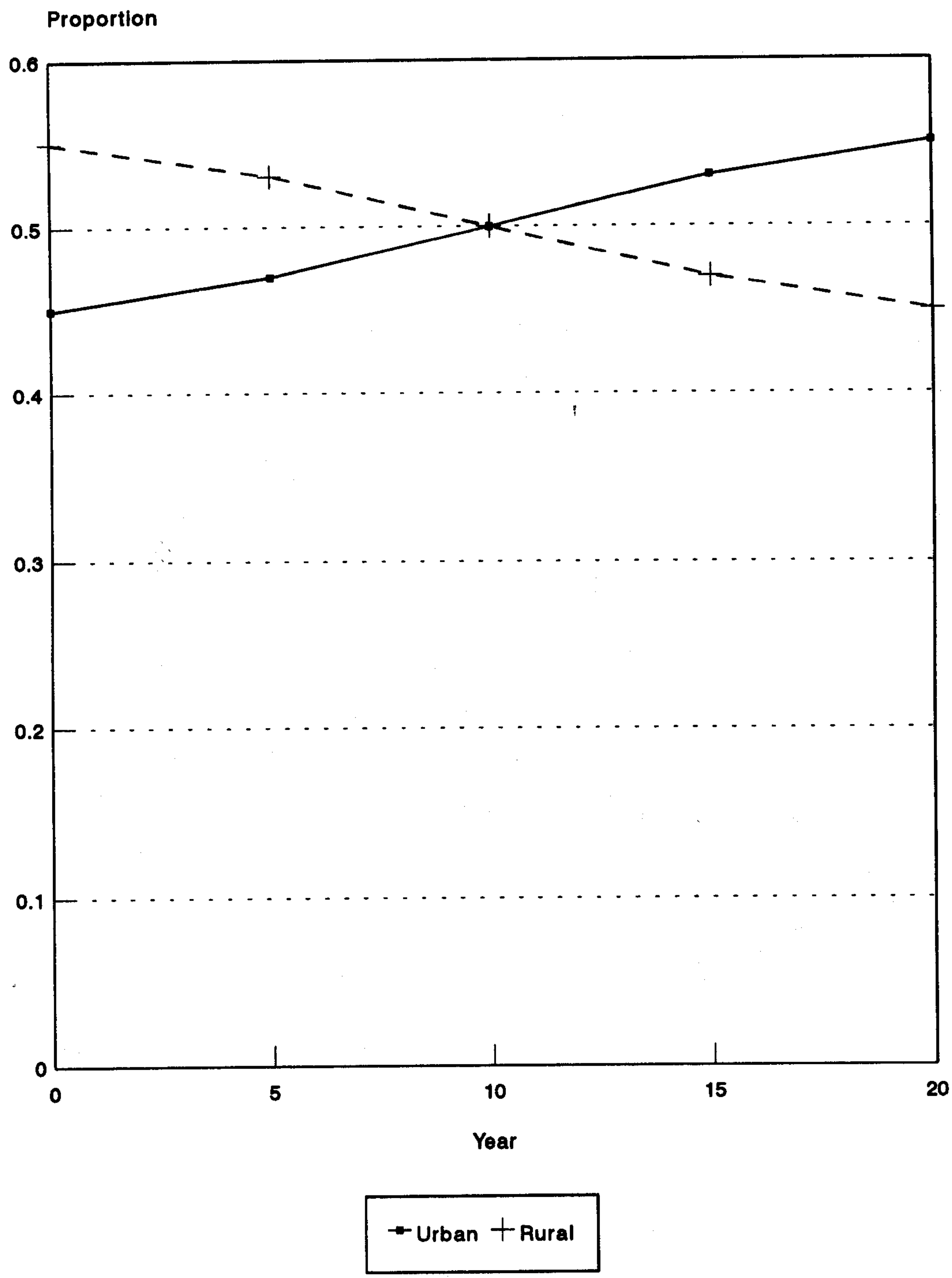
a/ Local currency units.

Figure XXX. Household savings: urban, rural and national



a/ Local currency units.

Figure XXXI. Proportions of household consumption that are urban and rural



the entire country. For the end of the interval 0-5, the proportion of household savings that is urban, 0.48, which is indicated in table 94, is obtained as:

$$0.48 = 28.6/59.7; \tag{27}$$

where 28.6 is the household savings in the urban areas and 59.7 is the household savings for the entire country in year 5 (shown, respectively, in tables 92 and 94).

The proportion of household savings that is rural at the end of the interval 0-5, 0.52, is calculated as a complement of the relevant proportion urban:

$$0.52 = 1 - 0.48; \tag{28}$$

where 0.48 is the proportion of household savings that is urban.

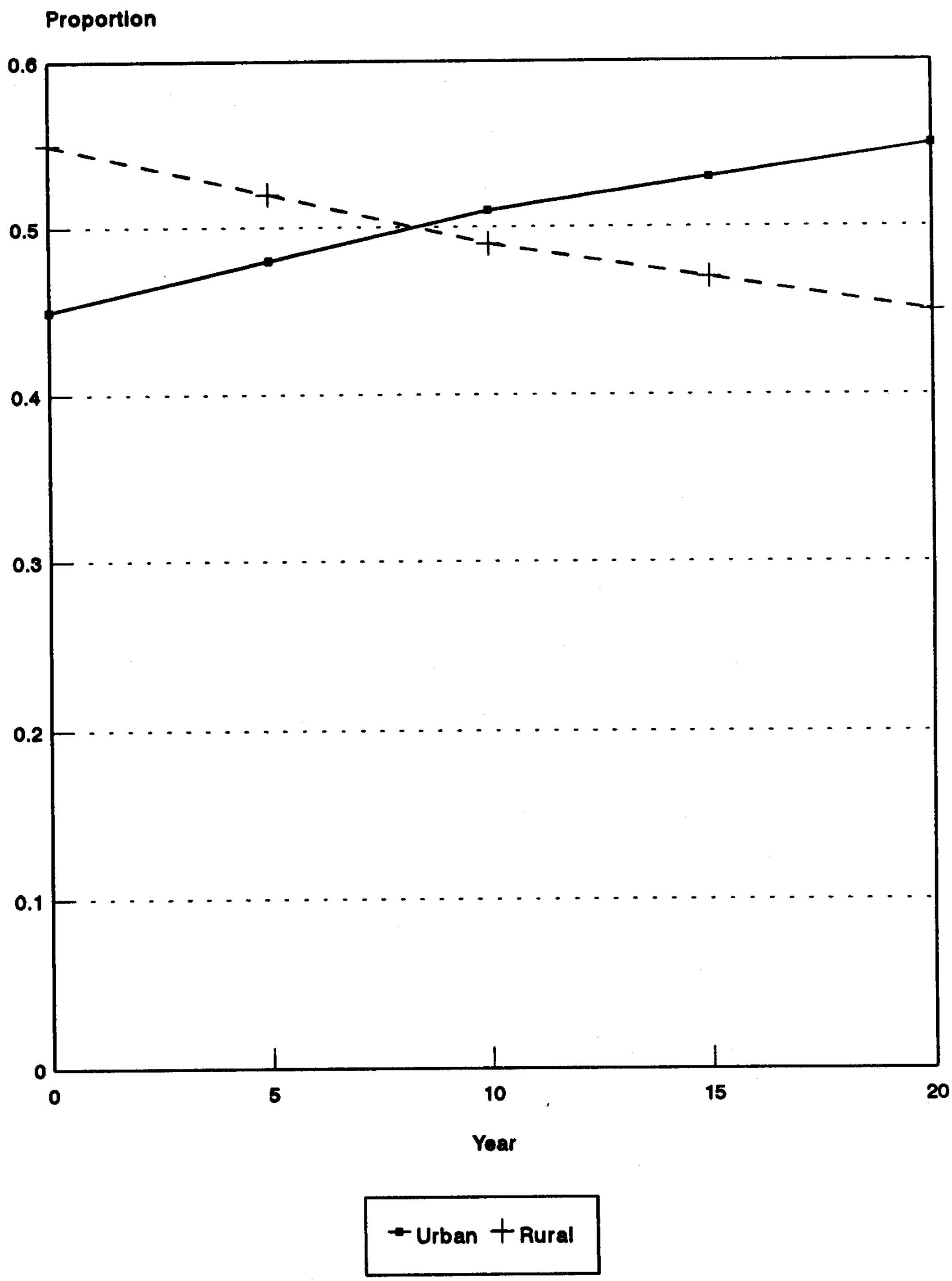
Proportions of household savings that are urban and rural over the projection period are shown in figure XXXII.

This completes the illustration of the procedures to project household consumption and savings using the linear expenditure systems and the extended linear expenditure system.

E. Summary

The present chapter has described a method for preparing household consumption and savings projections using variants of the linear expenditure system and the extended linear expenditure system that assume fixed commodity prices. The method can be employed to make national or urban-rural projections. In addition, the types of inputs required by the method have been described and the preparation of those inputs discussed. Lastly, an example of a national projection using expenditure functions of the linear expenditure system and an example of an urban-rural projection using expenditure functions of the extended linear expenditure system were described. A complete listing of the outputs that can be generated by the method is shown in box 26.

Figure XXXII. Proportions of household savings that are urban and rural



Box 26

Outputs of the method for making household consumption and savings projections using the linear expenditure system or the extended linear expenditure system

1. Levels of per capita household consumption by commodity group and per household savings (national or urban, rural and national)

2. Levels of household consumption by commodity group and levels of household savings (national or urban, rural and national)

3. Household consumption and savings aggregates (national or urban, rural and national)

   Levels of household consumption and savings:

   Total consumption

   Consumption by broad commodity groups (e.g., food, clothing, other)

   Savings

   Growth in household consumption and savings:

   Total

   Consumption by broad commodity groups

   Savings

4. Indicators of the spending pattern of households (national or urban, rural and national)

   Proportions of disposable household income spent or saved:

   Consumption by broad commodity groups

   Savings

(continued)

Box 26 (continued)

5. Indicators of the urban-rural distribution of total household consumption and savings (national only, if urban and rural household consumption and savings are being projected)

Proportions of total household consumption:

Urban
Rural

Proportions of household savings:

Urban
Rural

6. Rates of growth of household consumption and savings (nationalor urban, rural and national)

Total consumption

Consumption by commodity groups

Savings

F. Notation and equations

1. Indices, variables and special symbols

(a) List of indices

$g = 1,\ldots,G$	are commodity groups
$h = 1,\ldots,H$	are broad commodity groups
j	is the cluster of households
$k = 1,2$	are urban and rural locations
t	is the year of the projection period
t'	is the calendar year

(b) List of variables

ASVR(t+5)	is the average household savings ratio at the end of the interval
DHI(t+5)	is the disposable household income at the end of the interval
EGRHC	is the average annual exponential growth rate of total household consumption for the interval
EGRHC(h)	is the average annual exponential growth rate of household consumption in broad commodity group h for the interval
EGRHSV	is the average annual exponential growth rate of household savings for the interval
GGRHC	is the average annual geometric growth rate of total household consumption for the interval
GGRHC(h)	is the average annual geometric growth rate of household consumption in broad commodity group h for the interval
GGRHSV	is the average annual geometric growth rate of household savings for the interval
HC(g,t+5)	is the level of household consumption of goods and services in commodity group g at the end of the interval

HC(h,t+5)	is the level of household consumption of goods and services in broad commodity group h at the end of the interval
HC(k,t+5)	is the total household consumption in location k at the end of the interval
HC(t+5)	is the level of total household consumption at the end of the interval
HCG	is the growth of total household consumption during the interval
HCG(h)	is the growth of household consumption in broad commodity group h over the interval
HSV(k,t+5)	is the level of household savings in location k at the end of the interval
HSV(t+5)	is the level of household savings at the end of the interval
HSVG	is the growth of household savings during the interval
PCC(g,j)	is the mean level of per capita household consumption of goods and services in commodity group g in household cluster j
PCC(g,t')	is the level of per capita consumption of goods and services in commodity group g in year t'
PCC(g,t+5)	is the level of per capita household consumption of goods and services in commodity group g at the end of the interval
PCC(t+5)	is the level of per capita total household consumption at the end of the interval
PCDHI(j)	is the mean level of per capita disposable household income in household cluster j
PCDHI(t')	is the level of per capita disposable household income in year t'
PCDHI(t+5)	is the level of per capita disposable household income at the end of the interval
PCSV(t+5)	is the level of per capita household savings at the end of the interval
PCTHE(j)	is the mean level of per capita total household expenditure in household cluster j

PCTHE(t') is the level of per capita total household expenditure in year t'

PCTHE(t+5) is the level of per capita total household expenditure at the end of the interval

POP(t+5) is the population size at the end of the interval

PRDHIC(h,t+5) is the proportion of disposable household income spent on consumption of goods and services in broad commodity group h at the end of the interval

PRDHISV(t+5) is the proportion of disposable household income saved at the end of the interval

PRHCRUR(t+5) is the proportion of total household consumption that is rural at the end of the interval

PRHCURB(t+5) is the proportion of total household consumption that is urban at the end of the interval

PRHSVRUR(t+5) is the proportion of household savings that is rural at the end of the interval

PRHSVURB(t+5) is the proportion of household savings that is urban at the end of the interval

(c) List of special symbols

a(g) is the intercept coefficient of the expenditure function for commodity group g in the linear expenditure system or the extended linear expenditure system

a*(g) is the estimate of the intercept coefficient of the expenditure function for commodity group g in the linear expenditure system or the extended linear expenditure system

b(g) is the partial coefficient of per capita total household expenditure in the expenditure function for commodity group g in the linear expenditure system or the partial coefficient of per capita disposable household income in the expenditure function for the same commodity group in the extended linear expenditure system

b*(g) is the estimate of the partial coefficient of per capita total household expenditure in the expenditure function for commodity group g in the linear expenditure system or the partial coefficient of per capita disposable household income in the expenditure functions for the same commodity group in the extended linear expenditure system

G — is the number of commodity groups

H — is the number of broad commodity groups

T — is a transformation indicating the way household consumption levels by commodity groups are aggregated to obtain household consumption levels by broad commodity groups

u(g,j) — is the random disturbance term for commodity group g in household cluster j

2. Equations

A. The technique

National level

(a) Procedure based on the linear expenditure system

(i) Expenditure functions

$$PCC(g,t') = a(g) + b(g) \cdot PCTHE(t'); \qquad g = 1,\dots,G \tag{1}$$

(ii) Levels of per capita household consumption and savings

a. Level of per capita total household expenditure

$$PCTHE(t+5) = PCDHI(t+5) \cdot [\ 1 - ASVR(t+5)\ ]; \tag{2}$$

b. Levels of per capita household consumption by commodity group

$$PCC(g,t+5) = a^*(g) + b^*(g) \cdot PCTHE(t+5); \qquad g = 1,\dots,G \tag{3}$$

c. Level of per capita household savings

$$PCSV(t+5) = PCDHI(t+5) - PCTHE(t+5); \tag{4}$$

(iii) <u>Levels of household consumption by commodity group and levels of household savings</u>

a. <u>Household consumption by commodity group</u>

$$HC(g,t+5) = PCC(g,t+5) \cdot POP(t+5); \qquad (5)$$

$$g = 1,\dots,G$$

b. <u>Household savings</u>

$$HSV(t+5) = PCSV(t+5) \cdot POP(t+5); \qquad (6)$$

(iv) <u>Other results</u>

a. <u>Household consumption and savings aggregates</u>

i. <u>Total household consumption</u>

$$HC(t+5) = \sum_{g=1}^{G} HC(g,t+5); \qquad (7)$$

ii. <u>Household consumption by broad commodity groups</u>

$$HC(h,t+5) = T\;[\;HC(g,t+5)\;]; \qquad (8)$$

$$h = 1,\dots,H$$

iii. <u>Growth in total household consumption</u>

$$HCG = HC(t+5) - HC(t); \qquad (9)$$

iv. <u>Growth of household consumption by broad commodity groups</u>

$$HCG(h) = HC(h,t+5) - HC(h,t); \qquad (10)$$

$$h = 1,\dots, H$$

v. Growth in household savings

$$HSVG = HSV(t+5) - HSV(t); \qquad (11)$$

b. Indicators of the spending pattern of households

i. Disposable household income

$$DHI(t+5) = PCDHI(t+5) \cdot POP(t+5); \qquad (12)$$

ii. Proportions of disposable household income spent on goods and services in broad commodity groups

$$PRDHIC(h,t+5) = HC(h,t+5) \;/\; DHI(t+5); \qquad (13)$$

$$h = 1,\ldots,H$$

iii. Proportion of disposable household income saved

$$PRDHISV(t+5) = HSV(t+5) \;/\; DHI(t+5); \qquad (14)$$

c. Rates of growth of household consumption and savings

i. Rate of growth of total household consumption

Geometric growth rate

$$GGRHC = [\ (\ HC(t+5)/HC(t)\ )^{1/5} - 1\ ] \cdot 100; \qquad (15)$$

Exponential growth rate

$$EGRHC = [\ \ln\ (\ HC(t+5)/HC(t)\ )\ /\ 5\ ] \cdot 100; \qquad (16)$$

ii. Rates of growth of household consumption by broad commodity groups

Geometric growth rate

$$GGRHC(h) = [\ (\ HC(h,t+5)/HC(h,t)\ )^{1/5} - 1\ ] \cdot 100; \qquad (17)$$

$$h = 1,\ldots,H$$

Exponential growth rates

$$EGRHC(h) = [\ \ln\ (\ HC(h,t+5)/HC(h,t)\ )\ /\ 5\ ] \cdot 100; \qquad h = 1,\ldots,H \tag{18}$$

iii. Rate of growth of household savings

Geometric growth rate

$$GGRHSV = [\ (\ HSV(t+5)/HSV(t)\ )^{1/5} - 1\ ] \cdot 100; \tag{19}$$

Exponential growth rate

$$EGRHSV = [\ \ln\ (\ HSV(t+5)/HSV(t)\ )\ /\ 5\ ] \cdot 100; \tag{20}$$

(b) Procedure based on the extended linear expenditure system

(i) Expenditure functions

$$PCC(g,t') = a(g) + b(g) \cdot PCDHI(t'); \qquad g = 1,\ldots,G \tag{21}$$

(ii) Levels of per capita household consumption and savings

a. Levels of per capita household consumption by commodity group

$$PCC(g,t+5) = a^*(g) + b^*(g) \cdot PCDHI(t+5); \qquad g = 1,\ldots,G \tag{22}$$

b. Level of per capita total household consumption

$$PCC(t+5) = \sum_{g=1}^{G} PCC(g,t+5); \tag{23}$$

c. Level of per capita household savings

$$PCSV(t+5) = PCDHI(t+5) - PCC(t+5); \tag{24}$$

(iii) Levels of household consumption and savings and other results

2. Urban-rural level

(a) Procedure based on the linear expenditure system

(i) Expenditure functions

(ii) Levels of per capita household consumption and savings

(iii) Levels of household consumption and savings

(iv) Other results

a. Proportions of total household consumption that are urban and rural

PRHCURB(t+5) = HC(1,t+5) / HC(t+5); (25)

PRHCRUR(t+5) = 1 - PRHCURB(t+5); (26)

b. Proportions of household savings that are urban and rural

PRHSVURB(t+5) = HSV(1,t+5) / HSV(t+5); (27)

PRHSVRUR(t+5) = 1 - PRHSVURB(t+5); (28)

(b) Procedures based on the extended linear expenditure system

(i) Expenditure function

(ii) Levels of per capita household consumption and savings

(iii) Levels of household consumption and savings and other results

B. The inputs

1. Types of inputs required

2. Preparation of inputs

(a) Assumptions on the average household savings ratio

(b) Estimates of expenditure functions of the alternative expenditure systems

(i) Cross-section data

(ii) Procedures to estimate alternative expenditure systems

a. National level

i. Linear expenditure system

$$PCC(g,j) = a(g) + b(g) \cdot PCTHE(j) + u(g,j); \qquad (29)$$

$$g = 1,\ldots,G$$

ii. Extended linear expenditure system

$$PCC(g,j) = a(g) + b(g) \cdot PCDHI(j) + u(g,j); \qquad (30)$$

$$g = 1,\ldots,G$$

b. Urban-rural level

i. Linear expenditure system

ii. Extended linear expenditure system

Notes

1/ Throughout this chapter, "household consumption" and "household savings" refer to the value of household consumption and savings measured in constant prices.

2/ For projections carried out by means other than those using LES and ELES and employing the assumption of fixed relative prices, see, for example, Mason and others (1987a).

3/ Much of this section is similar to section B.2.(a)(iv) in chapter X. The reader who is familiar with the content of that section may wish to skip the current section.

4/ The proportion of disposable household income saved, which is obtained using the procedure based on the linear expenditure system, equals the assumed average household savings ratio.

5/ This description of the procedures to estimate alternative demand systems will use the cluster of households as the unit of observation instead of the calendar year. Illustrative applications of the procedures to be discussed below will use cross-sectional data pertaining to the household clusters.

6/ Much of this section is similar to section D.1.(c) in chapter X. The reader who is familiar with the content of that section may wish to skip the current section.

7/ The figures presented in the text have been rounded to the nearest decimal point. Therefore the components may not add up to the totals.

Annex I

LINEAR EXPENDITURE SYSTEM

The linear expenditure system (LES) is the best known of the demand systems rooted in neoclassical economic theory. It has been estimated using a variety of data [a] and has been used as part of analytical and planning models.[b] This system, which assumes that household decisions are made on the basis of per capita resources, postulates that the determinants of the allocation of the total household expenditure are the level of that expenditure and relative prices. Other factors that may have an influence on household allocation decisions, such as location of residence and various characteristics of the household, are not part of the demand system.

The linear expenditure system can be estimated under assumptions of variable or constant relative prices. If suitable data, such as time series information on the levels of per capita consumption by commodity category and per capita total expenditure are available from national accounts, in both current and constant prices, the parameters of the expenditure functions of this system can be estimated under the assumption of variable relative prices. If the available data are more limited, such as cross-sectional survey information on the levels of per capita household consumption by commodity group and per capita total household expenditure, the expenditure functions must be estimated by assuming that the relative prices of the various commodities are fixed.

This annex will initially present the standard specification of LES, which assumes variable prices. Then, it will show how this specification can be transformed into one that assumes constant relative prices. Throughout this discussion, the calendar year will be used as the unit observation.

