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MODELLING POVERTY REDUCTION

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This publication series has been launched in response to the requests Debt Relief International (DRI) has received for information on the activities of the Heavily Indebted Poor Countries Debt Strategy and Analysis Capacity Building Programme (HIPC CBP) and on the technical aspects of public debt management and negotiations needed to develop and implement national debt and new financing strategies. The aim of the HIPC CBP, funded by seven OECD governments (Austria, Canada, Denmark, Ireland, Sweden, Switzerland and the United Kingdom), is to build and strengthen the capacity of HIPC governments to develop and implement their own national debt relief strategy, and a new financing policy consistent with long-term debt sustainability and development financing (poverty reduction), without having to rely on international assistance. DRI is the HIPC CBP's not-for-profit technical office and the programme is implemented with four regional organisations: BCEAO/BEAC Pôle-Dette for Francophone Africa especially franc zone members States, CEMLA for Latin America, MEFMI for Eastern and Southern Africa, and WAIFEM for Anglophone West Africa.

This series is targeted mainly at senior officials and policymakers in HIPC countries. It will also be useful for officials of regional African, Asian and Latin American organisations, NGOs and academics in developing and developed countries.

The aim of the series is to present particular topics in a concise, accessible and practical way for use and implementation by HIPC governments. The series should enable senior officials and policymakers to focus on some of the key issues relating to long-term external and domestic debt sustainability, external new financing, macroeconomic forecasting and its interrelation with poverty reduction and development financing in HIPCs. Each publication is intended to be reasonably self-contained.

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ABBREVIATIONS AND ACRONYMS

123PRSP	123 PRSP Model
AERC	African Economic Research Consortium
BCEAO	Central Bank of West African States
BEAC	Bank of Central African States
CEMLA	Centre for Latin American Monetary Studies
CES	Constant elasticity of substitution
CFD	Caisse française de développement (replaced by Agence française de développement, Afd)
CGE	Computable General Equilibrium
CGEM	Computable General Equilibrium Model
CRÉA	Centre de recherches économiques appliqués (Applied Economic Research Centre, University of Dakar, Senegal)
DRI	Debt Relief International
ECAM	Enquête budget de consommation des ménages (Household Consumption Survey, Senegal)
EPD	Economic Policy Division (Ministry of Economy and Finance, Senegal)
EPEP	Economic Policy Empowerment Programme (Eurodad)
ESAM	Enquête sénégalaise auprès des ménages (Senegalese Household Survey)
ESCAP	Economic and Social Commission for Asia and the Pacific (UN)
EURODAD	European Network on Debt and Development
FGT	Foster, Greer and Thorbecke Indexes
FP	Financial Programming
FSD	Forecasting and Statistics Department (Ministry of Economy and Finance, Senegal)
GDP	Gross Domestic Product
HIPC	Heavily Indebted Poor Country
HIPC CBP	HIPC Debt Strategy and Analysis Capacity Building Programme
ICOR	Incremental Capital-Output Ratio
IDRC	International Development Research Centre (Canada)
IFPRI	International Food Policy Research Institute

IMF	International Monetary Fund
IMMPA	Integrated macroeconomic model for poverty analysis
IOT	Input-Output Table
IS-LM	Investments and Savings/Liquidity and Money Supply
MDG	Millennium Development Goals
MIMAP	Micro Impacts of Macroeconomic and Adjustment Policies (IDRC, Canada)
MRS	Marginal Rate of Substitution
MTEF	Medium-term expenditure framework
PAMS	Poverty analysis macroeconomic simulator
PDM	Pôle-Dette Model
Pôle-Dette	BCEAO/BEAC Regional Debt Management Training Unit for Central and Western Africa
PRESTO	See glossary
PRGF	Poverty Reduction and Growth Facility
PRSP	Poverty Reduction Strategy Paper
RMSM	Revised Minimum Standard Model (World Bank)
RMSM-X	Revised Minimum Standard Model Extended (World Bank)
RMSM-X + P	Revised Minimum Standard Model Extended plus Poverty (World Bank)
RMSM-X + LP	Revised Minimum Standard Model Extended plus Labour and Poverty (World Bank)
SAM	Social Accounting Matrix
SimSIP	SSimulations for Social Indicators and Poverty (World Bank)
TABLO	See glossary
TOFE	Government Flow-of-Fund Table
UCAD	Cheikh Anta Diop University (Dakar, Senegal)
UNDP	United Nations Development Programme
VAT	Value-Added Tax