A. Linear expenditure system under variable prices

The linear expenditure system under variable prices consists of a set of linear expenditure functions in per capita terms that postulate that the amount of household resources spent on each commodity or group of commodities is a function of per capita total household expenditure and the prices of those commodities. The functions are as follows:

$$PCC(g,t') = c(g) \cdot PR(g,t') + b(g) \cdot \left[PCTHE(t') - \sum_{g'=1}^{G} c(g') \cdot PR(g',t') \right]; \quad g = 1,\ldots,G, \qquad (1)$$

where:

$g = g' = 1,\ldots,G$	are commodity groups,
G	is the number of commodity groups,

t′	is the calendar year,
PCC(g,t′)	is the level of per capita consumption of goods and services in commodity group g in year t′,
PR(g,t′)	is the composite price of goods and services in commodity group g in year t′,
PCTHE(t′)	is the level of per capita total household expenditure in year t′,
b(g)	is the coefficient representing the marginal budget share for goods and services in commodity group g, and
c(g)	is the coefficient for commodity group g indicating the level of committed consumption of goods and services of commodity group g.

The levels of committed consumption, c(g)'s, which are also referred to as levels of basic needs or subsistence quantities, are hypothesized to be positive. The value of the committed consumption of various goods and services, $\Sigma^{G}_{g'=1,}$ c(g)· PR(g,t′), is referred to as total committed or subsistence expenditure. The difference between the total expenditure and the total committed expenditure, PCTHE(t′) - $\Sigma^{G}_{g'=1,}$ c(g) · PR(g,t), may be thought of as uncommitted or "supernumerary" expenditure.

The marginal budget shares, b(g)'s, are marginal propensities to consume out of total expenditure, which add up to unity, i.e., $\Sigma^{G}_{g'=1,}$ b(g) = 1. They indicate how the supernumerary expenditure is allocated among the goods and services in the various commodity groups.

B. Linear expenditure system under constant relative prices

If it is assumed that prices are relatively fixed, then the expenditure functions indicated in equation (1) can be rewritten as follows:

$$\mathrm{PCC}(g,t') = c(g) \cdot \mathrm{PR}(g) + b(g) \cdot \left[\, \mathrm{PCTHE}(t') - \sum_{g'=1}^{G} c(g') \cdot \mathrm{PR}(g') \,\right]; \quad (2)$$

$$g = 1,\ldots,G,$$

where:

PR(g)	is the constant composite price of goods and services in commodity group g.

Further, the expenditure functions shown in equation (2) can be rewritten in order to obtain the following set of functions:

$$PCC(g,t') = c(g) \cdot PR(g) + b(g) \cdot PCTHE(t') - b(g) \cdot \sum_{g'=1}^{G} c(g') \cdot PR(g'); \quad g = 1,\ldots,G. \tag{3}$$

Moreover, the functions shown in equation (3) can be rearranged in order to obtain the following set of expenditure functions expressing per capita consumption by commodity group in terms of per capita total expenditure:

$$PCC(g,t') = a(g) + b(g) \cdot PCTHE(t'); \quad g = 1,\ldots,G, \tag{4}$$

where:

$$a(g) = c(g) \cdot PR(g) - b(g) \cdot \sum_{g'=1}^{G} c(g') \cdot PR(g'); \tag{5}$$

The expenditure functions shown in equation (4) are the functions of the linear expenditure system under fixed relative prices, which are indicated in equation (1) in chapter XI. Equation (5) shows the relationship between the intercept coefficients of LES expenditure functions under constant prices and the coefficients and variables of the standard specification of LES expenditure functions under this assumption -- c(g)'s, PR(g)'s and b(g)'s.

C. Notation and equations

1. Indices, variables and special symbols

(a) List of indices

$g = g' = 1,\ldots,G$	are commodity groups
t'	is the calendar year

(b) List of variables

PCC(g,t')	is the level of per capita consumption of goods and services in commodity group g in year t'
PCTHE(t')	is the level of per capita total household expenditure in year t'
PR(g)	is the constant composite price of goods and services in commodity group g
PR(g,t')	is the composite price of goods and services in commodity group g in year t'

(c) List of special symbols

b(g)	is the coefficient representing the marginal budget share for goods and services in commodity group g
c(g)	is the coefficient for commodity group g indicating the level of committed consumption of goods and services of commodity group g
G	is the number of commodity groups

2. Equations

A. Linear expenditure system under variable prices

$$PCC(g,t') = c(g) \cdot PR(g,t') + b(g) \cdot \left[PCTHE(t') - \sum_{g'=1}^{G} c(g') \cdot PR(g',t') \right]; \quad g = 1,\ldots,G \tag{1}$$

B. Linear expenditure system under constant prices

$$PCC(g,t') = c(g) \cdot PR(g) + b(g) \cdot \left[PCTHE(t') - \sum_{g'=1}^{G} c(g') \cdot PR(g') \right]; \quad g = 1,\ldots,G \tag{2}$$

$$PCC(g,t') = c(g) \cdot PR(g) + b(g) \cdot PCTHE(t') - b(g) \cdot \sum_{g'=1}^{G} c(g') \cdot PR(g'); \quad g = 1,\ldots,G \tag{3}$$

$$PCC(g,t') = a(g) + b(g) \cdot PCTHE(t'); \quad g = 1,\ldots,G \tag{4}$$

where:

$$a(g) = c(g) \cdot PR(g) - b(g) \cdot \sum_{g'=1}^{G} c(g') \cdot PR(g'); \tag{5}$$

Notes

a/ Data used to estimate this demand system include time series observations on consumption and total expenditure in constant and current prices, as well as cross-section information on consumption and total expenditure in local prices.

b/ Examples of analytical and planning models embodying the linear expenditure system and the Kelly-Williamson-Cheetham model (Kelly and others, 1972) and the Indian planning model (Government of India, 1981).

Annex II

EXTENDED LINEAR EXPENDITURE SYSTEM

The extended linear expenditure system (ELES) is a variant of the linear expenditure system (LES) (annex I). This system has been estimated using data from a number of countries, but unlike LES it has not often been used in the context of analytic or planning models. Similar to LES, it assumes that household decisions are made on a per capita basis and postulates that the allocation of the disposable household income is a function of the level of that income and commodity prices. Other factors that may have an effect on the household allocation decisions are not part of this demand system.[a]

Like the linear expenditure system, the extended linear expenditure system can be estimated under assumptions of variable or constant relative prices. If appropriate information is available in current and constant prices from national accounts, estimates of the parameters of the expenditure functions of this system can be obtained under the assumption of variable relative prices. If the requisite information does not contain data on price variations, the expenditure functions must be estimated by assuming that the relative prices of the various commodities are fixed.

This annex first describes the standard specification of ELES, which assumes variable prices. Then, using the assumption of constant prices, it will show how this specification can be transformed into one that is based on such an assumption. In this discussion, the calendar year will be used as the unit observation.

A. Extended linear expenditure system under variable prices

The extended linear expenditure system under constant relative prices consists of a set of linear expenditure functions in per capita terms that postulate that the amount of household resources spent on each commodity or group of commodities is a function of per capita disposable household income and the relative prices of those commodities. The functions are as follows:

$$PCC(g,t') = c(g) \cdot PR(g,t') + b(g) \cdot \left[PCDHI(t') - \sum_{g'=1}^{G} c(g') \cdot PR(g',t') \right], \quad g = 1,\ldots,G, \tag{1}$$

where:

$g = g' = 1,\ldots,G$	are commodity groups,
G	is the number of commodity groups,
t'	is the calendar year,

PCC(g,t')	is the level of per capita consumption of goods and services in commodity group g in year t',
PR(g,t')	is the composite price of goods and services in commodity group g in year t',
PCDHI(t')	is the level of per capita disposable household income in year t',
b(g)	is the coefficient representing the marginal income share for goods and services in commodity group g, and
c(g)	is the coefficient for commodity group g indicating the level of committed consumption of goods and services of commodity group g.

As in the case of the linear expenditure system, the levels of committed consumption, c(g)'s, which are also referred to as levels of basic needs or subsistence quantities, are assumed to be positive. The value of the committed consumption of various goods and services, $\Sigma^{G}_{g'=1}$ c(g) · PR(g,t'), is referred to as total committed or subsistence expenditure. The difference between the disposable household income and the total committed expenditure, PCDHI(t') - $\Sigma^{G}_{g'=1}$ c(g) · PR(g,t), may be thought of as uncommitted or "supernumerary" income.

The marginal income shares, b(g)'s, are marginal propensities to consume out of disposable income. They indicate how the supernumerary income is allocated among the goods and services in the various commodity groups. Marginal propensities to consume add up to the aggregate marginal propensity to consume. The complement of this aggregate marginal propensity to consume is the marginal propensity to save.

B. Extended linear expenditure system under constant prices

If it is assumed that prices are fixed, then the expenditure functions indicated in equation (1) can be rewritten as follows:

$$PCC(g,t') = c(g) \cdot PR(g) + b(g) \cdot [\ PCDHI(t') - \sum_{g'=1}^{G} c(g') \cdot PR(g')\ ]; \quad (2)$$

$$g = 1,\ldots,G,$$

where:

PR(g)	is the constant composite price of goods and services in commodity group g.

Next, the expenditure functions shown in equation (2) can be rewritten in order to obtain the following set of functions:

$$PCC(g,t') = c(g) \cdot PR(g) + b(g) \cdot PCDHI(t') - b(g) \cdot \sum_{g'=1}^{G} c(g') \cdot PR(g'); \quad g = 1,\ldots,G. \tag{3}$$

In addition, the functions shown in equation (3) can be rearranged in order to arrive at the following set of expenditure functions expressing per capita consumption by commodity group in terms of per capita disposable household income:

$$PCC(g,t') = a(g) + b(g) \cdot PCDHI(t'); \quad g = 1,\ldots,G, \tag{4}$$

where:

$$a(g) = c(g) \cdot PR(g) - b(g) \cdot \sum_{g'=1}^{G} c(g') \cdot PR(g'); \tag{5}$$

The expenditure functions indicated in equation (4) are the functions of the extended linear expenditure system under fixed prices, which are shown in equation (21) in chapter XI. Equation (5) shows the relationship between the intercept coefficients of ELES expenditure functions under constant prices and the coefficients and variables of the standard specification of ELES expenditure functions under that assumption -- c(g)'s, PR(g)'s and b(g)'s.

C. Notation and equations

1. Indices, variables and special symbols

(a) List of indices

$g = g' = 1,\ldots,G$	are commodity groups
t'	is the calendar year

(b) List of variables

PCC(g,t')	is the level of per capita consumption of goods and services in commodity group g in year t'
PCDHI(t')	is the level of per capita disposable household income in year t'
PR(g)	is the constant composite price of goods and services in commodity group g

PR(g,t')	is the composite price of goods and services in commodity group g in year t'

(c) List of special symbols

b(g)	is the coefficient representing the marginal income share for goods and services in commodity group g
c(g)	is the coefficient for commodity group g indicating the level of committed consumption of goods and services of commodity group g
G	is the number of commodity groups

2. Equations

A. Extended linear expenditure system under variable prices

$$PCC(g,t') = c(g) \cdot PR(g,t') + b(g) \cdot \left[PCDHI(t') - \sum_{g'=1}^{G} c(g') \cdot PR(g',t') \right], \quad g = 1,\dots,G \tag{1}$$

B. Extended linear expenditure system under constant prices

$$PCC(g,t') = c(g) \cdot PR(g) + b(g) \cdot \left[PCDHI(t') - \sum_{g'=1}^{G} c(g') \cdot PR(g') \right], \quad g = 1,\dots,G \tag{2}$$

$$PCC(g,t') = c(g) \cdot PR(g) + b(g) \cdot PCDHI(t') - b(g) \cdot \sum_{g'=1}^{G} c(g') \cdot PR(g'); \quad g = 1,\dots,G \tag{3}$$

$$PCC(g,t') = a(g) + b(g) \cdot PCDHI(t'); \qquad g = 1,\dots,G, \tag{4}$$

where:

$$a(g) = c(g) \cdot PR(g) - b(g) \cdot \sum_{g'=1}^{G} c(g') \cdot PR(g'); \tag{5}$$

Notes

a/ The extended linear expenditure system is a variant of the linear expenditure system. This annex is similar to annex I. The reader who is familiar with annex I may, while reading the present annex, focus on features unique to the extended linear expenditure system.

Annex III

PROCEDURES TO CALIBRATE THE LINEAR EXPENDITURE SYSTEM AND THE EXTENDED LINEAR EXPENDITURE SYSTEM

Estimated expenditure functions may be adjusted so that they will accurately yield levels of per capita household consumption for a given historical year or time period using as inputs the observations on the explanatory variables for that year or period.[a] These adjustments, which are normally referred to as calibration, may be employed, for example, where household consumption and savings projections need to be consistent with the corresponding data coming from the national accounts or a social accounting matrix for a given year or time period.

Calibrating expenditure functions may involve adjustments in estimates of the intercept coefficients of the functions, in estimates of the partial coefficients or in both. Since adjustments in the intercept coefficients are more straightforward than those in the partial coefficients, calibration may often be restricted to intercepts. Moreover, in the case of expenditure functions of the linear expenditure system or the extended linear expenditure system, one may wish to restrict calibration to estimates of the intercept coefficient, so that the adding-up property that those functions possess is retained. Therefore, this annex will describe how the intercept coefficients of the expenditure functions of those two linear demand systems can be calibrated. It will first describe calibration procedures and then selectively illustrate their application.

A. Procedures

The principles for adjusting the intercept coefficients of expenditure functions are the same for the linear expenditure system as for the extended linear expenditure system. The steps make use of the estimates of the partial coefficients of the functions, as well as observations on the levels of per capita household consumption by commodity groups and the observation on the explanatory variable, which are for the selected year or time period. Depending on the demand system used, the explanatory variable may be per capita total household expenditure or per capita disposable household income. The actual steps involved in adjusting the intercepts vary, however, depending on the demand system involved, as well as on whether the expenditure functions are for the entire country or for urban and rural areas.

1. National level

This section will describe procedures that apply to expenditure functions estimated for the entire country. It will first discuss adjustments to the functions of the linear expenditure system and then to those of the extended linear expenditure system. Procedures applicable to functions estimated for urban and rural areas will be explained in a subsequent section.

(a) Linear expenditure system

The procedure used to obtain adjusted intercepts of expenditure functions of the linear expenditure system using the relevant observations for a given year is as follows:

$$[a^*(g)]' = PCC(g,t') - b^*(g) \cdot PCTHE(t'); \qquad (1)$$

$$g = 1,\ldots,G,$$

where:

$g = 1,\ldots,G$	are commodity groups,
G	is the number of commodity groups,
t'	is the given calendar year,
PCC(g,t')	is the observed mean level of per capita household consumption in commodity group g in year t',
PCTHE(t')	is the observed mean level of per capita total household expenditure in year t',
[a*(g)]'	is the adjusted intercept coefficient of the expenditure function for commodity group g in the linear expenditure system, and
b*(g)	is the estimate of the partial coefficient of per capita total household expenditure in the expenditure function for commodity group g in the linear expenditure system.

The expression shown in equation (1) can also be used to adjust the intercept coefficients employing data for a few or several years rather than a single year. The observed levels of per capita consumption by commodity group and per capita total household expenditure for the years in question would be the mean values of the observations on those variables for those years centred on one particular year, t'.

(b) Extended linear expenditure system

The procedure to calculate adjusted intercept coefficients of expenditure functions of the extended linear expenditure system is as follows:

$$[a^*(g)]' = PCC(g,t') - b^*(g) \cdot PCDHI(t'); \qquad (2)$$

$$g = 1,\ldots,G,$$

where:

PCDHI(t')	is the observed mean level of per capita disposable household income in year t',
[a*(g)]'	is the adjusted intercept coefficient of the expenditure function for commodity group g in the extended linear expenditure system, and
PCC(g,t')	is the observed mean level of per capita household consumption in commodity group g in year t',
b*(g)	is the estimate of the partial coefficient of per capita disposable household income in the expenditure function for commodity group g in the extended linear expenditure system.

The intercept coefficients of the expenditure functions can be adjusted with data for a few or several years, rather than a single year, by using the expression shown in equation (2). In that instance, the relevant observations would be the mean values of the observations.

1. Urban-rural level

After estimating the expenditure functions for urban and rural areas, the intercept coefficients of those functions can be adjusted. To do so, it is necessary to use the estimates of the partial coefficients of the functions along with observations on the levels of per capita household consumption by commodity group, as well as observations on the relevant explanatory variable for a given year or time period.

(a) Linear expenditure system

The procedure for calibrating expenditure functions of the linear expenditure system for urban and rural areas would include steps that are urban-rural equivalents of the steps described above using equation (1).

(b) Extended linear expenditure system

The procedure for calibrating expenditure functions of the extended linear expenditure system for urban and rural areas would be an urban-rural counterpart of the procedure described above using equation (2).

B. Illustrative examples of calibration

The examples presented below will illustrate selected procedures to calibrate functions of alternative demand systems for the entire country and urban and rural areas. They will show how to calibrate the functions that were employed in chapter XI in order to illustrate their use in preparing household consumption and savings projections. The first example will show how to derive adjusted intercept coefficients for the expenditure functions of the linear expenditure system for the entire country. The second example will indicate the way to adjust intercepts for expenditure functions of the extended linear expenditure system for urban and rural areas.

1. National level

This example will illustrate a procedure to calibrate the estimates of the expenditure functions of a linear expenditure system as shown in table 72 (chapter XI) using, among other things, the estimated partial coefficients of those functions. The hypothetical mean values of the levels of per capita household consumption will be used, along with hypothetical mean values of per capita total household expenditure. It will be assumed that those values refer to a year that precedes the initial year of the projection (year 0) by two years and is therefore referred to as year -2.

Table 95 illustrates the calculation of the adjusted intercepts of the functions in question. The adjusted intercept coefficient (column 5) for each commodity group is obtained as the difference between the observed level of per capita household consumption in year -2 (column 4) and the product of the estimated coefficient of per capita total household expenditure for the commodity group in question (column 2) and the level of per capita total household expenditure in year -2 (column 3).

Thus, the adjusted intercept in the function for food, 1.60775, is obtained as follows:

$$1.60775 = 15.39 - (0.52404)\ (26.30); \qquad (1)$$

where 15.39 is the level of per capita household consumption of food in year -2, while 0.52404 is the estimate of the total expenditure coefficient for food and 26.30 is the mean value of the per capita total household expenditure in year -2.

2. Urban-rural level

This example shows how to calibrate estimates of expenditure functions of the extended linear expenditure system for urban and rural areas, which were shown in tables 77 and 78 (chapter XI). To derive adjusted intercepts for these functions, the estimates of the partial coefficients of those functions will be used along with the hypothetical values of per capita household consumption by commodity group and hypothetical values of per capita disposable household income for urban and rural areas.

Tables 96 and 97 illustrate calculations of the adjusted intercepts for the functions in question. For either location the adjusted intercept coefficient (column 5) for each commodity group is obtained as the difference between the mean level of per capita household consumption for the group for year -2 (column 4) and a product. The product is obtained by multiplying the estimated disposable income coefficient for the commodity group in question (column 2) by the mean value of per capita disposable household income in year -2 (column 3).

Table 95. Computing adjusted intercept coefficients for expenditure functions of the linear expenditure system for the entire country using data for a selected year

Commodity group	Total expenditure coefficient a/	Per capita total expenditure in year -2	Per capita household consumption in year -2	Adjusted intercept coefficient b/
		(in LCUs) c/		
(1)	(2)	(3)	(4)	(5)
Food	0.52404	26.30	15.39	1.60774
Clothing	0.07371	26.30	2.18	0.24142
Housing	0.05472	26.30	0.98	-0.45913
Fuel and light	0.04882	26.30	2.24	0.95603
Durables	0.13690	26.30	1.70	-1.90047
Transportation	0.01033	26.30	0.40	0.12832
Personal care	0.03095	26.30	0.83	0.01601
Recreation	0.06829	26.30	1.53	-0.26602
Other services	0.05223	26.30	1.05	-0.32364

a/ From table 72, col. 3.
b/ (Col. 4) - ((col. 2) . (col. 3)).
c/ Local currency units.

Table 96. Computing adjusted intercept coefficients for expenditure functions of the extended linear expenditure system for urban areas using data for a selected year

Commodity group	Disposable income coefficient a/	Per capita disposable household income in year -2	Per capita household consumption in year -2	Adjusted intercept coefficient b/
		(LCUs) c/		
(1)	(2)	(3)	(4)	(5)
Food	0.41002	48.93	23.30	3.23772
Clothing	0.06637	48.93	3.71	0.46251
Housing	0.05144	48.93	1.42	-1.09695
Fuel and light	0.03972	48.93	3.31	1.36650
Durables	0.14387	48.93	3.63	-3.40955
Transportation	0.01193	48.93	0.64	5.62651
Personal care	0.02590	48.93	1.18	-0.08729
Recreation	0.06831	48.93	2.88	-0.46240
Other services	0.06105	48.93	1.97	-1.01717

a/ From table 77, col. 3.
b/ (Col. 4) - ((col. 2) . (col. 3)).
c/ Local currency units.

Table 97. Computing adjusted intercept coefficients for expenditure functions of the extended linear expenditure system for rural areas using data for a selected year

Commodity group	Disposable income coefficient a/	Per capita disposable household income in year -2 (LCUs) a/	Per capita household consumption in year -2	Adjusted intercept coefficient b/
(1)	(2)	(3)	(4)	(5)
Food	0.56330	23.73	12.45	-0.91710
Clothing	0.05910	23.73	1.60	0.19755
Housing	0.03527	23.73	0.82	-1.69571
Fuel and light	0.04354	23.73	1.84	0.80679
Durables	0.06922	23.73	0.99	-0.65259
Transportation	0.00766	23.73	0.30	0.11822
Personal care	0.03022	23.73	0.69	-2.71206
Recreation	0.03652	23.73	1.02	0.15338
Other services	0.02199	23.73	0.71	0.18817

a/ From table 78, col. 3.
b/ (Col. 4) - ((col. 2) . (col. 3)).
c/ Local currency units.

For example, the adjusted intercept coefficient in the urban expenditure function for food, 3.23772, is obtained as follows:

$$3.23772 = 23.30 - (0.41002)(48.93),$$

where 23.30 is the mean level of per capita household consumption of food in the urban areas in year -2; 0.41002 is the estimate of the urban disposable income coefficient for food; and 48.93 is the mean value of per capita disposable household income in the same location in year/-2.

C. Notation and equations

1. Indices, variables and special symbols

(a) List of indices

g = 1,...,G	are commodity groups
t'	is the given calendar year

(b) List of variables

PCC(g,t')	is the observed mean level of per capita household consumption in commodity group g in year t'
PCDHI(t')	is the observed mean level of per capita disposable household income in year t'
PCTHE(t')	is the observed mean level of per capita total household expenditure in year t'

(c) List of special symbols

[a*(g)]'	is the adjusted intercept coefficient of the expenditure function for commodity group g in the linear expenditure system or in the extended linear expenditure system
b*(g)	is the estimate of the partial coefficient of per capita total household expenditure in the expenditure function for commodity group g in the linear expenditure system, or the estimate of the partial coefficient of per capita disposable household income in the expenditure function for commodity group g in the extended linear expenditure system
G	is the number of commodity groups

2. Equations

National Level

(i) Linear expenditure system

$$[a^*(g)]' = PCC(g,t') - b^*(g) \cdot PCTHE(t'); \qquad (1)$$

$$g = 1,\ldots,G$$

(ii) Extended linear expenditure system

$$[a^*(g)]' = PCC(g,t') - b^*(g) \cdot PCDHI(t'); \qquad (2)$$

$$g = 1,\ldots,G$$

Notes

a/ Depending on the demand system selected, the variable would be per capita total household expenditure or per capita disposable household income.

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XII. PROJECTING GOVERNMENT CONSUMPTION AND INVESTMENT IN EDUCATION, HEALTH AND HOUSING

A. Introduction

Coordinated projections of total government expenditure and total government revenue would normally be an integral part of a comprehensive development plan in order to gauge the surplus or deficit in government budget (box 27) implicit in the plan. Preparing projections of total government expenditure would as a rule require making projections of government recurrent expenditures and investment expenditures for a variety of sectors, including education, health and housing.

Government expenditures can be projected by a variety of methods. Some of those methods use demographic inputs because the levels of those expenditures depend in part on the size and age-sex structure of the population and its relevant subgroups. This chapter describes one such method that can be used to project government recurrent and investment expenditures in the education, health and housing sectors. This method is representative of a number of computer-based techniques for making government expenditure projections. [1/]

The technique draws on the methodology of the integrated system of computer programs for demographic, economic and social projections, known as the Long-Range Planning Model, Version 2 (LRPM2) (United States, 1972). The programs, which had originally been developed for application on a mainframe computer have been adapted for use on a microcomputer (box 28). In particular, the method borrows from the methodology embodied in the three modules of LRPM2 - EDUC, HEALTH and HOUSE - which can be used to project government consumption and investment in the education, health and housing sectors, respectively. Though the three modules of LRPM2 are suitable for making annual projections, the technique is presented here as a procedure for making quinquennial projections.

The method initially calculates requirements for various service inputs used by a sector of government. These requirements are based on the projected numbers of users of services requiring those inputs and the number of service inputs assumed to be required per thousand users. Depending on the sector for which the projection is being prepared, the users may be the total population or a particular subpopulation, such as students enrolled in public schools, or those households in need of special kinds of housing services. In addition, the method can be used to project recurrent and investment expenditures that the Government must incur in order to secure the service inputs required, using, among other things, the projected service input requirements and assumed unit operating recurrent expenditures and unit investment expenditures (box 29).

Box 27

Glossary

Administrative expenditure
A type of recurrent expenditure incurred to administer institutions that directly and indirectly participate in the delivery of services. For example, in the education sector, those institutions might include school and other education authorities, including the ministry of education. Such expenditures could include both labour and material costs.

Government budget
An estimate of government revenues and expenditures for a future period, usually a year, as opposed to an account that records the Government's financial transactions.

Investment expenditures
Expenditure on real fixed assets and human capital. It includes the cost of building schools or hospitals when these assets require expansion or replacement. Also it includes expenditure incurred in training personnel, such as teachers and medical doctors, required to increase their numbers or replace them.

Operating expenditure
A type of recurrent expenditure directly incurred in the production of services; for example, teacher salaries and the costs of maintaining classrooms.

Recurrent expenditures
Expenditure on goods and services consumed during production, which is incurred continuously. This would include both administrative and operating expenditures.

Service input unit
A unit of a given service input, such as teacher, classroom or medical doctor, used in producing services in a given sector.

Box 28

Microcomputer version of the Long-Range
Planning Model, Version 2

The Latin American Demographic Centre (CELADE) of the Economic Commission for Latin America and the Caribbean (ECLAC) has recently modified the original LRPM2 programs for use on IBM PC microcomputers or IBM compatibles, giving this projection system a high degree of "user-friendliness".a/

The package consists of eight interconnected modules for projections of the national or urban and rural populations, selected subpopulations (labour force, school-age population, equivalent health consumers etc.), as well as for selected economic aggregates along with government consumption and investment demand. The modules for making projections of government consumption and investment relate to education, health, housing and family planning.

The fact that the LRPM/PC model is an integrated package offers the planner a substantial advantage over independent programs for making similar projections. The model conveniently links methods for projecting social-service requirements and expenditures with other techniques, the use of which is required in order to prepare selected inputs for those projections. For example, the model allows the planner to project demands for the public health system by utilizing, among other things, projected numbers of equivalent health consumers that are generated within the model by the population projection module. Moreover, since projections for several sectors can be simultaneously prepared by the various modules, the LRPM/PC model can generate results that can be used to make comparisons of competing resource requirements. The planner can, for instance, see at a glance the effects of population growth on projected expenditures of the combined demand generated in the education, health and housing sectors.

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a/ The LRPM/PC model is available on floppy diskettes in Spanish and English from CELADE, Casilla 91, Santiago, Chile.

Where necessary, the method can be used to prepare projections for segments of the government sectors (or subsectors) in question. Thus, for example, it can be employed to project government consumption and investment for individual school levels. Moreover, the method can be used to make projections at the national or urban-rural level.

Box 29

Glossary

<u>Attrition rates</u>
The number of units of a given service input lost during a year per thousand units of that service input available in the year. Examples of attrition would be the loss of teachers through retirement or the loss of equipment through obsolescence.

<u>Service input rates</u>
The average number of units of a given service input available during a year per thousand users of services rendered by that input in the year.

<u>Unit operating expenditures</u>
Expenditures incurred in a year in order to secure services associated with a unit of a given service input, such as teacher or medical doctor, or classroom or hospital bed.

<u>Unit investment expenditures</u>
Expenditures incurred in adding a new unit of a given service input or replacing an existing unit. In the case of personnel, it would include the cost of training a person. In the case of facilities, it would include the cost of installing a unit of facility.

A major advantage of this technique is that it can readily be used to project government service input needs and related financial resource requirements for the major social-service sectors -- education, health and housing - in a way that takes future demographic change into account. Projections of those requirements could be of great value in planning by making it possible to quantify, among other things, the implications of demographic change for public expenditure and public resource allocation. Through the use of such projections, the resource allocation process may become more responsive to the shifting service needs of the population.

Another advantage of this technique is its simplicity. The method yields results that can be easily understood and interpreted. The quality of those results may, however, vary depending on the quality of data and assumptions used with the method. Thus, the method may yield seemingly accurate projections of service input and financial resource requirements even if estimates of the relevant projection inputs, such as <u>service input rates</u> and unit expenditures, are incorrect.

Although this method is described here only in the context of the education, health and housing sectors, it can readily be extended to make projections for other government sectors, provided that the requisite inputs can be prepared. On the other hand, owing to data limitations, the technique may not be able to take into account all the relevant programmes funded by the Government in the sector for which the projection is being made, such as adult literacy programmes in the education sector.

Furthermore, the method cannot effectively deal with shifts in average service input needs arising from the changing composition of the user population. An example of such a change in composition is the changing proportions of children, adults and the elderly, who have different requirements for various preventive and curative medical services. This difficulty may be more acute when the method is applied to the health and housing sectors than to the education sector.

Yet another difficulty may be encountered when this method is used to project public housing requirements in situations where households belonging to the user population, e.g., the elderly or disabled, account for only a fraction of all households and have demographic characteristics that are considerably different from the average of all households. It may not be possible to prepare separate projections of the number of user households and, as a consequence, it may be necessary to impute to that populations of all the households.

B. The technique

The discussion of the technique for projecting government consumption will be introduced by a general overview. Then, the calculation will be described, first at the national level and then at the urban-rural level.

1. Overview

This overview will list the inputs required to apply the method and the types of outputs that it can generate. The overview will also outline the steps involved in applying the method.

(a) Inputs

The inputs required to project government consumption and investment for a given sector (or subsector) will include:

(i) Projected numbers of users of services provided by the sector;
(ii) Assumptions on service input rates, by type of service input;
(iii) Assumptions on attrition rates, by type of service input;
(iv) Assumptions on unit operating expenditures, by type of service input;
(v) Assumptions on unit investment expenditures, by type of service input;
(vi) Assumptions on ratios of administrative expenditure to operating expenditure.

Since this method is described as a technique for preparing quinquennial projections, inputs (i) through (vi) should be for dates five years apart. However, it should be noted that annual projections can be obtained by interpolation.

For a national projection, the inputs should be for the entire country. For an urban-rural projection, they should be for urban and rural areas, respectively. The inputs are listed in box 30.

(b) Outputs

The types of outputs that the method can generate would depend in part on the type of projection being made. In the case of a national projection, the method would yield:

(i) Numbers of service input units required, changes in those numbers, and numbers of service input units requiring replacement, by type of service input;
(ii) Levels of operating expenditure and investment expenditure, by type of service input;
(iii) Total operating and administrative recurrent expenditures;
(iv) Various expenditure aggregates, such as levels of total recurrent and total investment expenditures, and changes in those levels;
(v) Indicators of the structure of expenditures, such as proportions of total government expenditure accounted for by total recurrent and total investment expenditures;
(vi) Rates of change in selected expenditure aggregates, such as total recurrent and total investment expenditures.

Box 30

Inputs for making government consumption and investment projections

1. Number of users

2. Assumptions on rates

Service input rates, by type of service input

Attrition rates, by type of service input *

3. Assumptions on unit expenditures

Unit operating expenditures, by type of service input

Unit investment expenditures, by type of service input

4. Assumptions on ratios of administrative to operating recurrent expenditures

Ratios of administrative expenditure to operating recurrent expenditure

If the technique is used to make an urban-rural projection, the results would include all those listed under (i) through (vi), which would be for urban and rural areas as well as the entire country. In addition, the results would include indicators of the urban-rural distribution of the total government expenditure for the sector (or subsector). The types of outputs that the method can generate as part of the national or urban-rural projection are shown in box 31.

(c) Computational steps

The first step in projecting government consumption and investment is to calculate the numbers of required input units of various types for the terminal year of a given projection interval. These numbers are then multiplied by unit operating expenses to derive levels of operating expenses. The operating expenditures by type of service input are next aggregated in order to obtain the total operating expenditure. Total administrative expenses are calculated as an assumed proportion of total operating expenses. Total operating and total administrative expenses are then aggregated to produce total recurrent expenses.

Also calculated for each such year are the numbers of new service input units that must be added and the number of service input units that require replacement, by type of service input. Those numbers are then used together with assumed unit investment expenditures to derive levels of investment expenditures, by type of service input. The remaining steps are used to obtain, among other things, various expenditure aggregates, indicators of the structure of expenditures and rates of change of the various expenditure categories.

2. National level

This section will initially elaborate the steps required to project government consumption and investment at the national level. A summary of those steps is presented in box 32. The major steps are also presented in figure XXXIII. The method for making an urban-rural projection will be described in a later section.

(a) Recurrent expenditures

Recurrent expenditures include both operating and administrative expenditures. They are calculated by first calculating operating expenses and then using that figure to calculate administrative expenditures. The two types of expenditures are then aggregated.

(i) Operating expenditures

The first step in calculating operating expenditures is to calculate the required number of service input units, by type of service input, at the end of the given projection interval. The second step is to calculate the levels of operating expenditures by type of service input. The last step is to calculate total operating expenditures.

Box 31

Types of outputs obtained by projecting government consumption and investment

1. Numbers of service input units

2. Changes in numbers of service input units and numbers of service input units requiring replacement

3. Expenditures by type of service input

   Operating expenditures

   Administrative expenditures

   Recurrent expenditures

   Investment expenditures

4. Expenditure aggregates

   Total recurrent expenditure

   Total investment expenditure

   Total government expenditure

5. Indicators of the structure of expenditures

   Proportions of total government expenditure accounted for by recurrent and investment expenditures

6. Indicators of the urban-rural distribution of total government expenditure (only if government consumption and investment are being projected at the urban-rural level)

   Proportions of total government expenditure incurred in different locations

7. Rates of growth of expenditures

   Rates of growth of total recurrent expenditure

   Rates of growth of total investment expenditure

   Rates of growth of total government expenditure

Box 32

Computational steps needed to project government consumption and investment at the national level

The steps used to project government consumption and investment at the national level over a five-year projection interval are as follows:

1. For each type of service input, calculate the recurrent expenditures. The first step in this procedure is to calculate the number of service input units for the end of the projection interval as the product of the projected number of users and the assumed service input rate.

2. For each type of service input, calculate the level of operating expenditure for the end of the interval as the product of the projected number of service input units and the assumed unit operating expenditure for that date.

3. Aggregate operating expenditures across different types of services inputs to obtain the total operating expenditure for the end of the interval.

4. Calculate the total administrative expenditure for the end of the interval as the product of the total operating expenditure and the assumed ratio of administrative to operating expenditures for that date.

5. Calculate total recurrent expenditure as the sum of total operating expenditure and total administrative expenditure.

6. For each type of service input, calculate the investment expenditures. The first step in this procedure is to calculate the change in the number of service input units for the terminal year of the projection interval using the projected numbers of service input units for different projection dates.

7. For each type of service input, calculate the number of service input units requiring replacement for the end of the interval as the product of the projected number of service input units and the assumed attrition rate for that date.

8. For each type of service input, calculate the level of investment expenditure for the end of the interval as the product of the sum of the change in the number of service input units and the number of units requiring replacement, on the one hand, and the assumed unit investment expenditure, on the other, for that date.

9. Aggregate investment expenditures across different types of service inputs to obtain the total investment expenditure for the same date.

(continued)

Box 32 (continued)

10. Calculate the total government expenditure for the sector (or subsector). Using those totals for the beginning and the end of the interval, compute changes in those expenditure aggregates for the interval.

11. Derive indicators of the structure of the total government expenditure for the end of the interval, such as proportions of the total expenditure accounted for by recurrent and investment expenditures.

12. Compute the rates of growth of the various expenditure aggregates for the interval, such as growth rates of total recurrent and investment expenditures.

Number of service input units, by type of input. For each type of service input, this number can be obtained by multiplying the number of users by the assumed service input rate (the number of service input units per thousand users of services requiring that input, and dividing by one thousand). For the end of the interval (t to t+5), the number of service input units of each type is calculated as follows:

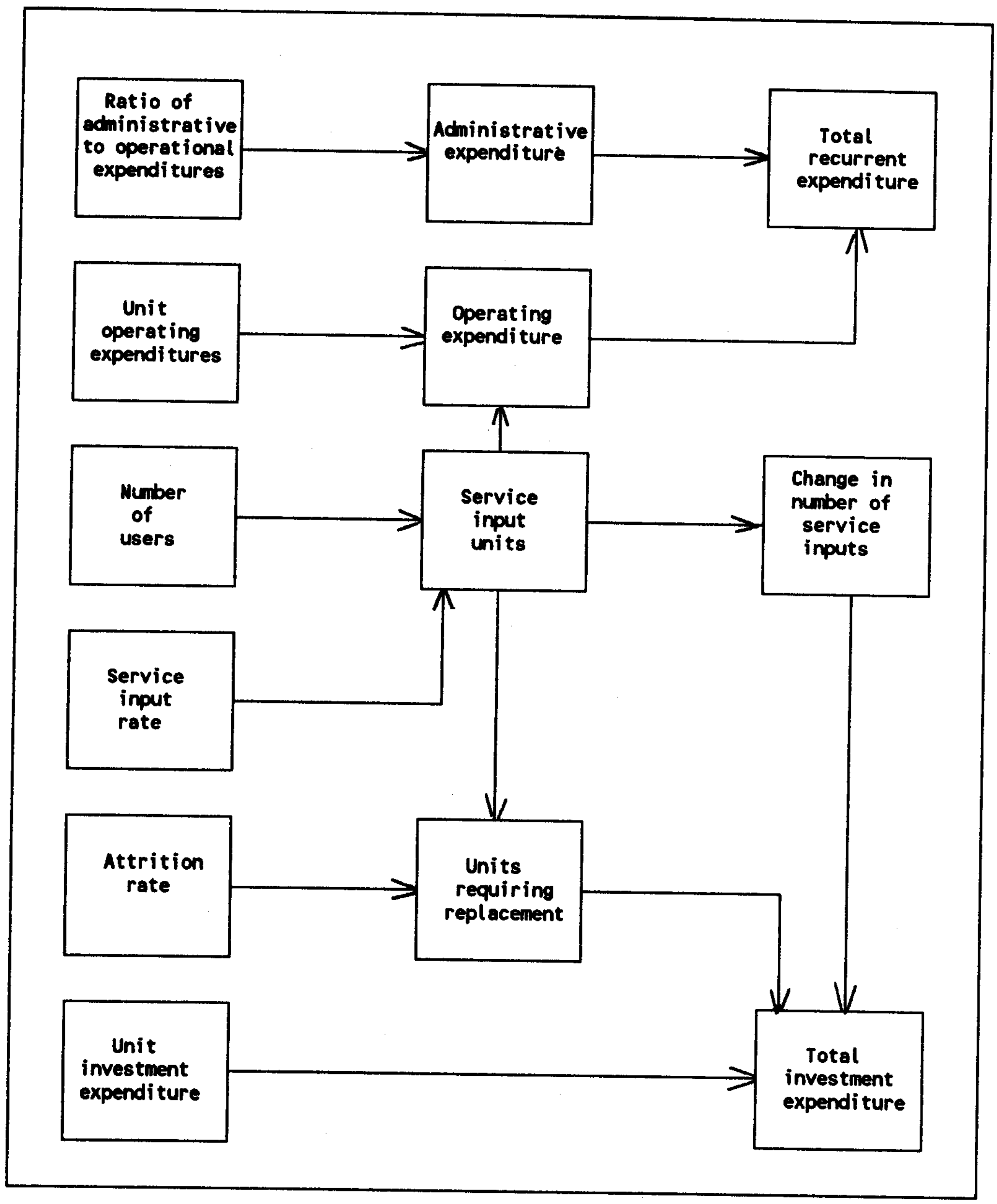
$$NSIU(j,t+5) = [\ NUS(t+5) \cdot SIRT(j,t+5)\ ] / 1{,}000; \qquad j = 1,\ldots,J, \tag{1}$$

where:

$j = 1,\ldots,J$	are various types of service inputs,
J	is the number of different types of service inputs,
t	is the year of the projection period,
$NSIU(j,t+5)$	is the number of service input units of type j at the end of the interval,
$NUS(t+5)$	is the number of users at the end of the interval, and
$SIRT(j,t+5)$	is the service input rate for service input j at the end of the interval.

In equation (1), the product of the number of users and the service input rate is divided by a thousand in order to obtain the number of service input

Figure XXXIII. Steps needed to project government consumption and investment at the national level



units. This division is necessary because the service input rate is defined as the number of service input units per thousand users.

Levels of operating expenditures, by type of service input. Given the number of service input units for a given date, the levels of operating expenditures, by type of service input, can be obtained by multiplying the number of service input units by the unit operating expenditure. Thus, for the end of the projection interval, levels of operating expenditure for this type of service input are as follows:

$$OEX(j,t+5) = NSIU(j,t+5) \cdot UOEX(j,t+5); \quad j = 1,\ldots,J, \tag{2}$$

where:

OEX(j,t+5)	is the level of operating expenditure for type of service input j at the end of the interval, and
UOEX(j,t+5)	is the unit operating expenditure for type of service input j at the end of the interval.

Total operating expenditure. The total operating expenditure can be obtained by adding up the levels of operating expenditure for the various types of service inputs. The total operating expenditure at the end of the projection interval is, therefore:

$$OEX(t+5) = \sum_{j=1}^{J} OEX(j,t+5); \tag{3}$$

where:

OEX(t+5)	is the total operating expenditure at the end of the interval.

(ii) Total administrative expenditure

The total administrative expenditure can be obtained by multiplying the total operating expenditure by the assumed ratio of administrative to operating expenditure. The total administrative expenditure at the end of the projection period is, therefore:

$$AEX(t+5) = OEX(t+5) \cdot RAOE(t+5); \tag{4}$$

where:

AEX(t+5)	is the total administrative expenditure at the end of the interval, and
RAOE(t+5)	is the ratio of administrative to operating expenditure at the end of the interval.

(iii) Total recurrent expenditure

Total recurrent expenditure for the end of the interval can be obtained as the sum of the total recurrent operating expenditure and the total recurrent administrative expenditure for that date: [2]

$$REX(t+5) = OEX(t+5) + AEX(t+5); \qquad (5)$$

where:

REX(t+5) is the total recurrent expenditure for the end of the interval.

(b) Investment expenditures

The first step in calculating investment expenditures is to calculate the change in the numbers of service input units. The next step is to calculate the number of service inputs requiring replacements. The last step is to calculate total investment expenditures by multiplying the change and the number of replacements by unit investment expenditures.

(i) Change in the numbers of service input units, by type of input

This procedure calculates changes in the numbers of service input units, by type of service input, for the terminal year of the projection interval. Each such change stands for the number of units of the given type of service input (e.g., teachers or classrooms) that must be added to (or subtracted from) the stock of service input units in that year. The changes in question can be calculated from the projected numbers of service input units using alternative procedures. One such procedure, which includes steps that vary depending on the projection interval in question, as well as on assumption about the nature of growth in the numbers of service input units, is described below. It assumes that growth in the numbers of service units occurs over discrete intervals or that it is continuous.

Geometric growth. If it is assumed that growth in the number of service units occurs over discrete intervals, the change in the number of service input units for a given type of service input for the terminal year of a given projection interval (for each interval except the last) can be approximated using a formula based on this assumption. Thus, changes in the numbers of service input units for the terminal year of the interval (t to t+5) can be obtained as follows:

$$CNSIU(j,t+5) = NSIU(j,t+5) \cdot \qquad (6)$$

$$[\ (\ NSIU(j,t+10)/NSIU(j,t+5)\ )^{1/10} -$$

$$(\ NSIU(j,t+5)/NSIU(j,t)\ )^{-1/10}\ ];$$

$$j = 1,....J,$$

where:

CNSIU(j,t+5) is the change in the number of units of service input j for the end of the interval.