1. INTRODUCTION¹

1.1 CONTEXT

The key items for a national strategy for financing development, as it was elaborated in the Heavily Indebted Poor Countries debt strategy and analysis capacity building programme (HIPC CPB), are as follows. On the one hand, the prospects of decreasing the existing debt and implementing new external and domestic financing; and, on the other hand, the financing needs which stem from macroeconomic as well as poverty reduction forecasts.

These needs are preferably calculated using modelling techniques. However, most macroeconomic models used up until now in the poorest countries have not taken account of poverty reduction, even though there have been models appropriate to this goal for a long time.

In 2000, the international community agreed that the Millennium Development Goals (MDGs), and more specifically those relating to poverty reduction, are the fundamental basis of any development policy, and introduced the IMF's Poverty Reduction and Growth Facility (PRGF), which requires each government to elaborate formal poverty reduction strategies. In response to the greater focus on the formal link between macroeconomic policy and poverty reduction, the question of how to model poverty reduction in a macroeconomic framework is all the more pertinent, and an increasing effort has been made to build and perfect models seeking to attain this goal. Today, the main problem is that the poorest countries have too broad a choice in terms of models. The goal of this document is to evaluate these models and help these countries establish criteria for choosing an appropriate model for poverty reduction forecasting, which is suited to their national requirements and therefore to elaborating a national development financing strategy.

1.2 MODELLING GOALS

The elaboration of an adequate strategy for fighting against poverty, and therefore modelling goals, must take into account the specific situation in each country. However, several universal principles can be defined. The models must:

- enable the changes in poverty to be measured according to as many definitions of poverty as possible;
- help identify and analyse the deciding factors of this change, especially those that are subject to the impact of actions relating to governmental policy;
- establish links between stabilisation, growth and poverty reduction;
- be credible as tools for discussion between partners in the elaboration of a national poverty reduction strategy, in which the civil society and the international financial community participate;

¹ The first version of this document was presented at the 5th *Senior Policy Seminar* organised in Dar-es-Salaam in February 2002 by the African Economic Research Consortium (AERC). I am indebted to Matthew Martin, Director of Debt Relief International (DRI), to the experts of the AERC (Nairobi) – in particular Njuguna N'dungu – and the colleagues in charge of defining poverty reduction strategies in the countries that are members of the CFA Franc Zone for their precious observations and their great help in finalising this document. In addition, I benefited from fruitful discussion with Mbaye Faye – Senior Manager of the National Accounting Office in the Forecasting and Statistics Department of the Ministry of Economy and Finance in Senegal – who is also a member of the IMMPA and 123 teams in Senegal. Nonetheless, I take full responsibility for the points of view expressed in this document.

- be appropriate and adapted to the circumstances and characteristics of each country;
- be simple enough to use the data and capacities available at the national level (or be accompanied by a significant effort in data and capacity building).

In this way, the modelling must provide a key instrument for elaborating a national poverty reduction strategy, helping to formulate a policy, to study the implications of alternative strategies, and to establish effective dialogue between the partners in order to draw up a financing plan. In addition, better forecasting can help in assessing the relevance of the policies being considered so as to relieve the local populations affected, evaluate alternative solutions enabling better decisions be made to help them escape from poverty, and therefore contribute to economic viability and social balance.

2. LESSONS FROM THE LITERATURE ON MODELLING

This chapter attempts to identify the lessons that can be drawn from the significant body of literature on poverty reduction in order to model this phenomenon. The following three aspects are emphasized: the definitions of poverty, the causes of poverty, and the relationship between growth and poverty. In particular, we attempt to identify key factors and principles that must be modelled, without judging as to what their results might be. There are ongoing discussions in the literature, sometimes with differing results for each country. Each factor and/or principle must be tested, preferably at the national level, before being included in any model.