This formula is based on an assumption that the number of service input units changes through each five-year interval according to a constant rate of change. It calculates the change in the number of units for the terminal year of the interval as the difference between the numbers of units at the end and the beginning of that year, which are obtained from the number of units projected for that year; this number is assumed to refer to the middle point of the year. (For the derivation of this formula and related formulas, see the annex to the present chapter.)

The procedure described by equation (6) cannot be used to calculate changes in the numbers of service input units for the initial year of the projection period. Those changes are therefore approximated using a formula that utilizes the projected units for the initial year and the fifth year of the projection. Changes in the number of input units for the initial year of the projection period are obtained as follows:

$$CNSIU(j,0) = NSIU(j,0) \;.\; [\,(NSIU(j,5)/NSIU(j,0))^{1/10} - (NSIU(j,5)/NSIU(j,0))^{-1/10}\,]; \quad j = 1,\ldots,J. \qquad (7)$$

The formula shown by equation (6) cannot be used to calculate changes in the numbers of service input units for the terminal year of the last projection interval, which is the terminal year of projection. Therefore, those changes are approximated using the formula that utilizes the projected numbers of input units for that particular year and the year that precedes it by five years. Changes in the numbers of service input units for the terminal year of projection period are obtained as:

$$CNSIU(j,T) = NSIU(j,T) \;.\; [\,(NSIU(j,T)/NSIU(j,(T-5))^{1/10} - (NSIU(j,T)/NSIU(j,(T-5))^{-1/10)}\,]; \quad j = 1,\ldots,J; \qquad (8)$$

where:

T is the terminal year of the projection.

<u>Exponential growth</u>. Where it is assumed that growth in the number of service input units is continuous, the change in the number of service input units for a given type of service input for the terminal year of a given projection interval

can be obtained using a formula based on this assumption. Thus, changes in the numbers of service input units for the terminal year of the interval can be calculated as follows:

$$\text{CNSIU}(j,t+5) = \text{NSIU}(j,t+5) \cdot \left[e(1/10) \cdot \ln(\text{NSIU}(j,t+10)/\text{NSIU}(j,t+5)) - e(-1/10) \cdot \ln(\text{NSIU}(j,t+5)/\text{NSIU}(j,t)) \right]; \quad j = 1,\dots,J; \tag{9}$$

where:

e	is the base of the natural logarithm, and
ln	is the natural logarithm.

Formulas for calculating changes in the initial and the terminal year of the projection period differ from that shown in equation (9). In particular, the formula for calculating the change in the initial year of the projection period is as follows:

$$\text{CNSIU}(j,0) = \text{NSIU}(j,0) \cdot \left[e^{(1/10) \cdot \ln(\text{NSIU}(j,5)/\text{NSIU}(j,0))} - e^{(-1/10) \cdot \ln(\text{NSIU}(j,5)/\text{NSIU}(j,0))} \right]; \quad j = 1,\dots,J. \tag{10}$$

Lastly, the formula for calculating the changes in the terminal year of the projection period (T) is as follows:

$$\text{CNSIU}(j,T) = \text{NSIU}(j,T) \cdot \left[e^{(1/10) \cdot \ln(\text{NSIU}(j,T)/\text{NSIU}(j,t+5))} - e^{(-1/10) \cdot \ln(\text{NSIU}(j,T)/\text{NSIU}(j,t+5))} \right]; \quad j = 1,\dots,J. \tag{11}$$

where:

T	is the terminal year of projection.

(ii) <u>Numbers of service input units requiring replacement, by type of input</u>

For each type of service input, the number of service input units requiring replacement can be obtained for the terminal year of the projection interval by multiplying the projected number of service input units by the attrition rate for the year in question and dividing by one thousand. Thus, the number of service input units requiring replacement in the terminal year of the interval is obtained as follows:

$$RNSIU(j,t+5) = [\ NSIU(j,t+5)/1{,}000\ ] \cdot ART(j,t+5); \qquad j = 1,\ldots,J, \tag{12}$$

where:

RNSIU(j,t+5) is the number of service input units of type j requiring replacement at the end of the interval, and

ART(j,t+5) is the attrition rate for service input j at the end of the interval.

In equation (12), the number of service input units is divided by one thousand to obtain the number of service input units requiring replacement. This division is necessary because the attrition rate is defined as the number of service input units being retired per thousand service input units.

(iii) Levels of investment expenditures, by type of service input

Given the changes in the numbers of service input units required, as well as the numbers of service input units requiring replacement, it is possible to obtain levels of gross investment expenditures for the terminal year of a given projection interval, by type of service input. For each type of service input, the level of gross investment expenditure is obtained in two steps. First, the change in the number of service input units is added to the number of service input units requiring replacement. Then this total is multiplied by the unit investment expenditure. Thus, levels of gross investment expenditures for the various types of services inputs for the end of the projection interval are calculated as follows: [3]

$$IEX(j,t+5) = [\ CNSIU(j,t+5) + RNSIU(j,t+5)\ ] \cdot UIEX(j,t+5); \qquad j = 1,\ldots,J, \tag{13}$$

where:

IEX(j,t+5) is the level of gross investment expenditure for service input j at the end of the interval, and

UIEX(j,t+5) is the unit investment expenditure for service input j at the end of the interval.

(iv) Total investment expenditure

The total investment expenditure can be obtained by adding up the levels of investment expenditure for the various types of services inputs:

$$IEX(t+5) = \sum_{j=1}^{J} IEX(j,t+5); \tag{14}$$

where:

IEX(t+5) is the total investment expenditure at the end of the interval.

(c) Other results

As part of projecting government consumption and investment, it is possible to derive several useful indicators. Among such indicators are expenditure aggregates, indicators of the structure of expenditures, as well as rates of change in different types of expenditures.

(i) Expenditure aggregates

Expenditure aggregates may include the total government expenditure for the sector (or subsector). Once aggregates are obtained for different dates five years apart, it is further possible to calculate increases in those aggregates over the intervening five-year projection intervals.

Total government expenditure. The total government expenditure for the sector (or subsector) may be obtained as the sum of the total recurrent expenditure and the total investment expenditure:

$$EX(t+5) = REX(t+5) + IEX(t+5); \tag{15}$$

where:

EX(t+5) is the total government expenditure for the sector (or subsector) for the end of the interval.

(ii) Growth in expenditures

Total recurrent expenditures. The increases in total recurrent expenditures over the projection interval can be obtained as the difference between the levels of those expenditures at the end and the beginning of the interval. The growth in the total recurrent expenditure is:

$$REXGR = REX(t+5) - REX(t); \tag{16}$$

where:

REXGR is the growth in the total recurrent expenditure during the interval.

<u>Total investment expenditures</u>. The growth in the total investment expenditure is:

$$IEXGR = IEX(t+5) - IEX(t); \tag{17}$$

where:

IEXGR — is the growth in the total investment expenditure during the interval.

<u>Total government expenditure</u>. The increase in the total government expenditure over the interval can be obtained as the difference between the levels of that expenditure at the end and the beginning of the interval:

$$EXGR = EX(t+5) - EX(t); \tag{18}$$

where:

EXGR — is the growth in the total government expenditure during the interval.

(iii) <u>Indicators of the structure of expenditure</u>

Once the various expenditure aggregates are obtained, it is possible to derive proportions of the total government expenditure accounted for by total recurrent and investment expenditures, respectively.

The proportion of the total government expenditure in a given sector going to recurrent expenditure is obtained as a ratio of the total recurrent expenditure to the total government expenditure. For the end of the projection interval, this proportion is:

$$PREX(t+5) = REX(t+5) / EX(t+5); \tag{19}$$

where:

PREX(t+5) — is the proportion of the total government expenditure devoted to recurrent expenditure at the end of the interval.

The proportion of the total expenditure going to investment expenditure can be obtained as a complement of the proportion going to the recurrent expenditure:

$$PIEX(t+5) = 1 - PREX(t+5); \tag{20}$$

where:

PIEX(t+5) — is the proportion of the total government expenditure devoted to investment expenditure at the end of the interval.

(iv) Rates of growth of expenditures

As part of projecting government consumption and investment, it is also possible to compute annual average rates of growth of the various expenditure aggregates.

Rates of growth of total recurrent and total investment expenditures. Average annual rates of growth of these expenditure aggregates for a given projection interval can be computed from the levels of those expenditures at the beginning and the end of the interval. Depending on what is assumed about the nature of the growth in the various expenditure categories, one can obtain either geometric or exponential rates of growth.

Geometric growth rates. If it is assumed that growth occurs over discrete intervals, then percentage rates of growth can be obtained as follows, using the formula for calculating a geometric growth rate:

The rate of growth of the total recurrent expenditure is calculated as:

$$GGRREX = [(REX(t+5)/REX(t))^{1/5} - 1] \cdot 100; \qquad (21)$$

where:

GGRREX is the average annual geometric growth rate of the total recurrent expenditure for the interval,

The rate of growth of the total investment expenditure is calculated as:

$$GGRIEX = [(IEX(t+5)/IEX(t))^{1/5} - 1] \cdot 100; \qquad (22)$$

where:

GGRIEX is the average annual geometric growth rate of the total investment expenditure for the interval.

Exponential growth rates. If it is assumed that growth occurs continuously, percentage rates of growth can be obtained using the formula for calculating an exponential growth rate as follows:

The rate of growth of the total recurrent expenditure is calculated as:

$$EGRREX = [(\ln (REX(t+5)/REX(t))) / 5] \cdot 100; \qquad (23)$$

where:

EGRREX is the average annual exponential growth rate of the total recurrent expenditure for the interval.

The rate of growth of the total investment expenditure is calculated as:

$$EGRIEX = [(\ln (IEX(t+5)/IEX(t))) / 5] \cdot 100; \qquad (24)$$

where:

EGRIEX is the average annual exponential growth rate of the total investment expenditure for the interval.

<u>Rates of growth of total government expenditure</u>. Depending on the type of assumption used with respect to growth of the total government expenditure, rates of growth will be computed using either geometric or exponential growth rate formulas.

<u>Geometric growth rate</u>. If it is assumed that growth occurs over discrete intervals, the rate of growth of the total government expenditure is calculated as:

$$GGREX = [(EX(t+5)/EX(t))^{1/5} - 1] \cdot 100; \qquad (25)$$

where:

GGREX is the average annual geometric growth rate of the total government expenditure for the interval.

<u>Exponential growth rate</u>. If it is assumed that growth occurs continuously, the rate of growth of the total expenditure is calculated as:

$$EGREX = [(\ln (EX(t+5)/EX(t))) / 5] \cdot 100; \qquad (26)$$

where:

EGREX is the average annual exponential growth rate of the total government expenditure for the interval.

This completes the description of the method for making national level projections of government consumption and investment.

3. <u>Urban-rural level</u>

This section will outline a procedure that can be used to make an urban-rural projection of government consumption and investment in education, health or housing. The procedure, which is similar to the one that can be used to prepare a national projection, consists of steps used to project levels of different types of expenditures, such as operating expenditures and investment expenditures, by type of service input, as well as levels of total expenditures. Moreover, the procedure can be used to derive a variety of other results, including indicators of the urban-rural distribution of total government expenditures for the sector (or subsector).

(a) Recurrent expenditures

Recurrent expenditures can be calculated by first calculating operating expenditures and, on the basis of that figure, calculating administrative expenditures. The two are added to get total recurrent expenditure. The first step in calculating operating expenditures is to calculate the required numbers of service input units. These are then converted to operating expenditures by multiplying by unit operating expenditures.

(i) Operating expenditures

Numbers of service input units, by type of input. The numbers of service input units, by type of service input, can be derived by an urban-rural counterpart of the steps employed to derive those numbers in a national projection, which is indicated by equation (1). For example, the number of service input units for the end of the projection interval (t to t+5) can be obtained as follows:

$$NSIU(j,k,t+5) = [\ NUS(k,t+5) \cdot SIRT(j,k,t+5)\ ] \ / \ 1{,}000; \qquad j = 1,\ldots,J; \quad k = 1,2, \tag{27}$$

where:

k = 1,2	are urban and rural locations,
NSIU(j,k,t+5)	is the number of service input units of type j in location k at the end of the interval,
NUS(k,t+5)	is the number of users in location k at the end of the interval, and
SIRT(j,k,t+5)	is the service input rate for service input j in location k at the end of the interval.

Levels of operating expenditures, by type of service input. For each type of service input, levels of operating expenditures can be derived using urban-rural counterparts of the steps indicated by equation (2).

(ii) Administrative expenditures

Levels of total administrative expenditures can be derived in an urban-rural projection employing an urban-rural equivalent of equation (4).

(iii) Total recurrent expenditures

Levels of total recurrent expenditures can be derived in an urban-rural projection employing an urban-rural equivalent of the steps shown by equation (5).

(b) Investment expenditures

Investment expenditures can be calculated by computing the required changes in service inputs and the number of units requiring replacement. Finally, these numbers are multiplied by unit investment expenditure.

(i) Changes in service input units

Changes in the numbers of service input units and the numbers of units requiring replacement can be obtained employing urban-rural equivalents of equations (6) through (8) or equations (9) through (11), which were used to calculate corresponding results in the national projection.

(ii) Service input units requiring replacement

The number of service input units requiring replacement can be calculated by the urban-rural equivalent of equation (12).

(iii) Levels of investment expenditures by type of service input

Levels of investment expenditures are calculated using the urban-rural equivalent of equations (13) and (14).

(c) Other results

The indicators described in connection with the national projection can also be derived as part of an urban-rural projection. However, those indicators are calculated for urban and rural areas and for the entire country, employing steps that are analogous to those shown in equations (5) through (26). In addition, it is possible to obtain indicators of the distribution of the total government expenditure by location -- proportions of the total government expenditure that are urban and rural.

(i) Proportion urban

The proportion of the total government expenditure that is urban (k = 1) at the end of a projection interval can be computed by dividing the total government expenditure incurred in urban areas by the total government expenditure for the entire country:

$$PREXURB(t+5) = EX(1,t+5) / EX(t+5); \qquad (28)$$

where:

PREXURB(t+5) is the proportion of the total government expenditure that is urban at the end of the interval, and

EX(1,t+5) is the total government expenditure in location 1 urban areas at the end of the interval.

(ii) Proportion rural

The proportion of the total government expenditure that is rural ($k = 2$) can be found as a complement of the proportion urban:

$$PREXRUR(t+5) = 1 - PREXURB(t+5); \qquad (29)$$

where:

PREXRUR(t+5) is the proportion of the total government expenditure that is rural at the end of the interval.

This completes the description of the procedure for making projections of government consumption and investment in selected sectors at the urban-rural level.

C. The inputs

This section will first consider the types of inputs used by this method. Then, it will discuss how these inputs can be prepared.

1. Types of inputs required

To project government consumption and investment by this method, it is necessary to use the following inputs:

(a) Projected numbers of users of the services provided by the sector;
(b) Assumed service input rates, by type of service input;
(c) Assumed attrition rates, by type of service input;
(d) Assumed unit operating expenditures, by type of service input;
(e) Assumed unit investment expenditures, by type of service input;
(f) Assumed ratios of administrative to operating expenditures.

Depending on whether one wishes to make a national projection or a projection for urban and rural areas, these projection inputs will be required for the entire country or for urban and rural areas. Irrespective of the type of projection desired, the inputs should refer to individual dates five years apart, starting with the initial year of projection.

2. Preparation of inputs

If the projected number of users is not already available, the preparation of inputs may begin with the projection of those numbers.

(a) Projected numbers of users

Depending on the sector for which the projection is being prepared, users may include students, all members of the population or a group of households. In particular, if the projection is for the education sector, users may include students in public schools, at individual school levels or for the various school levels combined. The numbers of students in such schools may be projected by the enrolment ratio method (chap. IV). If the projection is, however, for the health sector, users may include the entire population, a projection of which can be obtained by means of the cohort component method (chap. II). In the case of a projection for the housing sector, users could consist of a special group of needy households. The number of such households may be obtained as a product of the projected total number of households and an assumed proportion of all households that may belong to the needy group. The projection of the total number of households can be obtained by the headship rate method of household projections (chap. III).

(b) Observations on service input rates, attrition rates, unit expenditures and ratios of administrative to operating expenditures

To prepare assumptions on initial and future values of these various projection inputs, observations on those inputs may need to be prepared for a recent date or several such dates. The data that may be required in order to calculate those observations will depend on the sector for which the projection is to be prepared.

(i) Service input rates

Service input rates are defined as the numbers of service input units of different types required per thousand users. Service input units may be expressed in terms of personnel, such as teachers or doctors, or in terms of facilities, such as classrooms or hospital beds. The number of users may stand for the number of students, the population size or the number of needy households.

If the projection being prepared is for the various school levels in the education sector, requisite observations on service input rates will be calculated as the number of teachers and the number of classrooms per thousand students in public schools at those levels. For each school level, those rates can be calculated by dividing the numbers of teachers and classrooms by the numbers of students, and multiplying by a thousand. The data on the numbers of teachers, classrooms and students in public schools may be obtained from compilations of current educational statistics.

If the projection is for the health sector, the requisite observations on service input rates may be those on the numbers of doctors, dentists, nurses and other categories of medical personnel per thousand population. They may also be on the numbers of hospital beds, health centres, health subcentres and units of other health facilities per thousand population. The requisite data on medical personnel and health facilities may be obtained from compilations of current health statistics. Information on the population size may come from the population census or from intercensal population estimates.

If the projection is being made for the housing sector, it will be necessary to derive observations on service input rates that stand for the numbers of different types of housing service inputs per thousand households in need of housing services. Those observations can sometimes be derived from the data on the numbers of housing service inputs provided to the specified households by the

Government and the numbers of those households. Where such data are not available because the Government, for example, did not have a public housing programme, "observations" on service input rates will need to be subjective estimates of current needs for different types of housing service by the relevant types of households.

(ii) Attrition rates

Attrition rates are defined as the number of service input units, such as teachers or hospital beds, that are lost annually to the sector, per thousand service input units available in the year. In the case of personnel, attrition may be due to retirement, death or change of job. In the of facilities, the basic form of attrition is mainly due to scrapping of facilities after they have become obsolete or have completed their useful life.

To obtain observations on attrition rates for various types of personnel, such as teachers or doctors, it would first be necessary to derive the total annual loss jointly caused by retirement, death, change of job etc., using the data from a variety of statistical sources. Since some of those data, such as those on deaths among active teachers or medical doctors, would be typically very difficult to obtain, attrition owing to such causes would need to be estimated. Given the total annual loss for each type of personnel, the observed attrition rate can be obtained by dividing the annual loss by the yearly number of personnel, and multiplying by a thousand. Annual data on the relevant personnel could be readily available in many countries.

In the case of various facilities, such as classrooms or health centres, the measurement of attrition would be even more difficult since the serviceable life or "retirement" of fixed assets is often set arbitrarily by policy decisions. Therefore, data enabling the measurement of attrition of fixed assets, if at all available, may reflect such policy decisions rather than actual physical deterioration. Furthermore, as buildings cannot be moved to accommodate the spatial pattern of demand generated by the population redistribution, classrooms in areas of falling demand, for example, may be unused even though they are as serviceable as those classrooms that are being used. In view of all these difficulties, deriving observations on attrition rates for different types of facilities may involve a considerable degree of subjective estimation.

(iii) Unit expenditures

Unit operating expenditures for teachers, doctors and other personnel include various labour costs, the most important of which are gross salaries and employee benefits. Therefore, observations on unit operating expenditures for the various types of personnel can be obtained by calculating average annual labour costs for those categories of personnel. The data on salaries and benefits and those on the number of employees, which are needed to obtain those average costs, could be obtained from compilations of current statistics for the relevant sector.

Unit operating expenditures for classrooms, hospital beds and other types of facilities consist of the various labour and material costs incurred in connection with operating those facilities. In the case of classrooms, for example, those costs include outlays required to repair and clean classrooms, and schools in general. Such outlays would include salaries and benefits of maintenance employees, plus expenditures for the relevant materials used in maintenance. Therefore, observations on unit operating expenditures for the various types of facilities can be obtained by calculating annual average costs of maintaining units of those facilities. Data on salaries and benefits of maintenance personnel and other maintenance costs could come from current compilations of statistics for the relevant sector. Information on the numbers of units of the facilities can be obtained from the same source.

This method assumes that investments are initiated and completed in the same year. This assumption is adopted to simplify the calculations, though investments in, say, education and health personnel and facilities are typically spread out over a period of a few years. Given this assumption, observations on unit investment expenditure should represent total costs of training new personnel or installing new facilities no matter whether those costs are incurred in one year or during several years. In particular, in the case of personnel, observations on unit investment expenditures relating to training can be obtained as the total cost to the sector incurred in training new personnel, divided by the relevant number of persons. Data on the total cost of training and the number of personnel trained may be available in the current compilations of statistics for the sector. Where the sector, however, does not incur the cost of training, observations on unit investment expenditures for the personnel should be set at zero.

In the case of facilities, observations on unit investment expenditures can be obtained as the total cost to the sector of building new schools or hospitals, divided by the number of classrooms and hospital beds obtained in the process. This procedure will yield the cost of adding another classroom or hospital bed, which will reflect not only the expenditure of installing the physical service units, but also relevant related costs. Thus, in the education sector, costs per classroom may include those of building school gymnasiums and other facilities that are not classrooms _per se_. In the health sector, cost per hospital bed may include the costs of building laboratories or hospital operating rooms.

(iv) _Ratios of administrative to operating expenditure_

Observations on the ratio of administrative to operating expenditures can be obtained as the total administrative expenditure, divided by the total operating expenditure for the sector (or subsector). Those totals can be derived from information on various administrative costs, such as gross salaries of administrative personnel and maintenance expenses, and on various operating costs, such as gross salaries and employees' fringe benefits of teachers or doctors, as well as fuel expenses etc. Those data may come from the expenditure statistics compiled for the sector.

(c) _Assumptions on service input rates, attrition rates, unit expenditures and ratios of administrative to operating expenditures_

To prepare assumptions on values of the various projection inputs over the projection period, it will be necessary to use observations on those inputs for the recent past. In particular, those recent observations would be required in order to prepare values of the projection inputs for the initial year of the period. This can be done by extrapolation from such recent observations. The procedure by which values of the various inputs are prepared for the years beyond the initial year of projection may vary from one type of input to another.

(i) Service input rates

To specify service input rates for dates beyond the initial year, it will be essential to consider the Government's intentions regarding the standards at which services are to be provided by the sector over the plan horizon.

Thus, if the projection is being prepared for the education sector, it will be important to consider whether or not the Government wishes to reduce the student-teacher ratio and the average class size at specific school levels. If this is the Government's intention, future values of service input rates should reflect this. Moreover, depending on the type of projection considered -- national or urban-rural -- it would be necessary to consider the Government's intentions at the relevant level. Unless the Government's policy in this area is taken into account, future service input rates could only be specified in an *ad hoc* fashion.

If the projection being prepared is for the housing sector, additional care may be needed in specifying service input rates. This is especially true if the households to receive housing services will each receive only one type of service. In such a situation, for any given projection date, service input rates should be selected in such a way that the sum of those rates across different types of service inputs equals a thousand.

(ii) Attrition rates

Specifying attrition rates for sectoral projections would typically prove more difficult than deciding on service input rates. This is so because attrition rates in a government sector, especially for the various types of facilities, are influenced by policy decisions, which may be fairly arbitrary, even more so than those relating to the standards at which services will be provided in the future. In view of this, assumptions on future values of attrition rates need to be made on the basis of information about the Government's position on the rapidity at which different types of service inputs are retired.

(iii) Unit expenditures

For the years beyond the base year of the projection, levels of unit operating expenditures for different types of personnel should reflect expected future levels of real gross salaries (including fringe benefits) of the relevant personnel categories. Levels of unit operating expenditures for the various types of facilities should reflect changes in the cost of labour and material used in maintaining those facilities. As those unit expenditures could be under substantial government control, it will be important to specify their future levels in conjunction with the Government's views on future trends in labour and related costs.

In addition, when specifying unit operating expenditures, it may be necessary to take into account likely future shifts in the age composition of personnel or facilities and possible effects of those shifts on unit operating expenditures.

For example, if owing to the expansion of the teaching staff at a particular school level the mean age of teachers is expected to decline, then one may allow for a slower increase or even a decline in the operating expenditure per teacher (assuming that teacher salaries increase with seniority). Similarly, if school buildings are expected to grow older on average as a result of anticipated slow additions to or slow replacement of the stock, then the assumption on operating expenditure per classroom may need to allow for increasing maintenance costs (assuming that older buildings would require more expensive maintenance).

Assumptions on unit investment expenditures for different types of service inputs should be based on anticipated future shifts in the cost of training personnel or the cost of adding new or replacing existing facilities. In part, those shifts will be brought about by changes in the standards at which the services are provided. For example, the cost of adding a new classroom in the future will in part depend on whether the Government wants to increase the ratio of expenditures on non-classroom facilities (e.g., school sports facilities) to expenditures on classrooms. Where those standards are expected to be raised, assumptions on future unit investment expenditure must reflect that change.

(iv) Ratios of administrative to operating expenditures

Ratios of administrative to operating expenditures in years 5 and beyond may be kept fixed at the level of the initial year of projection since the cost to the Government of administering a sector or subsector may be proportional to the costs of service delivery. Alternatively, the ratios may be allowed to shift over time, if administrative expenditures are expected to decline or increase relative to operating expenditures.

This completes the discussion of the inputs required for making projections of government expenditures.

D. Illustrative examples of projections

This section will present three examples to illustrate the use of this method to project government consumption and investment in the education, health and housing sectors, respectively. These examples will indicate how the relevant calculations are made by focusing on the projection interval 0-5. In addition, they will provide complete projection results for a 20-year projection period.

1. National projection for the education sector

This example will describe how projections of government operating and investment expenditures can be prepared for different school levels of the education system. The example assumes that government educational expenditures are confined to the public segment of the education system, or its various school levels. The calculations presented in the example will be based on the inputs shown in table 98, which refers to the lower-primary school level. Indicated in the table is the number of students in public schools of the relevant school level, plus service input rates, attrition rates, unit expenditures and ratios of administrative to recurrent operating expenditures.

Table 98. Inputs for projecting government consumption and investment in the education sector for the lower-primary school level: entire country

Variable	Year				
	0	5	10	15	20
(1)	(2)	(3)	(4)	(5)	(6)
Numbers of students (thousands)	1 020.9	1 216.7	1 363.3	1 581.1	1 807.8
Service input rates (per thousand students)					
Teachers	23.9	25.8	27.7	29.6	31.5
Classrooms	25.0	26.6	28.2	29.8	31.4
Attrition rates					
Teachers	33.0	33.0	33.0	33.0	33.0
Classrooms	50.0	50.0	50.0	50.0	50.0
Unit operating expenditures a/					
Teachers	36.3	40.1	44.2	48.9	53.9
Classrooms	4.7	5.2	5.7	6.3	7.0
Unit investment expenditures a/					
Teachers	0.0	0.0	0.0	0.0	0.0
Classrooms	172.0	199.4	231.2	268.0	310.7
Ratios of administrative to operating expenditure	0.15	0.15	0.15	0.15	0.15

a/ Local currency units.

Since the same set of computations could be used for each school level, this example will be limited to one of them -- the lower-primary school level. It will illustrate a complete set of the relevant calculations for that level.

(a) Recurrent expenditures

Recurrent expenditures are found by first calculating operating expenditures, then calculating administrative expenditures and finally adding the two types of expenditures.

(i) Operating expenditures

The first step in calculating operating expenditures is to calculate the number of service input units by type of service input. These are then multiplied by unit operating expenditures for each type of input. Finally, total operating expenditures are calculated by summing up the costs of all inputs.

Numbers of service input units, by type of service input. For each type of service input, the number of service input units is calculated using the number of users and assumed service input rates, by type of service input. The calculations performed for the lower-primary school level for the end of the projection interval (year 5) are illustrated in table 99. Thus, for a given type of service input, the number of service input units (column 4) is obtained as a product of the number of students (column 2) and the service input rate (column 3) for that type of service input.

For example, the number of teachers required (in thousands) at the end of the interval, 31.39, is obtained as:

$$31.39 = [\ (1{,}216.7)\ (25.8)\ ]\ /1{,}000; \qquad (1)$$

where 1,216.7 is the number of students in year 5 (in thousands) and 25.8 is the service input rate indicating the number of teachers per thousand students.

Levels of operating expenditures, by type of service input. After projecting the numbers of service input units by type of service input, it is possible to calculate operating expenditures by type of service input. As illustrated in table 100, operating expenditures for year 5 (column 4) are obtained as products of the number of service input units (column 2) and unit operating expenditures (column 3).

For example, the level of operating expenditure for teachers in year 5, 1,258.8, is obtained as:

$$1{,}258.8 = (31.39)\ (40.10); \qquad (2)$$

where 31.39 and 40.10 are, respectively, the number of teachers (in thousands) and the operating expenditure per teacher in year 5. [1]

Total operating expenditure. Given the projected levels of operating expenditures for different types of service inputs, the total operating expenditure can be obtained as the sum of those levels.

Table 99. Computing the numbers of service input units, by type of service input, for the lower-primary school level: entire country, year 5

Type of service input	Number of students a/	Service input rates a/	Number of service input units b/ (Thousands)
(1)	(2)	(3)	(4)
Teachers	1 216.7	25.8	31.39
Classrooms	1 216.7	26.6	32.36

a/ From table 98, column 3.
b/ (Col. 2) . (col. 3)/1,000.

Table 100. Calculating levels of operating expenditures, by type of service input, for the lower-primary school level: entire country, year 5

Type of service input	Number of service input units a/ (Thousands)	Unit operating expenditures b/ (Per thousand service input units)	Operating expenditures c/ (Thousands of LCUs) d/
(1)	(2)	(3)	(4)
Teachers	31.39	40.10	1 258.7
Classrooms	32.36	5.20	168.2
Total			1 427.0

a/ From table 99, col. 4.
b/ From table 98, col. 3.
c/ (Col. 2) . (col. 3).
d/ Local currency units.

For example, the total operating expenditure at the end of the projection interval 0-5, 1,427.1, is obtained as:

1,427.1 = 1,258.8 + 168.3; (3)

where 1,258.8 and 168.3 are operating expenditures for teachers and classrooms for year 5. This is illustrated in table 100 (column 4).

(ii) Total administrative expenditure

The calculation of the total administrative expenditure is illustrated in table 101. This total in year 5 (column 4) can be obtained as a product of the total operating expenditure (column 2) and the ratio of administrative to operating expenditure (column 3) for that year.

In particular, the total administrative expenditure in year 5, 214.1, is obtained as:

214.1 = (1,427.1) (0.15); (4)

where 1,427.1 and 0.15 are, respectively, the total operating expenditure and the ratio of administrative to operating expenditure in year 5.

(iii) Total recurrent expenditures

The level of total recurrent expenditures can be obtained as the sum of the levels of total operating expenditure and total administrative expenditure. Thus, the level of total recurrent expenditure for year 5, 1,641.1, is obtained as:

1,641.1 = 1,427.1 + 214.1; (5)

where 1,427.1 is the level of total operating expenditure in year 5 and 214.1 is the level of total administrative expenditure in the same year.

(b) Investment expenditures

The first step in calculating investment expenditures is to calculate the change in required service input units. The second step is to calculate the number of service input units requiring replacement. The last step is to calculate the level of investment expenditure by multiplying by unit investment expenditures.

(i) Changes in the numbers of service input units, by type of input service

Once the numbers of service input units are obtained for all relevant dates of the projection period, including the initial year of projection, it is possible to derive changes in the numbers of service input units during the relevant years. Changes in the numbers of service input units can be approximated for the years within the projection interval, as illustrated in table 102 for year 5. The

Table 101. Calculating total administrative expenditure for the lower-primary school level: entire country, year 5

Type of expenditure	Total operating expenditure a/ (Thousands of LCUs) d/	Ratio of administrative to operating expenditure b/	Total administrative expenditure c/ (Thousands of LCUs) d/
(1)	(2)	(3)	(4)
Recurrent	1 427.0	0.15	214.0

a/ From table 100; in col. 4, "Total".
b/ From table 98, col. 3.
c/ (Col. 2) . (col. 3).
d/ Local currency units.

Table 102. Computing changes in the numbers of service input units, by type of service input, for the lower-primary school level: entire country, year 5

(Thousands)

Type of service input	Numbers of service input units			Change in numbers of service input units in year 5 c/
	Year 0 a/	Year 5 b/	Year 10 a/	
(1)	(2)	(3)	(4)	(5)
Teachers	24.39	31.39	37.76	1.36
Classrooms	25.52	32.36	38.44	1.32

a/ Obtained using the steps illustrated in table 99.
b/ From table 99, col. 4.
c/ (Col. 3) . $(((\text{Col. }4)/(\text{col. }3))^{1/10} - ((\text{col. }3)/(\text{col. }2))^{-1/10})$.

illustrative calculations assume that the growth of the number of service input units for each type of service input occurs over discrete intervals.

For example, the change in the number of teachers in year 5, 1.37, can be obtained as follows:

$$1.37 = (31.39) [(37.76 / 31.39)^{1/10} - (31.39 / 24.40)^{-1/10}]; \qquad (6)$$

where 24.40, 31.39 and 37.76 are, respectively, the numbers of teachers in years 0, 5 and 10. This procedure is explained in the annex to the present chapter.

Changes in the numbers of service input units in the initial year of projection are obtained in a way similar to that of deriving changes in the terminal year of projection. Thus, the change in the number of teachers in year 0, 1.23, is approximated as:

$$1.23 = (24.40) [(31.39/24.40)^{1/10} - (31.39/24.40)^{-1/10}]; \qquad (7)$$

where 24.40 and 31.39 are, respectively, the numbers of teachers in years 0 and 5.

Changes in the numbers of service input units in the terminal year of the last projection interval are approximated in a different way. Thus, the change in the number of teachers in year 20, 2.23, is obtained as follows:

$$2.23 = (56.95) [(56.95/46.80)^{1/10} - (56.95/46.80)^{-1/10}]; \qquad (8)$$

where 46.80 and 56.95 are, respectively, the numbers of teachers in years 15 and 20.

(ii) Numbers of service input units requiring replacement, by type of input service

Given the numbers of service input units, by type of service input, for different projection dates, it is possible to calculate the numbers of units requiring replacement at those dates. The numbers of service input units requiring replacement in year 5 (column 4) are calculated as illustrated in table 103. They are obtained as products of the numbers of service input units (column 2) and attrition rates (column 3).

For example, the number of teachers requiring replacement in year 5, 1.04 (thousand), is obtained as:

$$1.04 = [(31.4)/1000] (33.0); \qquad (12)$$

where 31.4 and 33.0 are, respectively, the number of teachers (in thousands) and the attrition rate relating to teachers in year 5.

After calculating the numbers of service input units requiring replacement, in addition to calculating the numbers of service input units and the changes in those numbers for the entire projection interval, one obtains the results for the lower-primary school level shown in table 104.

Table 103. Calculating the numbers of service input units requiring replacement, by type of service input, for the lower-primary school level: entire country, year 5

Type of service input	Number of service input units a/	Attrition rates b/	Number of service input units requiring replacement c/
	(Thousands)	(Per thousand)	(Thousands)
(1)	(2)	(3)	(4)
Teachers	31.3	33.0	1.03
Classrooms	32.3	50.0	1.61

a/ From table 99, col. 4.
b/ From table 98, col. 3.
c/ ((Col. 2) . (col. 3))/1,000.

Table 104. Projected numbers of service input units, changes in those numbers and numbers of service input units requiring replacement for the lower-primary school level: entire country

(Thousands)

Variable	Year 0	5	10	15	20
Numbers of service input units					
Teachers	24.39	31.39	37.76	46.80	56.94
Classrooms	25.52	32.36	38.44	47.11	56.76
Changes in numbers of service input units					
Teachers	1.22	1.36	1.51	1.92	2.23
Classrooms	1.21	1.32	1.44	1.83	2.11
Numbers of service input units requiring replacement					
Teachers	0.80	1.03	1.24	1.54	1.87
Classrooms	1.27	1.61	1.92	2.35	2.83

(iii) Levels of investment expenditures, by type of service input

To obtain investment expenditure for each type of service, it is necessary to add the change in the number of service input units to the number of units requiring replacement and multiply the sum by the relevant unit investment expenditure. These calculations are illustrated for year 5 in table 105, where each investment expenditure (column 5) is obtained as a product of the sum of the change in the number of service input units (column 2) and the number of units requiring replacement (column 3), and the unit investment expenditure (column 4).

For example, the level of investment expenditure on classrooms in year 5, 586.2, is obtained as:

$$586.2 = (1.32 + 1.62)\ (199.4); \qquad (13)$$

where 1.32 and 1.62 are, respectively, the change in the number of classrooms and the number of classrooms requiring replacement in year 5. In this instance, the assumed investment expenditure per classroom in year 5 is 199.4. [5]

The results relating to operating expenditures and investment expenditures for teachers and classrooms at the lower-primary school level for the 20-year projection period are shown in table 106.

(iv) Total investment expenditure

Given the projected levels of investment expenditures, by type of service input, it is possible to calculate total investment expenditure as the sum of those levels.

For example, the total investment expenditure in year 5, 586.2, is obtained as:

$$586.2 = 0.0 + 586.2; \qquad (14)$$

where 0.0 and 586.2 are investment expenditures for teachers and classrooms for year 5.

The levels of total recurrent and total investment expenditures for the end of the interval 0-5 are shown in table 107 in the column corresponding to year 5, along with other results obtained for the lower-primary school level for the 20-year projection period. Those levels over the 20-year period are illustrated in figure XXXIV.

(c) Other results

Other results that can be obtained as part of a national projection of government consumption and investment for individual school levels include the various expenditure aggregates, indicators of the structure of total expenditure and rates of change of the expenditure aggregates.

Table 105. Calculating levels of investment expenditures, by type of service input, for the lower-primary school level: entire country, year 5

Type of service input	Change in the number of service input units a/ (Thousands)	Number of service input units requiring replacement b/ (Thousands)	Unit investment expenditures c/	Investment expenditures d/ (Thousands of LCUs) e/
(1)	(2)	(3)	(4)	(5)
Teachers	1.36	1.03	0.0	0.0
Classrooms	1.32	1.61	199.4	586.2
Total				586.2

a/ From table 102, col. 5.
b/ From table 103, col.4.
c/ From table 98, col. 3.
d/ ((Col. 2) + (col. 3)). (col. 4).
e/ Local currency units.

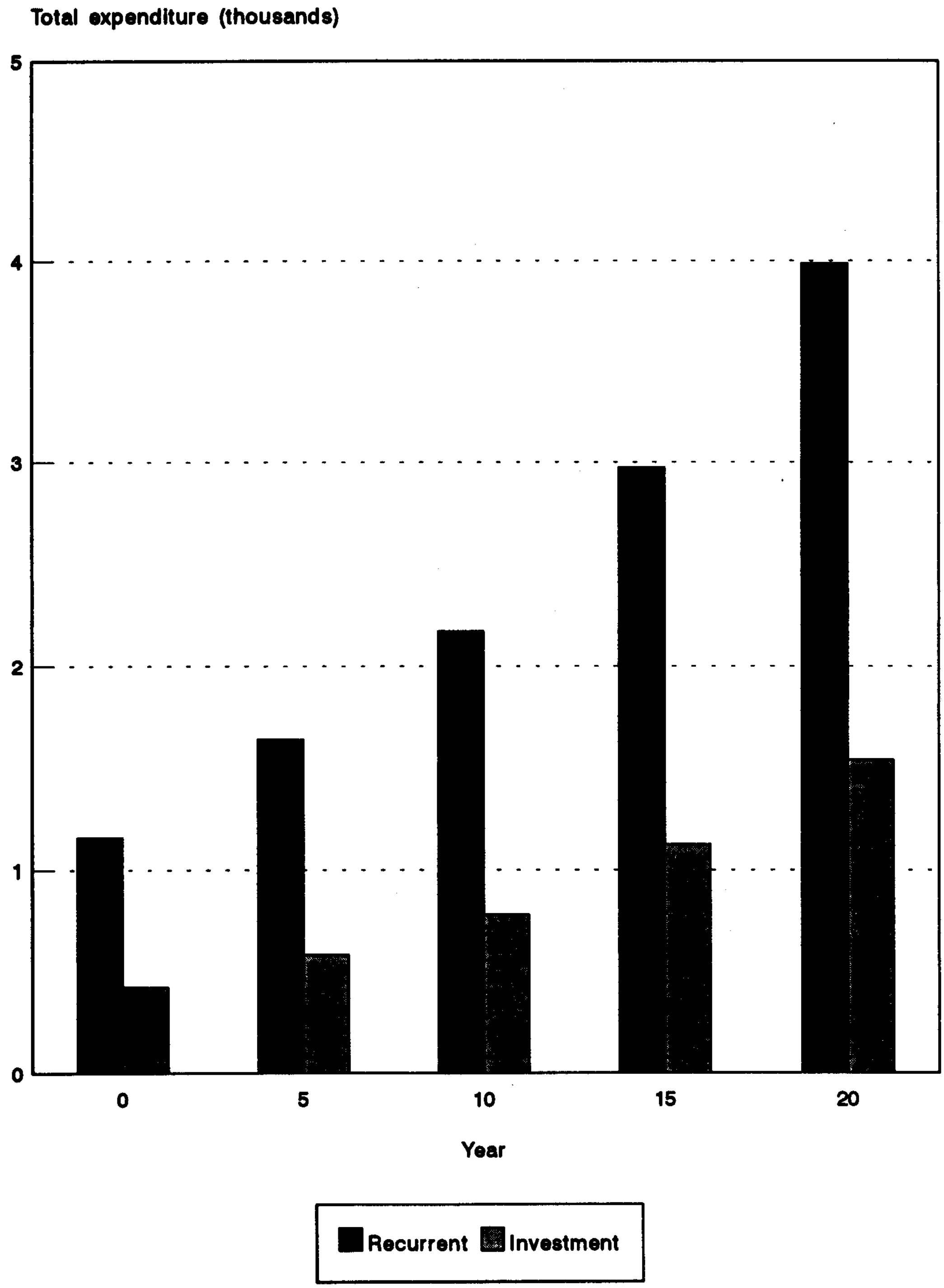
Table 106. Projected operating and investment expenditures, by type of service input, for the lower-primary school level: entire country

(Thousands of LCUs) a/

Variable	Year 0	5	10	15	20
Operating expenditures					
Teachers	885.7	1 258.7	1 669.1	2 288.5	3 069.3
Classrooms	119.9	168.2	219.1	296.8	397.3
Investment expenditures					
Teachers	0.0	0.0	0.0	0.0	0.0
Classrooms	428.0	586.2	778.7	1 123.0	1 538.9

a/ Local currency units.

Figure XXXIV. Total recurrent and investment expenditures: lower-primary school level



(i) Expenditure aggregates

Expenditure aggregates include the level of total government expenditure, which is the sum of total recurrent and total investment expenditures. Moreover, the aggregates also include changes in those expenditure levels over the five-year projection intervals.

Total government expenditure. The level of total government expenditure can be derived as the sum of the levels of total recurrent and total investment expenditures. In year 5, the level of total government expenditure for the lower-primary school level, 2,227.3, is:

$$2{,}227.3 = 1{,}641.1 + 586.2; \tag{15}$$

where 1,641.1 and 586.2 are, respectively, the levels of total recurrent and total investment expenditures in year 5.

The levels of total government expenditures for the lower-primary school level for the various dates over the 20-year period are indicated in table 107. They are also shown in figure XXXV.

(ii) Growth in expenditures

Total recurrent expenditure. The increases in total recurrent expenditures for the interval 0-5 can be obtained as follows:

The growth in the total recurrent expenditure, 484.6, is obtained as:

$$484.6 = 1{,}641.1 - 1{,}156.5; \tag{16}$$

where 1,156.5 and 1,641.1 are the levels of total recurrent expenditure in years 0 and 5, respectively.

Total investment expenditure. The growth in the total investment expenditure, 158.2, is calculated as:

$$158.2 = 586.2 - 428.0; \tag{17}$$

where 428.0 and 586.2 are, respectively, the levels of total investment expenditure in years 0 and 5.

Growth in total government expenditure. The increase in the total government expenditure for the interval 0-5, 642.8, is obtained as:

$$642.8 = 2{,}227.3 - 1{,}584.5; \tag{18}$$

where 1,584.5 and 2,227.3 are the levels of the total government expenditure in years 0 and 5.