2.1 LESSON CONCERNING THE DEFINITIONS OF POVERTY

Poverty is a multi-dimensional phenomenon, which manifests itself both through insufficient resources and in terms of precariousness and social exclusion. The priority indicators making it possible to monitor the phenomenon as well as those that determine it must be designated before the models are defined in order better to analyze and target actions. There are several definitions for designating them. In particular, there are approaches based on the well-being and income, living conditions and basic needs, and capacities and potentials of individuals.²

Measuring the incidence, depth and severity of poverty requires identifying who the poor people are and developing pertinent indicators of their poverty. In practice, two approaches are used: one is said to be 'objective' and the other 'subjective'.

2.1.1 'Objective' Approaches

'Objective' approaches are based on quantitative information that can be summarized using monetary or non-monetary indicators.

For each of the three approaches, i.e., well-being, basic needs and capacities, the key indicators are as follows:

- *Well-being/income*: an individual is poor if he or she does not have enough income in absolute or relative terms. There are a great many indicators of monetary poverty, according to which poverty is defined as a threshold below which the household (or individual) is considered to be poor. For example, for the MDGs, the indicator of

² This categorisation comes from studies by the United Nations – in particular the UNDP's Human Development Report – and by Bourguignon and Chakravarty (2003).

absolute poverty is the income that ensures minimum requirements in terms of food and non-food items.³ However, there are also extreme poverty lines (income which ensures minimum nutrition), relative poverty lines, such as the Gini Index,⁴ and indicators of the depth and severity of poverty, such as the FGT Index.⁵

- *Living conditions/basic needs*: an individual is poor if he or she has no access to basic services. The essential basic services normally defined as such are health, education, drinking water, sanitation, decent housing, and basic energy and transportation services. There are several key indicators for each sector and they can vary from one country to another.⁶
- *Capacities/potentials*: poverty is the result of not fulfilling individual potential, and is linked to the impossibility of having access to certain facilities or an influence on the governance and the society. The facilities that are essential for realizing an individual's potential have been identified as: financial intermediation (savings and credit), land ownership, access to markets, training and employment. The individual's influence depends on the how democratic centralised and decentralised governments are, the transparency of the economic governance, the fight against corruption, the degree to which the poor participate in social networks (and how well this is organised), and their participation in the elaboration and execution of national strategies for fighting against poverty.

2.1.2 The 'Subjective' Approach

The 'subjective' approach is based on the qualitative perception of local populations concerning their living conditions. When asked, local populations designate themselves as poor or not poor according to criteria that are specific to themselves. To that effect, a proverb stated during the participative process for elaborating the Poverty Reduction Strategy Paper (PRSP) in Senegal defines poverty as '**having nothing, knowing nothing and having no power**' (Fall, 2001). This approach examines the representations, culture and real life of local populations. It seeks to limit the concrete content of poverty using notions such as well-being, the priorities of poor people, risk, security and vulnerability, social exclusion, social cohesion and conflict. Thus, as noted by Sawadogo *et al* (1995):

'Culture conditions the various perceptions individuals have of a situation that is apparently objective. This results in the fact that each social body and each culture can have a conception of poverty that requires different actions for eradicating it.'

The perception of poverty is relative and must be related to the social practices, cultures, representations, ways of thinking, and forms of sociability. Therefore, there are as many different perceptions as there are socio-cultural entities, categories of actors, and eras.

³ The definition of this indicator varies a great deal according to the country. For example, the minimum nutritional needs vary between 2,300 and 3,000 calories, the method used to calculate the non-food needs is sometimes the result of a survey, but is sometimes calculated according to an international standard of 50% of the value of nutritional needs. These differences deserve a great deal more investigation in order to establish more coherent standards. For a more in-depth discussion on poverty indicators, see Kakwani, 2002; Lanjouw, 1998; Ravallion, 1992.