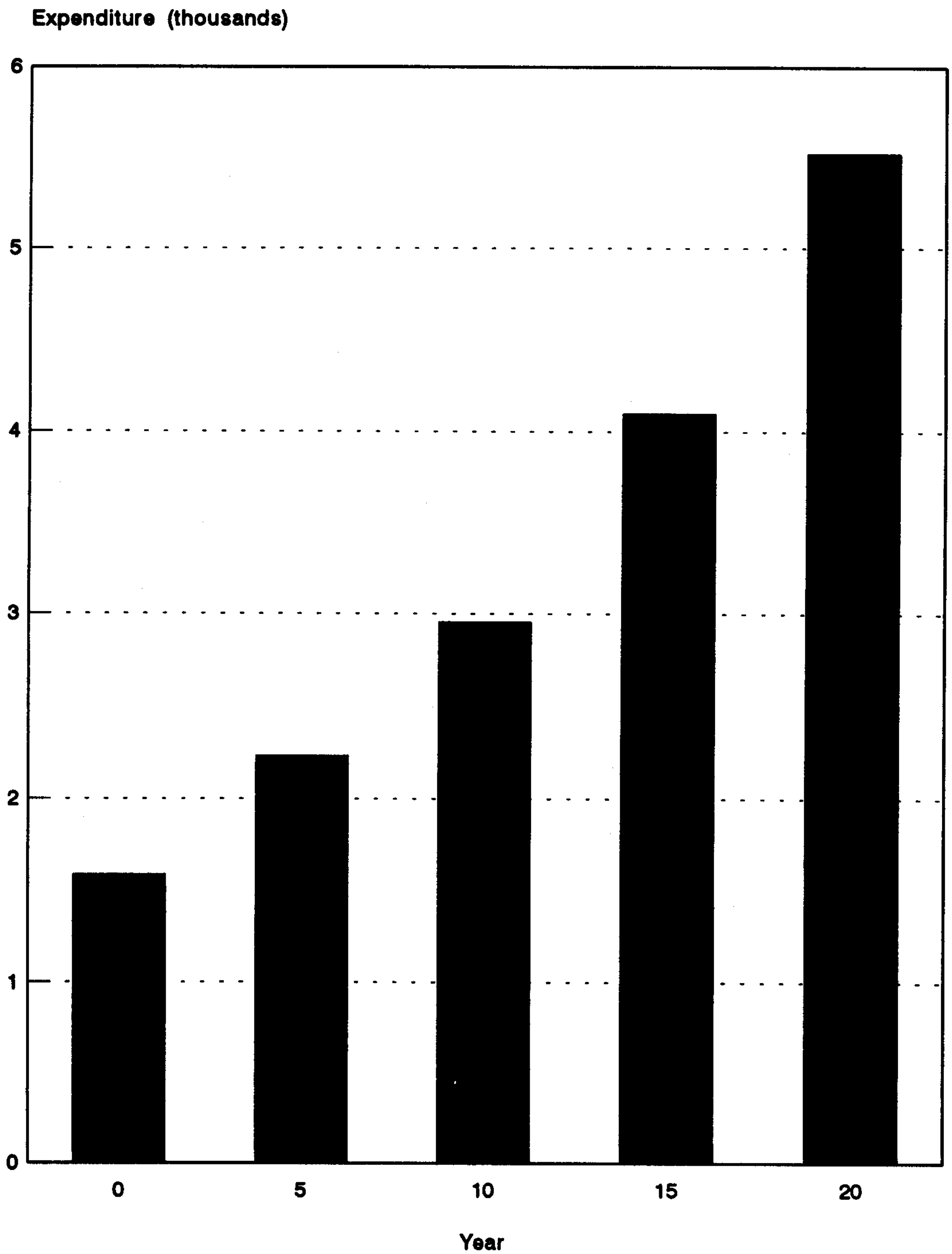
Increases in the various expenditure aggregates over the 20-year period are shown in table 107.

Table 107. Expenditure aggregates, structure and rates of growth for the lower-primary school level: entire country

Indicators	Year 0	5	10	15	20
Expenditure aggregates (thousands of LCUs) a/					
Levels of total expenditure					
Recurrent	1 156.5	1 641.1	2 171.5	2 973.1	3 986.7
Investment	428.0	586.2	778.7	1 123.0	1 538.9
Total	1 584.5	2 227.3	2 950.3	4 096.2	5 525.7
Growth in total expenditure					
Recurrent		484.6	530.3	801.6	1 013.5
Investment		158.1	192.5	344.2	415.9
Total		642.8	722.9	1 145.9	1 429.4
Indicators of expenditure structure					
Proportions accounted for by:					
Recurrent expenditure	0.72	0.73	0.73	0.72	0.72
Investment expenditure	0.27	0.26	0.26	0.27	0.27
Rates of growth in total expenditure (percentage)					
Recurrent		7.25	5.76	6.48	6.04
Investment		6.49	5.84	7.59	6.50
Total		7.04	5.78	6.78	6.16

a/ Local currency units.

Figure XXXV. Total government expenditure: lower-primary school level



(iii) Indicators of the structure of expenditures

Indicators of the structure of expenditures that can be calculated as part of this type of projection include proportions of the total government expenditure accounted for by total recurrent and total investment expenditures.

The proportions of the total government expenditure accounted for by total recurrent expenditures in year 5 can be calculated as follows:

The proportion of the total government expenditure accounted for by the total recurrent expenditure, 0.74, is:

$$0.74 = 1{,}641.1 \;/\; 2{,}227.3; \tag{19}$$

where 1,641.1 is the total recurrent expenditure in year 5 and 2,227.3 is the total government expenditure in the same year.

The proportion of the total government expenditure accounted for by the total investment expenditure, 0.26, is:

$$0.26 = 1 - 0.74; \tag{20}$$

where 0.74 is the proportion of the total government expenditure accounted for by the total investment expenditure.

The proportions calculated for the entire projection period are shown in table 107. The proportions obtained for the initial and terminal years of this period are also indicated in figure XXXVI.

(iv) Rates of growth of expenditures

Rates of growth can be calculated for all the different expenditure aggregates.

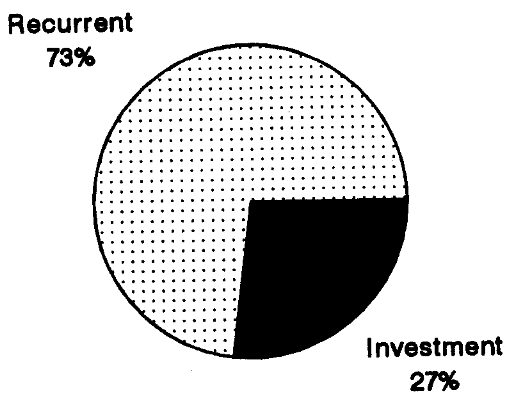
Rates of growth of total recurrent and total investment expenditures. Rates of growth can be computed assuming that growth in expenditures occurs over discrete intervals or continuously.

Geometric growth rates. If growth in expenditures is assumed to occur over discrete intervals, average annual growth rates of total recurrent and total investment expenditures for the interval 0-5 are obtained using the geometric growth rate formula as follows:

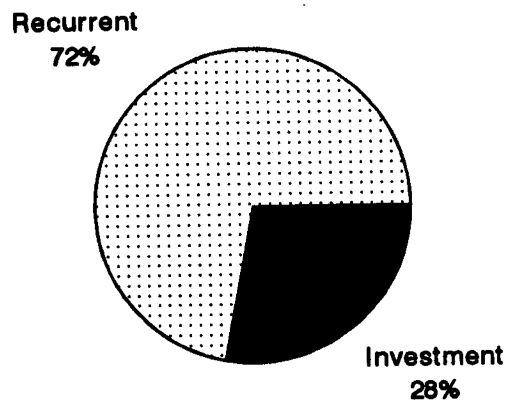
The annual rate of growth of the total recurrent expenditure, 7.25 per cent, is calculated as:

$$7.25 = [\ (\ 1{,}641.1/1{,}156.5\ )^{1/5} - 1\ ] \cdot 100; \tag{21}$$

Figure XXXVI. Proportions of total government expenditure accounted for by total recurrent and investment expenditure



Year 0



Year 20

where 1,156.5 and 1,641.1 are the levels of total recurrent expenditure in years 0 and 5, respectively, and 5 is the length of the interval.

The annual rate of growth of the total investment expenditure, 6.49 per cent, is calculated as:

$$6.49 = [(586.2/428.0)^{1/5} - 1] \cdot 100; \qquad (22)$$

where 428.0 and 586.2 are the levels of total investment expenditure in years 0 and 5, respectively.

The rates of growth of total recurrent and investment expenditures for each five-year period over the 20-year projection period, which were computed using the geometric growth rate formula are presented in table 107 and shown in figure XXXVII.

Exponential growth rates. If growth in expenditures were assumed to be continuous, average annual growth rates of total recurrent and total investment expenditures for the interval 0-5 would be obtained using the exponential growth rate formula as follows:

The annual rate of growth of the total recurrent expenditure, 7.00 per cent, is:

$$7.00 = [\ln (1,641.1/1,156.5) / 5] \cdot 100; \qquad (23)$$

where 1,156.5 and 1,641.1 are the levels of total recurrent expenditure in years 0 and 5, respectively.

The annual rate of growth of the total investment expenditure, 6.29 per cent, is:

$$6.29 = [\ln (586.2/428.0) / 5] \cdot 100; \qquad (24)$$

where 428.0 and 586.2 are the levels of total investment expenditure in years 0 and 5, respectively.

Rates of growth of total government expenditure. These rates of growth could also be computed using either geometric or exponential growth rate formulas.

Geometric growth rate. If growth in total government expenditure is assumed to take place over discrete intervals, the average annual growth rate for the interval 0-5, 7.05 per cent, is obtained as follows:

$$7.05 = [(2,227.3/1,584.5)^{1/5} - 1] \cdot 100; \qquad (25)$$

where 1,584.5 and 2,227.3 are the levels of total government expenditure in years 0 and 5, respectively.

Geometric rates of growth of total government expenditures for the lower-primary school level over the 20-year projection period are presented in table 107 and shown in figure XXXVIII.

Figure XXXVII. Rates of growth of total recurrent and investment expenditures: lower-primary school level

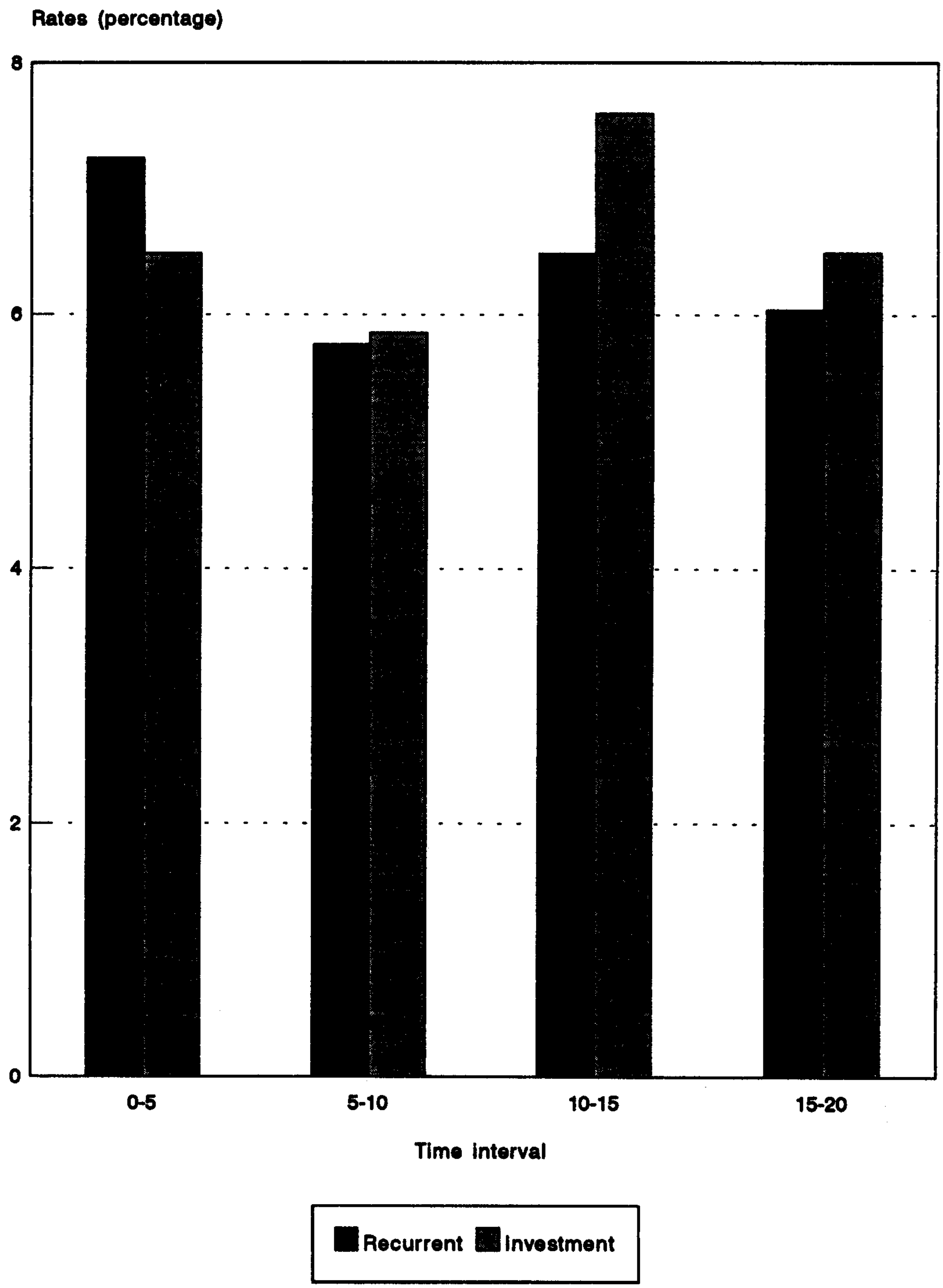
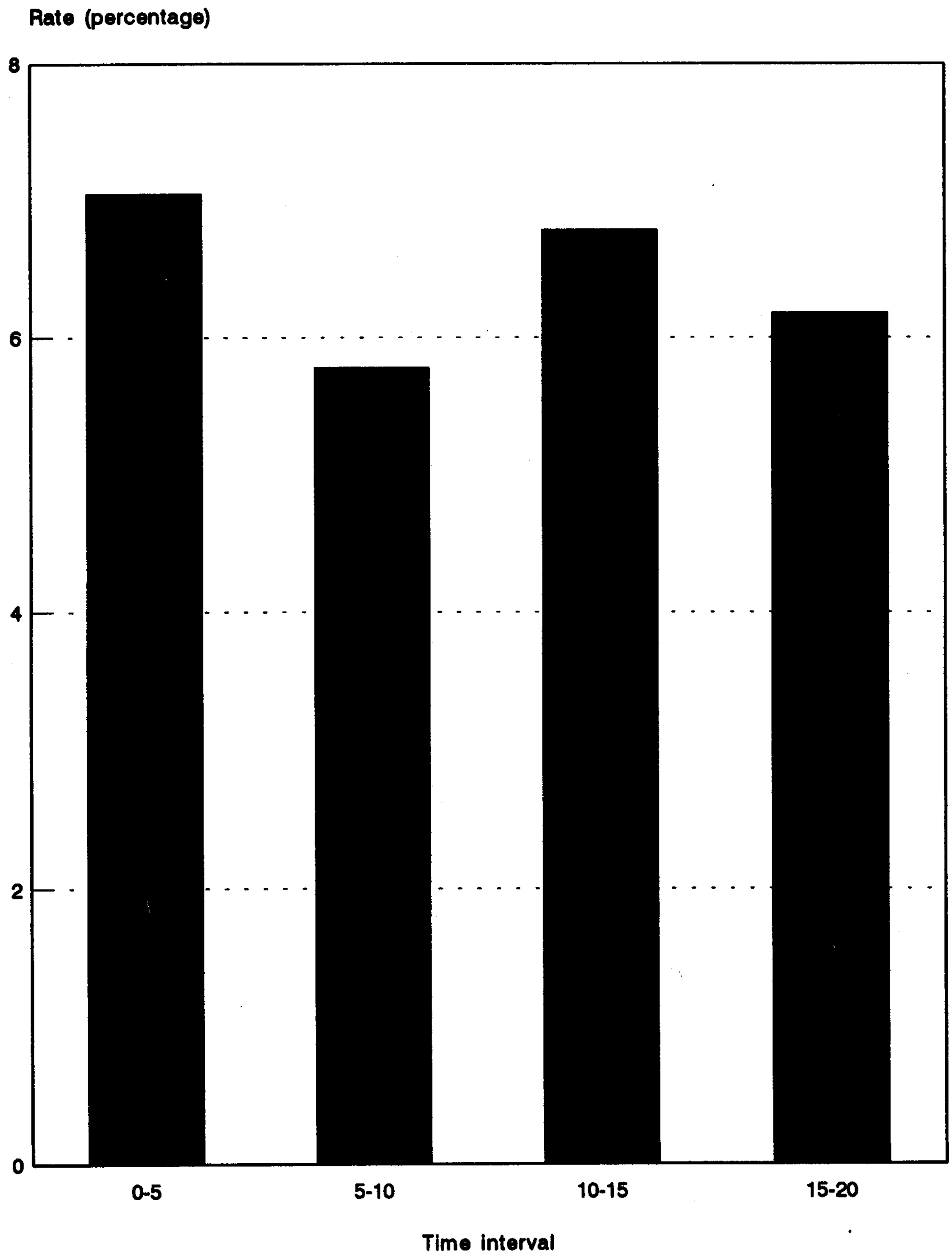


Figure XXXVIII. Rate of growth in total government expenditure lower-primary school level



Exponential growth rate. If growth were assumed to be continuous, the average annual growth rate of the total government expenditure for the interval 0-5 would be obtained using the exponential growth rate formula in a way that is analogous to that of deriving the growth rates of total recurrent and total investment expenditures.

This completes illustrative calculations for the lower-primary school level.

2. Urban-rural projection for the health sector

This example will illustrate an urban-rural projection of government consumption and investment for the health sector. The calculations described below will be based on the inputs shown in tables 108 and 109, which are for urban and rural areas, respectively. The example assumes that the types of health services inputs available to the rural population are the same as those available to urban residents, plus two additional types of services inputs, which are rural health subcentres and medical posts.

An urban-rural projection for the health sector can be obtained by performing calculations that are analogous to those illustrated above as part of a national projection for the education sector. Those calculations are, however, made for urban and rural areas rather than for the entire country. The types of service inputs may vary between the two areas and may exceed the number of the various types of service inputs used in the projection for the education sector. In view of the analogy, this example will focus on the steps specific to the urban-rural projection.

(a) Recurrent expenditures

Recurrent expenditures can be calculated by calculating operating and administrative expenditures.

Operating expenditures

Operating expenditures can be calculated by computing the number of service inputs required and then the levels of operating expenditures, by type of service inputs.

Numbers of service input units, by type of service input. The numbers of service input units, by type of service input, can be calculated using the steps illustrated in the preceding example. The results obtained by those steps for the entire projection period for urban and rural areas are shown, respectively, in tables 110 and 111. Those results can be aggregated across locations to obtain analogous results for the entire country, which are presented in table 112.

Levels of operating expenditures, by type of service input. It is possible to project levels of operating expenditures, for different types of service inputs, by residential location, using the numbers of service input units, along with assumed unit operating expenditures. Projections of the levels of those expenditures, by type of service input, for urban and rural areas, are shown in tables 113 and 114. Those results can be aggregated across locations in order to

Table 108. Inputs for projecting government consumption and investment in the health sector: urban areas

Variable	Year 0	5	10	15	20
Population size (thousands)	2 983.4	4 067.0	5 334.3	6 697.3	8 140.9
Service input rates					
Doctors	0.99	1.18	1.37	1.55	1.74
Dentists	0.24	0.37	0.51	0.64	0.77
Nurses	0.28	1.16	2.05	2.93	3.81
Nursing assistants	1.66	2.62	3.58	4.54	5.50
Hospital beds	4.83	5.18	5.54	5.89	6.24
Health centres	0.02	0.02	0.02	0.01	0.01
Attrition rates					
Doctors	30.0	30.0	30.0	30.0	30.0
Dentists	30.0	30.0	30.0	30.0	30.0
Nurses	40.0	40.0	40.0	40.0	40.0
Nursing assistants	50.0	50.0	50.0	50.0	50.0
Hospital beds	30.0	30.0	30.0	30.0	30.0
Health centres	30.0	30.0	30.0	30.0	30.0
Unit operating expenditures (LCUs) a/					
Doctors	239.0	263.9	291.3	321.7	355.1
Dentists	150.0	165.6	182.8	201.9	222.9
Nurses	144.0	159.0	175.5	193.8	214.0
Nursing assistants	112.0	123.7	136.5	150.7	166.4
Hospital beds	31.0	34.2	37.8	41.7	46.1
Health centres	683.0	754.1	832.6	919.2	1 014.9
Unit investment expenditures (LCUs) a/					
Doctors	0.0	0.0	0.0	0.0	0.0
Dentists	0.0	0.0	0.0	0.0	0.0
Nurses	0.0	0.0	0.0	0.0	0.0
Nursing assistants	0.0	0.0	0.0	0.0	0.0
Hospital beds	104.0	109.3	114.9	120.7	126.9
Health centres	2 330.0	2 448.9	2 573.8	2 705.1	2 843.0
Ratios of administrative to operating expenditure	0.10	0.10	0.10	0.10	0.10

a/ Local currency units.

Table 109. Inputs for projecting government consumption and investment in the health sector: rural areas

Variable	Year 0	5	10	15	20
Population size (thousands)	7 016.6	7 130.6	7 258.0	7 433.5	7 503.1
Service input rates					
Doctors	0.13	0.15	0.17	0.20	0.23
Dentists	0.03	0.03	0.04	0.05	0.05
Nurses	0.04	0.05	0.05	0.06	0.07
Nursing assistants	0.29	0.34	0.39	0.45	0.52
Hospital beds	0.15	0.17	0.20	0.23	0.27
Health centres	0.01	0.01	0.01	0.02	0.02
Health subcentres	0.01	0.01	0.01	0.02	0.02
Medical posts	0.01	0.01	0.01	0.02	0.02
Attrition rates					
Doctors	30.0	30.0	30.0	30.0	30.0
Dentists	30.0	30.0	30.0	30.0	30.0
Nurses	40.0	40.0	40.0	40.0	40.0
Nursing assistants	50.0	50.0	50.0	50.0	50.0
Hospital beds	30.0	30.0	30.0	30.0	30.0
Health centres	10.0	10.0	10.0	10.0	10.0
Health subcentres	20.0	20.0	20.0	20.0	20.0
Medical posts	70.0	70.0	70.0	70.0	70.0
Unit operating expenditures (LCUs) a/					
Doctors	239.0	263.9	291.3	321.7	355.1
Dentists	150.0	165.6	182.8	201.9	222.9
Nurses	144.0	159.0	175.5	193.8	214.0
Nursing assistants	112.0	123.7	136.5	150.7	166.4
Hospital beds	31.0	34.2	37.8	41.7	46.1
Health centres	550.0	607.2	670.4	740.2	817.3
Health subcentres	200.0	220.8	243.8	269.2	297.2
Medical posts	100.0	110.4	121.9	134.6	148.6
Unit investment expenditures (LCUs) a/					
Doctors	0.0	0.0	0.0	0.0	0.0
Dentists	0.0	0.0	0.0	0.0	0.0
Nurses	0.0	0.0	0.0	0.0	0.0
Nursing assistants	0.0	0.0	0.0	0.0	0.0
Hospital beds	104.0	109.3	114.9	120.7	126.9
Health centres	2 330.0	2 448.9	2 573.8	2 705.1	2 843.0
Health sub-centres	1 200.0	1 261.2	1 325.5	1 393.2	1 464.2
Medical posts	700.0	735.7	773.2	812.7	854.1
Ratios of administrative to operating expenditure	0.10	0.10	0.10	0.10	0.10

a/ Local currency units.

Table 110. Projected numbers of service input units for the health sector: urban areas

(Thousands)

Variable	Year 0	5	10	15	20
Numbers of service input units					
Doctors	2.95	4.79	7.30	10.38	14.16
Dentists	0.71	1.50	2.72	4.28	6.26
Nurses	0.83	4.71	10.93	19.62	31.01
Nursing assistants	4.95	10.65	19.09	30.40	44.77
Hospital beds	14.40	21.06	29.55	39.44	50.79
Health centres	5.96	8.13	0.10	6.69	8.14

Table 111. Projected numbers of service input units for the health sector: rural areas

(Thousands)

Variable	Year 0	5	10	15	20
Numbers of service input units					
Doctors	0.91	1.06	1.23	1.48	1.72
Dentists	0.21	0.21	0.29	0.37	0.37
Nurses	0.28	0.35	0.36	0.44	0.52
Nursing assistants	2.03	2.42	2.83	3.34	3.90
Hospital beds	1.05	1.21	1.45	1.70	2.02
Health centres	7.01	7.13	7.25	0.14	0.15
Health subcentres	7.01	7.13	7.25	0.14	0.15
Medical posts	7.01	7.13	7.25	0.14	0.15

Table 112. Projected numbers of service input units for the health sector: entire country

(Thousands)

Variable	Year 0	5	10	15	20
Numbers of service input units					
Doctors	3.86	5.86	8.54	11.86	15.89
Dentists	0.92	1.71	3.01	4.65	6.64
Nurses	1.11	5.07	11.29	20.06	31.54
Nursing assistants	6.98	13.07	21.92	33.75	48.67
Hospital beds	15.46	22.27	31.00	41.15	52.82
Health centres	0.12	0.15	0.17	0.21	0.23
Health subcentres	7.01	7.13	7.25	0.14	0.15
Medical posts	7.01	7.13	7.25	0.14	0.15

Table 113. Projected operating expenditures, by type of service input, for the health sector: urban areas

(Thousands of LCUs) a/

Variable	Year 0	5	10	15	20
Operating expenditures					
Doctors	705.9	1 266.4	2 128.8	3 339.5	5 030.0
Dentists	107.4	249.1	497.3	865.3	1397.2
Nurses	120.2	750.1	1 919.1	3 802.9	6 637.6
Nursing assistant	554.6	1 318.0	2 606.7	4 582.1	7 450.5
Hospital beds	446.7	720.4	1 117.0	1 644.9	2 341.8
Health centres	40.7	61.3	88.8	61.5	82.6

a/ Local currency units.

Table 114. Projected operating expenditures, by type of service input, for the health sector: rural areas

(Thousands of LCUs) a/

Variable	Year 0	5	10	15	20
Operating expenditures					
Doctors	218.0	282.2	359.4	478.2	612.8
Dentists	31.5	35.4	53.0	75.0	83.6
Nurses	40.4	56.6	63.6	86.4	112.3
Nursing assistants	227.8	299.8	386.3	504.1	649.2
Hospital beds	32.6	41.4	54.8	71.2	93.3
Health centres	38.5	43.2	48.6	110.0	122.6
Health subcentres	14.0	15.7	17.6	40.0	44.5
Medical posts	7.0	7.8	8.8	20.0	22.2

a/ Local currency units.

obtain operating expenditures, by type of service input, for the entire country. The results are indicated in table 115.

(b) Investment expenditures

Investment expenditures for rural and urban areas can be projected using procedures that are analogous to those used in making a national projection.

(c) Other results

As part of this projection, it is also possible to obtain a variety of additional results, such as expenditure aggregates, indicators of the structure of the total government expenditure and rates of change of expenditure aggregates. Those additional results can be obtained for urban and rural areas, as well as for the entire country, using procedures that are analogous to those illustrated above as part of the national projection for the education sector. The results obtained in this illustrative projection are shown in tables 116 to 118.

In the course of making an urban-rural projection, it is also possible to project the proportions of the total government expenditure that will be incurred in urban and rural areas. The rest of this section illustrates the calculation of those proportions.

(i) Proportion urban

The proportion of the total government expenditure that is urban is calculated for the end of the given projection interval as the ratio of the total government expenditure incurred in urban areas to the total government expenditure for the entire country. The proportion urban in year 5, 0.73, is therefore obtained as:

$$0.73 = 5{,}054.0 \ / \ 6{,}970.0; \qquad (35)$$

where 5,054.0 is the total government expenditure incurred in urban areas in year 5 and 6,970.0 is the total government expenditure for the entire country in the same year.

(ii) Proportion rural

The proportion of the total government expenditure that is rural, 0.27, is calculated as a complement of the proportion urban:

$$0.27 = 1 - 0.73; \qquad (38)$$

where 0.73 is the proportion of the total government expenditure that is urban.

The proportions of the total government expenditure that are urban and rural, which were calculated for the entire projection period, are shown in table 118. They are also indicated in figure XXXIX.

Table 115. Projected operating expenditures, by type of service input, for the health sector: entire country

(Thousands of LCUs) a/

Variable	Year 0	5	10	15	20
Operating expenditures					
Doctors	923.9	1 548.7	2 488.2	3 817.7	5 642.8
Dentists	138.9	284.6	550.3	940.4	1 480.8
Nurses	160.7	806.8	1 982.8	3 889.3	6 749.9
Nursing assistants	782.5	1 617.9	2 993.0	5 086.2	8 099.7
Hospital beds	479.3	761.9	1 171.9	1 716.2	2 435.2
Health centres	79.3	104.6	137.4	171.6	205.2
Health subcentres	14.0	15.7	17.6	40.0	44.5
Medical posts	7.0	7.8	8.8	20.0	22.2

a/ Local currency units.

Table 116. Expenditure aggregates, structure and rates of growth for the health sector: urban areas

Indicators	Year 0	5	10	15	20
Expenditure aggregates (thousands of LCUs) a/					
Levels of total expenditure					
Recurrent	2 173.2	4 802.2	9 193.6	15 726.1	25 233.9
Investment	171.6	251.6	317.4	400.7	535.4
Total	2 344.9	5 053.9	9 511.1	16 126.8	25 769.4
Growth in total expenditure					
Recurrent		2 628.9	4 391.3	6 532.4	9 507.7
Investment		80.0	65.7	83.2	134.7
Total		2 709.0	4 457.1	6 615.7	9 642.5
Indicators of expenditure structure					
Proportions accounted for by:					
Recurrent expenditure	0.92	0.95	0.96	0.97	0.97
Investment expenditure	7.31	4.98	3.33	2.48	2.07
Rates of growth in total expenditure (percentage)					
Recurrent		17.18	13.86	11.33	9.91
Investment		7.96	4.75	4.76	5.97
Total		16.60	13.48	11.13	9.82

a/ Local currency units.

Table 117. Expenditure aggregates, structure and rates of growth for the health sector: rural areas

Indicators	Year 0	5	10	15	20
Expenditure aggregates (thousands of LCUs) a/					
Levels of total expenditure					
Recurrent	671.1	860.9	1 091.8	1 523.7	1 915.0
Investment	14.0	16.5	44.2	80.8	35.5
Total	685.2	877.4	1 136.1	1 604.6	1 950.5
Growth in total expenditure					
Recurrent		189.7	230.9	431.8	391.3
Investment		2.4	27.7	36.6	-45.3
Total		192.1	258.7	468.4	345.9
Indicators of expenditure structure					
Proportions accounted for by:					
Recurrent expenditure	0.97	0.98	0.96	0.94	0.98
Investment expenditure	2.05	1.88	3.89	5.04	1.82
Rates of growth in total expenditure (percentage)					
Recurrent		5.10	4.86	6.89	4.67
Investment		3.24	21.77	12.81	-15.18
Total		5.06	5.30	7.14	3.98

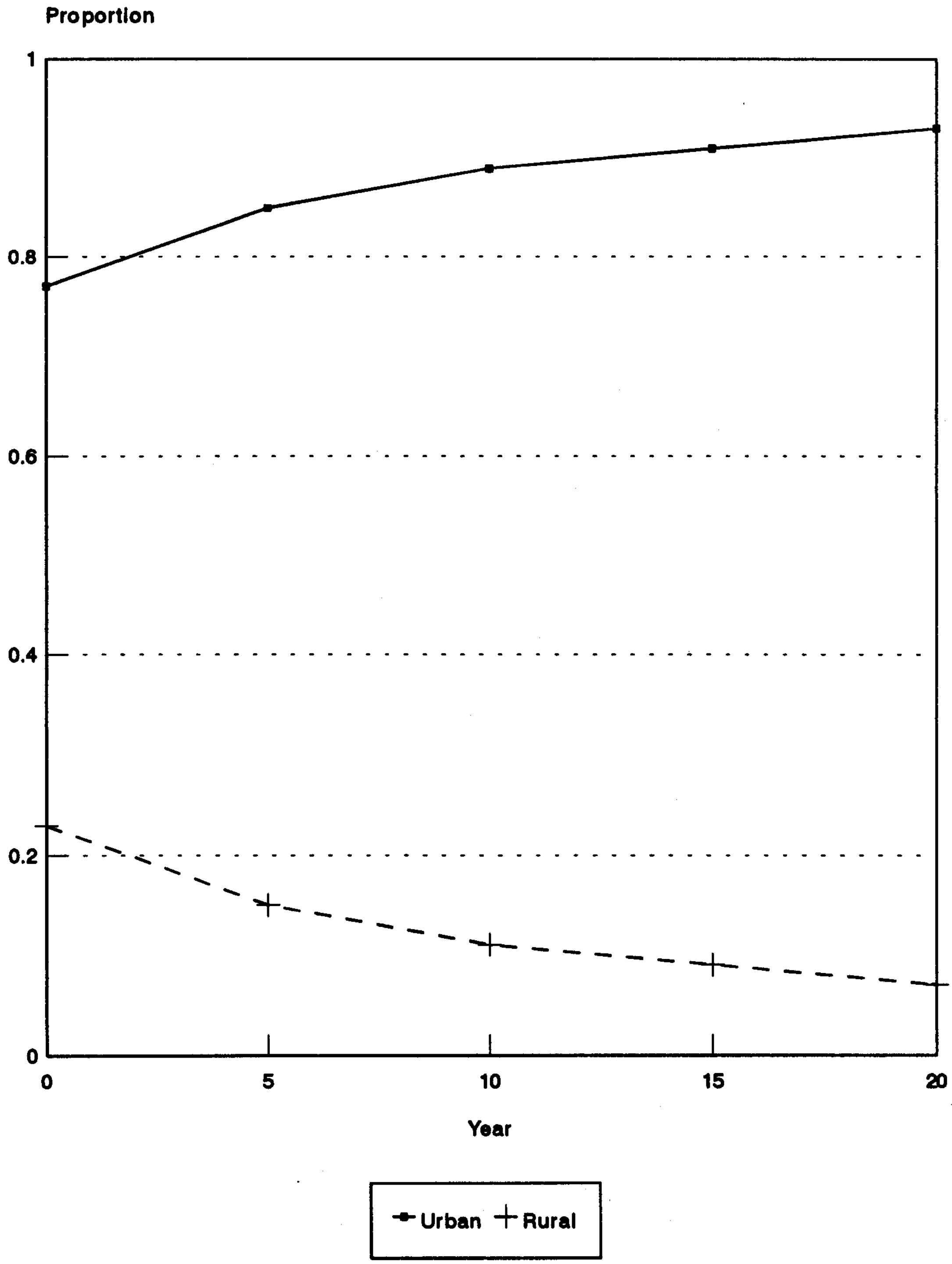
a/ Local currency units.

Table 118. Expenditure aggregates, structure and rates of growth for the health sector: entire country

Indicators	Year 0	5	10	15	20
Expenditure aggregates (thousands of LCUs) a/					
Levels of total expenditure					
Recurrent	2 844.4	5 663.1	10 285.5	17 249.9	27 148.9
Investment	185.6	268.2	361.7	481.6	571.0
Total	3 030.1	5 931.4	10 647.2	17 731.5	27 719.9
Growth in total expenditure					
Recurrent		2 818.7	4 622.3	6 964.3	9 899.0
Investment		82.5	93.4	119.8	89.4
Total		2 901.2	4 715.8	7 084.2	9 988.4
Indicators of expenditure structure					
Proportions accounted for by:					
Recurrent expenditure	0.93	0.95	0.96	0.97	0.97
Investment expenditure	6.12	4.52	3.39	2.71	2.05
Indicators of the distribution of total government expenditure					
Proportion of total government expenditure					
Urban	0.77	0.85	0.89	0.90	0.92
Rural	0.22	0.14	0.10	9.04	7.03
Rates of growth in total expenditure (percentage)					
Recurrent		14.76	12.67	10.89	9.49
Investment		7.63	6.16	5.89	3.46
Total		14.37	12.41	10.73	9.34

a/ Local currency units.

Figure XXXIX. Proportions of total government expenditure in the health sector: urban and rural



3. Urban projection for the housing sector

This example will illustrate the use of this general method to prepare a projection of government consumption and investment in the housing sector. The example, which assumes that the Government provides housing services only to selected urban households, is based on the inputs shown in table 119. The discussion of the example will focus on the projection results rather than on the calculations to obtain them since the calculations are fully analogous to those discussed above.

Table 120 presents the projected numbers of service input units, changes in those numbers and numbers of service input units requiring replacement for the 20-year projection period. Projected operating expenditures and investment expenditures, by type of service input, for the entire period are indicated in table 121. The various other results -- expenditure aggregates, indicators of the structure of expenditure and rates of growth of expenditure aggregates are presented in table 122.

E. Summary

This chapter has described a method for making projections of government consumption and investment in the education, health and housing sectors. The method can project different types of expenditures incurred by the Government in providing the relevant services, which are the total recurrent and total investment expenditures, as well as the total government expenditure for a given sector (or subsector). Procedures have been described that can be used to prepare projections at the national and urban-rural levels. Also, the types of inputs required by the method have been described and the preparation of the inputs was discussed. Lastly, three examples of projections have been described, one for each of the three sectors. A complete listing of the outputs that can be generated by the method is presented in box 33.

Table 119. Inputs for projecting government consumption and investment for the housing sector: urban areas

Variable	Year 0	5	10	15	20
Total number of households to receive public housing services (thousands)	144.45	268.52	354.24	574.00	732.30
Service input rates					
Serviced lots	300.0	290.0	280.0	270.0	260.0
"Progressive" housing	280.0	270.0	260.0	250.0	240.0
Basic housing	250.0	260.0	270.0	280.0	290.0
Economic housing	170.0	180.0	190.0	200.0	210.0
Attrition rates					
Serviced lots	80.0	80.0	80.0	80.0	80.0
"Progressive" housing	70.0	70.0	70.0	70.0	70.0
Basic housing	40.0	40.0	40.0	40.0	40.0
Economic housing	40.0	40.0	40.0	40.0	40.0
Unit operating expenditures (LCUs) a/					
Serviced lots	0.0	0.0	0.0	0.0	0.0
"Progressive" housing	0.0	0.0	0.0	0.0	0.0
Basic housing	0.2	0.2	0.2	0.2	0.2
Economic housing	0.3	0.3	0.3	0.3	0.3
Unit investment expenditures (LCUs) a/					
Serviced lots	50.0	55.2	60.9	67.3	74.3
"Progressive" housing	75.0	82.8	91.4	100.9	111.4
Basic housing	130.0	150.7	174.7	202.5	234.8
Economic housing	200.0	231.9	268.8	311.6	361.2
Ratios of administrative to operating expenditure	0.05	0.05	0.05	0.05	0.05

a/ Local currency units.

Table 120. Projected numbers of service input units, changes in those numbers numbers and numbers of units requiring replacement for the housing sector: urban areas

(Thousands)

Variable	Year				
	0	5	10	15	20
Number of service input units					
Serviced lots	144.45	194.67	247.96	309.96	380.79
"Progressive" housing	134.82	181.25	230.25	287.00	351.50
Basic housing	120.37	174.53	239.11	321.44	424.73
Economic housing	81.85	120.83	168.26	229.60	307.56
Changes in numbers of service input units					
Serviced lots	8.62	10.49	11.52	13.28	15.67
"Progressive" housing	7.98	9.67	10.57	12.13	14.25
Basic housing	8.94	11.94	14.59	18.45	23.67
Economic housing	6.37	8.68	10.79	13.83	17.98
Numbers of service input units requiring replacement					
Serviced lots	11.55	15.57	19.83	24.79	30.46
"Progressive" housing	9.43	12.68	16.11	20.09	24.60
Basic housing	4.81	6.98	9.56	12.85	16.98
Economic housing	3.27	4.83	6.73	9.18	12.30

Table 121. Projected operating and investment expenditures for the housing sector: urban areas

(Thousands of LCUs) a/

	Year				
	0	5	10	15	20
Operating expenditures					
Serviced lots	0.0	0.0	0.0	0.0	0.0
"Progressive" housing	0.0	0.0	0.0	0.0	0.0
Basic housing	24.0	34.9	47.8	64.2	84.9
Economic housing	24.5	36.2	50.4	68.8	92.2
Investment expenditures					
Serviced lots	1 008.9	1 438.8	1 909.8	2 562.9	3 428.1
"Progressive" housing	1 306.3	1 851.6	2 439.5	3 251.1	4 328.8
Basic housing	1 789.0	2 852.5	4 219.8	6 340.6	9 547.6
Economic housing	1 930.3	3 134.5	4 710.0	7 173.5	10 940.2

a/ Local currency units.

Table 122. Expenditure aggregates, structure and rates of growth for the housing sector: urban areas

Indicators	Year 0	5	10	15	20
Expenditure aggregates (thousands of LCUs) a/					
Levels of total expenditure					
Recurrent	51.0	74.7	103.2	139.8	186.0
Investment	6 034.6	9 277.6	13 279.3	19328.3	28 245.0
Total	6 085.7	9 352.3	13 382.5	19468.1	28 431.1
Growth in total expenditure					
Recurrent		23.6	28.5	36.6	46.2
Investment		3 242.9	4 001.7	6 048.9	8 916.6
Total		3 266.6	4 030.2	6 085.5	8 962.9
Indicators of expenditure structure					
Proportions accounted for by					
Recurrent expenditure	8.39	7.98	7.71	7.18	6.54
Investment expenditure	0.99	0.99	0.99	0.99	0.99
Rates of growth in total expenditure (percentage)					
Recurrent		7.90	6.67	6.25	5.88
Investment		8.98	7.43	7.79	7.88
Total		8.97	7.42	7.78	7.86

a/ Local currency units.