⁴ The Gini Index helps show inequalities in income (Atkinson, 1970; Cowell, 2000).

⁵ The FGT Indexes (based on the study by Foster, Greer and Thorbecke, 1994) measure the incidence, the depth and the severity of poverty.

⁶ For a partial list of the indicators considered to be the most important by the international community, see <http://www.developmentgoals.org>.

However, the results of surveys having to do with perceptions generally identify very few indicators, which are not covered by the three 'objective' approaches analysed above. Their importance is rather in the identification of priority indicators for the poor themselves, and therefore in a modification in the hierarchy of priority actions for fighting against poverty.

The 'subjective' approach reveals the primordial importance of actions that reinforce the potential of poor people, especially the recourse to social networks (family, brotherhood and ethnic relations) for resisting poverty. Social links are the foundations for making individuals feel secure. The consultations carried out within the framework of the elaboration of the PRSP in Senegal underscored that: *'Being poor means not having any relational capital'*. This quality seems as decisive as monetary reasoning or the 'objective' indicators.

2.1.3 What Can We Conclude?

In any case, we must select a combination of criteria that are both monetary and non-monetary, quantitative and qualitative, objective and subjective, which make it possible to define poverty according to the situation of each country. The results of the surveys made among households and the participative surveys represent therefore important additional sources for understanding poverty and to be fed into the models. Preferably, all the criteria identified by these surveys should be integrated into the construction of the model. If this is not possible, the model must be flexible enough to adapt to the results from the surveys and to integrate the most important elements from the three definitions of poverty.

2.2 LESSONS FROM THE DETERMINERS OF POVERTY

This step consists in retaining the indicators of the determiners of poverty and introducing them into the modelling exercises. The empirical literature considers there to be a wide variety of variables likely to have an effect on poverty reduction. The number and nature of the variables to be used should depend on their influence on poverty in the country concerned and the availability of data.

However, the literature (and consultation with those in charge of the PRSPs for 30 HIPC, which took place during the workshops organised by the HIPC CBP from 2000 to 2003) allowed us to identify several groups of factors that have an impact on each of the three types of indicators (Dasgupta, 2003; Fofack, 2002; Hanmer and Naschold, 2000; HIPC CBP 2000 and 2001):

- *Determiners of income poverty and (monetary poverty)*: the lack of income is determined by economic growth,⁷ exogenous shocks (climatic, international economic trends, conflicts, etc.), demographic trends, key macroeconomic indicators, such as inflation and unemployment, productivity and the use of resources in the sectors (added value, level of technology, capital/production and work/capital ratios)-especially in the farming sector.
- *Determiners of poverty in terms of living conditions*: the lack of access to basic services depends on the offer of these services (which itself depends on the quantity and the quality of public and private spending) and the demand by poor people for these services (which depends on the price of services, information and cultural factors).

- *Determiners of poverty relating to unrealised potentials:* the determiners of indicators of use of facilities are also the offer and cost of these facilities (micro-credit or decentralised financing systems, land redistribution systems, the existence of roads and shopping centres) and the demand by poor people for these services. This demand is closely linked to their level of education, how much they consult and have access to information, which depends on the programmes for democratisation, decentralisation, transparency and the fight against corruption, as well as the historical level of participation by these poor people in social networks.

A model that claims to be useful for defining national political actions for fighting against poverty must therefore be able to specifically define the main determiners of the three types of poverty, which have been identified by quantitative and qualitative national surveys. It must also clearly show the impact of the various governmental policies on these determiners to ensure maximum impact on the indicators.