Box 33

Outputs of a method for projecting government consumption and investment

1. <u>Numbers of service inputs unit, changes in those numbers and numbers of units requiring replacement, by type of serviceinput</u> (national or urban, rural and national)

2. <u>Operating expenditures and investment expenditures, by type of service input</u> (national or urban, rural and national)

3. <u>Expenditure aggregates</u> (national or urban, rural and national)

   Levels of total expenditures

   Recurrent
   Investment

   Total

   Growth in total expenditures

   Recurrent
   Investment

   Total

4. <u>Indicators of the structure of expenditures</u> (national or urban, rural and national)

   Proportions of total government expenditure accounted for by

   Recurrent expenditure
   Investment expenditure

5. <u>Indicators of the urban-rural distribution of total government expenditure</u> (national only; if government consumption and investment are being projected at the urban-rural level)

   Proportions of total government expenditure that are

   Urban
   Rural

6. <u>Rates of growth of total expenditures</u> (national or urban, rural and national)

   Recurrent
   Investment

   Total

F. Notation and equations

1. Indices, variables and special symbols

(a) List of indices

j = 1,...,J	are various types of service inputs
k = 1,2	are urban and rural locations
t	is the year of the projection period

(b) List of variables

AEX(t+5)	is the total administrative expenditure at the end of the interval
ART(j,t+5)	is the attrition rate for service input j at the end of the interval
CNSIU(j,t+5)	is the change in the number of units of service input j for the end of the interval
EGREX	is the average annual exponential growth rate of the total government expenditure for the interval
EGRIEX	is the average annual exponential growth rate of the total investment expenditure for the interval
EGRREX	is the average annual exponential growth rate of the total recurrent expenditure for the interval
EX(k,t+5)	is the total government expenditure in location k at the end of the interval
EX(t+5)	is the total government expenditure for the sector (or subsector) for the end of the interval
EXGR	is the growth in the total government expenditure during the interval
GGREX	is the average annual geometric growth rate of the total government expenditure for the interval
GGRIEX	is the average annual geometric growth rate of the total investment expenditure for the interval
GGRREX	is the average annual geometric growth rate of the total recurrent expenditure for the interval

IEX(j,t+5)	is the level of gross investment expenditure for service input j at the end of the interval
IEX(t+5)	is the total investment expenditure at the end of the interval
IEXGR	is the growth in the total investment expenditure during the interval
NSIU(j,k,t+5)	is the number of service input units of type j in location k at the end of the interval
NSIU(j,t+5)	is the number of service input units of type j at the end of the interval
NUS(k,t+5)	is the number of users in location k at the end of the interval
NUS(t+5)	is the number of users at the end of the interval
OEX(j,t+5)	is the level of operating expenditure for service input j at the end of the interval
OEX(t+5)	is the total operating expenditure at the end of the interval
PIEX(t+5)	is the proportion of the total government expenditure devoted to investment expenditure at the end of the interval
PREX(t+5)	is the proportion of the total government expenditure devoted to recurrent expenditure at the end of the interval
PREXRUR(t+5)	is the proportion of the total government expenditure that is rural at the end of the interval
PREXURB(t+5)	is the proportion of the total government expenditure that is urban at the end of the interval
RAOE(t+5)	is the ratio of administrative to operating recurrent expenditure at the end of the interval
REX(t+5)	is the total recurrent expenditure for the end of the interval
REXGR	is the growth in the total recurrent expenditure during the interval

RNSIU(j,t+5)	is the number of service input units of type j requiring replacement at the end of the interval
SIRT(j,k,t+5)	is the service input rate for service input j in location k at the end of the interval
SIRT(j,t+5)	is the service input rate for service input j at the end of the interval
UIEX(j,t+5)	is the unit investment expenditure for service input j at the end of the interval
UOEX(j,t+5)	is the unit operating expenditure for service input j at the end of the interval

(c) List of special symbols

e	is the base of the natural logarithm
J	is the number of different types of service inputs
ln	is the natural logarithm
T	is the terminal year of the projection

2. Equations

National level

(a) Research expenditures

(i) Operating expenditures

Numbers of service input units, by type of input

$$NSIU(j,t+5) = [\ NUS(t+5) \cdot SIRT(j,t+5)\ ] \ / \ 1{,}000; \qquad (1)$$

$$j = 1,\ldots,J$$

Levels of operating expenditure, by type of service input

$$OEX(j,t+5) = NSIU(j,t+5) \cdot UOEX(j,t+5); \qquad (2)$$

$$j = 1,\ldots,J$$

Total operating expenditure

$$OEX(t+5) = \sum_{j=1}^{J} OEX(j,t+5); \qquad (3)$$

(ii) Total administrative expenditure

$$AEX(t+5) = OEX(t+5) \cdot RAOE(t+5); \qquad (4)$$

(iii) Total recurrent expenditure

$$REX(t+5) = OEX(t+5) + AEX(t+5); \qquad (5)$$

(b) Investment expenditures

(i) Change in the numbers of service input units, by type of input geometric growth

$$CNSIU(j,t+5) = NSIU(j,t+5) \cdot \left[\left(NSIU(j,t+10)/NSIU(j,t+5) \right)^{1/10} - \left(NSIU(j,t+5)/NSIU(j,t) \right)^{-1/10} \right]; \quad j = 1,\ldots.J \qquad (6)$$

$$CNSIU(j,0) = NSIU(j,0) \cdot \left[\left(NSIU(j,5)/NSIU(j,0) \right)^{1/10} - \left(NSIU(j,5)/NSIU(j,0) \right)^{-1/10} \right]; \quad j = 1,\ldots,J \qquad (7)$$

$$CNSIU(j,T) = NSIU(j,T) \cdot \left[\left(NSIU(j,T)/NSIU(j,t+5) \right)^{1/10} - \left(NSIU(j,T)/NSIU(j,t+5) \right)^{-1/10)} \right]; \quad j = 1,\ldots,J \qquad (8)$$

Exponential growth

$$\mathrm{CNSIU}(j,t+5) = \mathrm{NSIU}(j,t+5) \cdot \left[e^{(1/10) \cdot \ln(\,\mathrm{NSIU}(j,t+10)/\mathrm{NSIU}(j,t+5)\,)} - e^{(-1/10) \cdot \ln(\,\mathrm{NSIU}(j,t+5)/\mathrm{NSIU}(j,t)\,)} \right]; \quad j = 1,\ldots,J \tag{9}$$

$$\mathrm{CNSIU}(j,0) = \mathrm{NSIU}(j,0) \cdot \left[e^{(1/10) \cdot \ln(\,\mathrm{NSIU}(j,5)/\mathrm{NSIU}(j,0)\,)} - e^{(-1/10) \cdot \ln(\mathrm{NSIU}(j,5)/\mathrm{NSIU}(j,0)\,)} \right]; \quad j = 1,\ldots,J \tag{10}$$

$$\mathrm{CNSIU}(j,T) = \mathrm{NSIU}(j,T) \cdot \left[e^{(1/10) \cdot \ln(\,\mathrm{NSIU}(j,T))/\mathrm{NSIU}(j,t+5)\,)} - e^{(-1/10) \cdot \ln(\,\mathrm{NSIU}(j,T)/\mathrm{NSIU}(j,t+5)\,)} \right]; \quad j = 1,\ldots,J \tag{11}$$

(ii) Numbers of service input units requiring replacement, by type of input

$$\mathrm{RNSIU}(j,t+5) = [\ \mathrm{NSIU}(j,t+5)/1{,}000 \cdot \mathrm{ART}(j,t+5)\ ]; \quad j = 1,\ldots,J \tag{12}$$

(iii) Levels of investment expenditure, by type of service input

$$\mathrm{IEX}(j,t+5) = [\ \mathrm{CNSIU}(j,t+5) + \mathrm{RNSIU}(j,t+5)\ ] \cdot \mathrm{UIEX}(j,t+5); \quad j = 1,\ldots,J \tag{13}$$

(iv) Total investment expenditure

$$\mathrm{IEX}(t+5) = \sum_{j=1}^{J} \mathrm{IEX}(j,t+5); \tag{14}$$

(c) Other results

(i) Expenditure aggregates

Total government expenditure

$$EX(t+5) = REX(t+5) + IEX(t+5); \qquad (15)$$

(ii) Growth in expenditures

Total recurrent expenditures

$$REXGR = REX(t+5) - REX(t); \qquad (16)$$

Total investment expenditures

$$IEXGR = IEX(t+5) - IEX(t); \qquad (17)$$

Total government expenditure

$$EXGR = EX(t+5) - EX(t); \qquad (18)$$

(iii) Indicators of the structure of expenditure

$$PREX(t+5) = REX(t+5) / EX(t+5); \qquad (19)$$

$$PIEX(t+5) = 1 - PREX(t+5); \qquad (20)$$

(iv) Rates of growth of expenditures

Rates of growth of total recurrent and total investment expenditures

Geometric growth rates

$$GGRREX = [\ (\ REX(t+5)/REX(t)\ )^{1/5} - 1\ ] \cdot 100; \qquad (21)$$

$$GGRIEX = [\ (\ IEX(t+5)/IEX(t)\ )^{1/5} - 1\ ] \cdot 100; \qquad (22)$$

Exponential growth rates

$$EGRREX = [\ (\ \ln\ (\ REX(t+5)/REX(t)\ )\ )\ /\ 5\ ] \cdot 100; \qquad (23)$$

$$EGRIEX = [\ (\ \ln\ (\ IEX(t+5)/IEX(t)\ )\ )\ /\ 5\ ] \cdot 100; \qquad (24)$$

Rates of growth of total government expenditure

Geometric growth rate

$$GGREX = [\ (\ EX(t+5)/EX(t)\ )^{1/5} - 1\ ] \cdot 100\ ; \qquad (25)$$

Exponential growth rate

$$EGREX = [\ (\ \ln\ (\ EX(t+5)/EX(t)\ )\ )\ /\ 5\ ] \cdot 100; \qquad (26)$$

Urban-rural level

(a) Recurrent expenditures

Operating expenditures

Numbers of service input units, by type of input

NSIU(j,k,t+5) = [NUS(k,t+5) · SIRT(j,k,t+5)] / 1,000; (27)

j = 1,...,J;

k = 1,2

(b) Investment expenditures

(c) Other results

(i) Proportion urban

PREXURB(t+5) = EX(1,t+5) / EX(t+5); (28)

(ii) Proportion rural

PREXRUR(t+5) = 1 - PREXURB(t+5); (29)

Notes

1/ Examples of such computer-based techniques are described in United States (1972), Bilsborrow (1984) and Goliker (1984).

2/ This is mathematically equivalent to REX(t+5) = OEX(t+5) · (1 + RAOE(t+5)).

3/ Implicit in this equation is a simplifying assumption that investment expenditures associated with adding new or replacing existing service input units are incurred fully in the year when the new units are added or the existing units replaced. This equation can be modified by adding additional terms utilizing values of the variables for previous periods in situations where expenditures incurred in order to add new or replace existing units are spread over several years. The equation could take the following form IEX(j,t+5) = [CNSIU(j,t+i) + RNSIU(j,t+i)]. UIEX(t+i).

4/ Since the projected numbers of service input units are expressed in thousands of respective units and because unit operating expenditures are given in local currency units, the projected operating expenditures are expressed in thousands of local currency units.

5/ The changes in the numbers of service input units and the numbers of units requiring replacement are given in thousands of respective units. Unit investment expenditures are in local currency units. As a result, investment expenditures are expressed in thousands of local currency units.

Annex

DERIVATION OF THE FORMULAS TO COMPUTE CHANGES IN THE NUMBERS OF SERVICE INPUT UNITS, ASSUMING THAT GROWTH IN THOSE NUMBERS OCCURS OVER DISCRETE INTERVALS

To derive the formula indicated in equation (2) in the text, it is necessary to make the following assumptions for each type of service input j:

(a) The number of service input units for year t+5 refers to the middle of that year;

(b) The growth in the number of service input units during the interval t to t+5 occurs at an average annual geometric rate of growth applying to that interval;

(c) The growth in the number of service input units during the interval t+5 to t+10 occurs at an average annual geometric rate of growth applying to the interval.

Under those assumptions, change in the number of service input units in year t+5 can be calculated as a difference between the numbers of units at the end and the beginning of that year as follows:

$$\begin{aligned} CNSIU(j,t+5) = {} & NSIU(j,t+5) \cdot \\ & [\,1 + GGRNSIU(j,t+5 - t+10)/100\,]^{1/2} - \\ & NSIU(j,t+5) \cdot \\ & [\,1 + GGRNSIU(j,t - t+5)/100\,]^{-1/2} \end{aligned} \tag{1}$$

where:

CNSIU(j,t+5)	is the change in the number of units for type of service input j in year t+5,
NSIU(j,t+5)	is the number of service input units of type j in year t+5,
GGRNSIU (j,t+5 - t+10)	is the average annual geometric rate of growth of the number of service input units of type j for the interval t+5 to t+10, and
GGRNSIU (j,t - t+5)	is the percentage average annual geometric rate of growth of the number of service input units for type of service j for the interval t to t+5.

The first term on the right-hand side of equation (1), NSIU(j,t+5) • [1 + GGRNSIU(j,t+5 - t+10)/100 $]^{1/2}$, indicates the projected number of service input units for the end of the year t+5. The number is obtained by forward projecting the number of service input units over a one-and-a-half-year interval, from the middle till the end of year t+5, using the number of service input units that refer to the middle of the year and the average annual growth rate that refers to the interval t+5 to t+10.

The second term, NSIU(j,t+5) • [1 + GGRNSIU(j,t - t+5)/100 $]^{-1/2}$, shows the projected number of service input units for the beginning of year t+5. The number is obtained by backward projecting the number of service input units over a one-and-a-half-year interval, from the middle till the beginning of year t+5, using the number of service input units that refer to the middle of the year and the average annual growth rate that refers to the interval t to t+5.

Equation (1) can be rewritten by substituting formulas for calculating geometric growth rates for the rates themselves:

$$\begin{aligned} \mathrm{CNSIU}(j,t+5) = {} & \mathrm{NSIU}(j,t+5) \cdot \\ & [1 + (((\mathrm{NSIU}(j,t+10)/\mathrm{NSIU}(j,t+5))^{1/5} - 1) \cdot 100) / 100]^{1/2} - \\ & \mathrm{NSIU}(j,t+5) \cdot \\ & [1 + (((\mathrm{NSIU}(j,t+5)/\mathrm{NSIU}(j,t))^{1/5} - 1) \cdot 100) / 100]^{-1/2}, \end{aligned} \tag{2}$$

where:

NSIU(j,t)	is the number of service input units of type j in year t, and
NSIU(j,t+10)	is the number of service input units of type j in year t+10.

After rearranging equation (2), the following expression can be obtained:

$$\begin{aligned} \mathrm{CNSIU}(j,t+5) = {} & \mathrm{NSIU}(j,t+5) \cdot \\ & [(\mathrm{NSIU}(j,t+10)/\mathrm{NSIU}(j,t+5))^{1/5}]^{1/2} - \\ & \mathrm{NSIU}(j,t+5) \cdot \\ & [(\mathrm{NSIU}(j,t+5)/\mathrm{NSIU}(j,t))^{1/5}]^{-1/2} . \end{aligned} \tag{3}$$

Further rearrangement leads to the following expression:

$$\begin{aligned} \mathrm{CNSIU}(j,t+5) = {} & \mathrm{NSIU}(j,t+5) \cdot \\ & [(\mathrm{NSIU}(j,t+10)/\mathrm{NSIU}(j,t+5))^{1/10} - \\ & (\mathrm{NSIU}(j,t+5)/\mathrm{NSIU}(j,t))^{-1/10}], \end{aligned} \tag{4}$$

which is the formula for calculating the change in the number of service input units indicated in equation (2) in the text.

Formulas for computing changes in the numbers of service input units in years 0 and 20, which are based on the assumption that growth in those numbers occurs over discrete intervals (equations (3) and (4) in the text) can be obtained in a way analogous to that of deriving the formula obtained above in this box. However, an additional assumption is used in those derivations. In particular, in the case of the formula for year 0, it is assumed that the number of service input units five years before and five years after that year increases at an average annual geometric growth rate applying to interval 0-5. In the case of the formula for year 20, it is assumed that the number of service input units five years before and five years after that year increases at an average annual geometric growth rate applying to interval 15-20.

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Glossary

Administrative expenditure
A type of recurrent expenditure incurred to administer institutions that directly and indirectly participate in the delivery of services. For example, in the education sector, those institutions might include school and other education authorities, including the ministry of education. Such expenditures could include both labour and material costs.

Attrition rates
The number of units of a given service input lost during a year, per thousand units of that service input available in the year. Examples of attrition would be the loss of teachers through retirement or the loss of equipment through obsolescence.

Average household savings ratio
Proportion of disposable household income devoted to savings.

Average household size
The mean number of members per household.

Budget survey
A random example survey of households conducted in order to collect information on expenditures of households on various individual consumption goods and services or groups of those goods and services. Such a survey may also collect information on the size and characterization of households.

Capital income
Income in the form of profits, dividends and interest, accruing to physical capital and financial claims in return for services rendered by those forms of capital.

Cluster of households
A group of households in a sample survey selected from the same community or geographical area.

Coefficient of determination R^2
The measure of the goodness of fit of a regression equation, which denotes the proportion of the variance in the dependent variable associated with independent variable(s) included in the regression. The coefficient may lie between 0 and 1; when it is close to 0, it suggests a weak relationship, when it is close to 1, a strong one.

Comprehensive planning

A form of development planning, sometimes referred to as aggregative, global or overall planning, which covers most or all sectors of the economy. This planning, unlike sectoral planning, is concerned with a full range of variables, including aggregate output, household and government consumption, savings and investment, imports and exports, employment and incomes.

Corporate income taxes

Taxes levied on the profits of companies.

Demand systems

A set of functions explaining consumption behaviour alone, or consumption as well as savings behaviours of a group of households, which make a population group or the total population.

Disposable income

The income of a particular type of institution, such as households, corporations or government, after taxes or transfers, whichever is appropriate, which is available for consumption or savings.

Dividends

Payments to shareholders of a company, usually in the form of cash or shares.

Econometric models

Mathematical models expressing economic theories in terms of empirically estimated coefficients of model relationships. The model coefficients are obtained by applying statistical estimation methods to suitable data. The models may be used to forecast future values of selected model variables.

Economic-demographic model

A mathematical representation of key economic and demographic variables and their interrelationships. The model may be used to make projections of output, use of productive factors and components of final demand, as well as the components of population change, population size and the structure of the labour force.

Electronic spreadsheet program

A type of microcomputer software used in making spreadsheet type calculations electronically.

Endogenous

A variable is said to be endogenous with respect to a model if its value is determined within the model.

Exogenous

A variable is said to be exogenous with respect to a model if its value is determined outside the model.

Factor incomes
The income accruing to a particular factor of production in return for services rendered by that factor. Examples of factor incomes are capital income and labour income.

Factor prices
The prices of factors of production, which normally reflect their scarcity value (or competitive market prices) unless distorted by institutional arrangements.

Factors of production
Resources or inputs required to produce a good or service. Basic categories of factors of production are land, labour and capital.

Final goods and services
Goods and services that are consumed to satisfy wants rather than used as inputs into further stages of production.

Fiscal policy
Government taxation and expenditure policy designed to regulate the aggregate level of economic activity.

Functional distribution of income
The distribution of income to factors of production without regard to ownership of those factors.

General equilibrium model
A type of quantitative economic model that considers an economic system as a whole and involves the simultaneous determination of all prices and quantities of all goods and services in the system.

Government budget
An estimate of government revenues and expenditures for a future period, usually a year, as opposed to an account that records Government's financial transactions.

Government transfers to corporations
Payments made by the Government to corporations, which do not entail an exchange of goods and services.

Government transfers to households
Payments made by the Government to households, which do not form part of an exchange of goods and services. Examples of such payments are social security benefits or student grants.

Gross domestic product
The total monetary value of all final goods and services produced in an economy over a given period of time, typically one year, calculated at market or factor prices .

Household consumption
The value of "final" goods and services consumed by households over a specified time period.

Household disposable income
The income of a household, after taxes and/or transfers, which is available for consumption or savings.

Household income taxes
Taxes levied on the income accruing to members of households.

Household savings
The portion of household disposable income that is not spent on consumption over a specified time period.

Income and expenditure survey
A random sample survey of households carried out in order to gather data on household income and expenditures. Such a survey may provide income by services in addition to the total income of household, as well as information on household savings and on expenditures on different consumer goods and services. The survey may collect information on household size and characterization.

Income elasticity of savings
The responsiveness of the amount of money saved to changes in the consumer's income, measured by the proportionate change in savings divided by the proportionate change in income.

Indirect taxes
Taxes levied on goods and services purchased by consumers and exported by producers, for which the taxpayer's liability varies in proportion to the quantity of particular goods purchased or sold. Examples of indirect taxes are customs duties (tariffs), excise duties, sales taxes and export duties.

Inflation
A process of above-normal general price increase as reflected in, for example, the consumer and wholesale price indices. More generally, the phenomenon of rising prices.

Input-output table
A table indicating in matrix form the linkages existing among industries in an economy. Each row of the input-output matrix indicates the way in which the output of the industry is used to satisfy final demand or as inputs to other industries. Each column of the matrix shows the origins of the inputs used by the given industry, including those of factors of production (e.g., labour).

Institutional distribution of income

The distribution of income to different types of institutions, such as households, corporations and government, which is influenced, among other things, by the ownership of the factors of production by the institutions.

Intermediate goods and services

Goods and services used as inputs into further stages of production, an example of which is leather in shoe manufacturing.

Investment expenditures

Expenditure on real fixed assets and human capital. It includes the cost of building schools or hospitals when these assets require expansion or replacement. Also, it includes expenditure incurred in training personnel, such as teachers and medical doctors, required to increase their numbers or replace them.

Labour income

Income, primarily in the form of wages and salaries, accruing to labour in return for services rendered by it.

Marginal propensity to consume

For a given time period, the change in the value of household consumption, divided by the change in the disposable household income.

Market prices

The amounts of money or money equivalents needed to be given up in order to obtain goods and services through exchange.

National accounts

A system of accounts that provides for a systematic and integrated recording of transaction flows in an economy. It brings into a coherent system data ranging in degree of aggregation from consolidated accounts of the nation to detailed input-output and flow-of-funds tables. They include production and goods and service accounts, along with outlay and capital finance accounts for institutions, such as households and government.

Net foreign investment

Total income from abroad less (minus) the sum of all exports of goods and services.

Net foreign transfers to households

The difference between the amounts of income that households received from and pay to the various institutions abroad. The receipts and payments may be in connection with the remuneration of the factors of production and/or transactions involving no exchange of goods and services.

Operating expenditure

A type of recurrent expenditure directly incurred in the production of services; for example, teacher salaries and the costs of maintaining classrooms.

Partial coefficient

A coefficient in a function seeking to explain variations in a given variable (dependent variable) in terms of variations in other relevant variables (independent variables). The coefficient measures partial or ceteris paribus effect of any given independent variable on the dependent variable.

Profits

Income accruing to capital in return for services rendered by it. It can be computed as the difference between the market value of output and the market value of inputs which were employed to produce that output.

Proxy (variable)

A variable used in regression analysis to represent a theoretically more satisfactory variable in cases where either data are not available on the latter or the latter is unobservable (e.g., "desired" level of consumption).

Random disturbance term

The term added to a regression equation which ensures equality between the left- and the right-hand side of the equation for each observation. The disturbance or error term may represent random disturbances in an observation or it may reflect errors of measurement.

Recurrent expenditures

Expenditure on goods and services consumed during production, which is incurred continuously. This would include both administrative and operating expenditures.

Relative price

A price of a commodity which is expressed in terms of the quantity of some other commodity which has to be given up. Thus, if all prices were to increase at the same rate, absolute prices would rise but relative prices would remain unchanged.

Rent

Income accruing to a durable good, such as land or buildings, in return for services rendered by the good.

Service input rates

The average number of units of a given service input available during a year per thousand users of services rendered by that input in the year.

Service input unit

A unit of a given service input, such as teacher, classroom or medical doctor, used in producing services in a given sector.

Social accounting matrix

The tabular presentation of the income and product flows in an economy during a specified time period. It consists of a set of accounts, such as those for factors of production (labour and capital) or institutions (households, corporations and government), along with the economy's input-output table.

Statistically significant

An estimate of a particular statistic, such as a partial regression coefficient, is said to be statistically significant if the probability that it could have occurred by chance is less than a specified percentage (often 5 per cent).

Subsidies

A special type of transfer payment to a corporation to prevent it from experiencing losses or to prevent an increase in its price.

t-statistic

In regression analysis, a statistic calculated for each partial coefficient, which makes it possible for the analyst to determine whether or not the coefficient is statistically significant.

Unit investment expenditures

Expenditures incurred in adding a new unit of a given service input or replacing an existing unit. In the case of personnel, it would include the cost of training a person. In the case of facilities, it would include the cost of installing a unit of facility.

Unit operating expenditures

Expenditures incurred in a year in order to secure services associated with a unit of a given service input, such as teacher or medical doctor, or classroom or hospital bed.

Value added

For a firm or farm, the difference between its total revenue and the cost of raw materials, services and components used in production, over a specified time period. For the economy as a whole or any of its industries, the aggregate of value added of different firms or farms of which the economy or industry is composed.

Wage freeze

The fixing of wages at their existing level for a specified or indefinite period.

Wages

Income accruing to labour in return for services rendered by it.

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