2.3 LESSONS FROM THE DISCUSSIONS ON PRO-POOR GROWTH⁸

Poverty reduction can be accomplished thanks to economic growth and/or redistribution of income. The relationship between economic growth, distribution of income, and poverty has raised great interest over the past years, and recent studies tend to show that there is no systematic link between rapid growth and an increase in inequalities, contrary to the hypothesis advanced by Kuznets.⁹

The first item in these discussions concerns the influence of growth on poverty reduction. Several recent studies have argued that there is a strong relation between growth and poverty reduction. These studies examine the fluctuations according to the countries at different levels of per capita income, as well as the fluctuations over time for a given country as per capita income rises. A study focusing on 80 countries over 40 years and reported by Dollar (2002), shows that on average the income of the lowest of five strata of the population increases in parallel to the total growth of the economy, when defined as GDP per capita. In addition, the study shows that the effect of growth on the income of the poor is the same in poor countries as in rich countries, that the link between poverty and growth has not changed in the past years, and that growth triggered by policies is as beneficial to the poor as to the economy in general. It also indicates that there is little fluctuation in the impact of economic growth on poverty, and that more than 80% of the fluctuation in poverty indicators *according to the country and over time* is due to fluctuations in general income per inhabitant, particularly to indicators of nutrition, schooling or healthcare. Bigsten and Levin (2000) extend this link with national per capita income to non-monetary indicators of poverty. They find a relationship with the infant mortality rate, the proportion of literate men and women, and average consumption.

However, other authors have also indicated that growth does not reduce monetary or non-monetary poverty (Gallup *et al*, 1999; Pernia, 2002; Timmer, 1997) and does not modify the distribution of income (Goudie and Ladd, 1999) systematically. Depending on the country, there can be great fluctuations in the impact of decreasing poverty on economic growth. Ravallion (2004) shows that the same rate of growth can have an impact on poverty *seven times greater* in one country than in another. Various studies (including Alderman *et al*, 2004) show that at all levels of per capita income significant differences are

⁸ Lopez (2004) analyses various definitions of pro-poor growth.

⁹ Kuznets (1955) found that the relation between per capita income and inequality is an inverted U.

observed in terms of improving infant mortality and malnutrition. Hanmer and Naschold (2000) also establish an inverse causality, according to which work productivity, job creation, and sector-based distribution of growth determine the contribution of growth to monetary poverty reduction. In the poorest countries (in which the percentage of the population below the poverty line is higher), growth has less impact on poverty reduction (Bourguignon, 2003; Lopez and Serven, 2004). This is perhaps why the correlation between growth and poverty reduction seems less obvious in Sub-Saharan Africa (Ali and Elbadawi, 2002; Christiaensen *et al*, 2002 and 2003; Kaboré, 2003).

The second item deals with the links between the stability of growth and poverty relief. Several recent studies indicate highly volatile economic growth in the poorest countries, which is caused especially by exogenous shocks, because the countries are exposed to major risks (IMF, 2004; Martin and Bargawi, 2004a). Dollar reports that in periods of crisis, in some countries the changes in poverty do not necessarily reflect the economic booms and recessions (this phenomenon is called 'hysteresis'). However, many other studies (Lustig, 2000; Papanek, 2004; Ferreira *et al*, 1999) indicate that the poor are much more affected by the crises and therefore that the crises increase poverty considerably. In addition, the short-term shocks that affect non-monetary concerns, such as education and healthcare, can have disastrous long-term consequences on growth and poverty reduction. By creating uncertainty, volatile growth also decreases the rate of growth (and of poverty reduction) in all years.

The third item concerns the distribution of growth, measured on three levels:

a) Inequality and growth

One of the general conclusions of the lessons drawn from the literature is that growth (even if it reduces poverty) does not necessarily have an impact on inequality. The multinational studies show no correlation between the two (Chen and Ravallion, 1997; Deininger and Squire, 1996; Dollar and Kraay, 2002; and Easterly 1999).

Nevertheless, the most egalitarian societies transform growth more easily into a reduction of poverty. The more the distribution of income is balanced in a country, the greater the impact of growth will be on the number of people living in poverty. Inequality also includes inequality of human resources, real estate and financial assets. For example, inequality in terms of land distribution, access to healthcare services and the level of instruction can have a strong effect on the relative gains made in terms of growth. Several researchers have demonstrated the significant effect of initial inequality on the transmission of growth in terms of poverty reduction (Hanmer and Naschold, 2000; Kakwani, 1993; Kanbur and Lustig, 1999; Lopez and Serven, 2004; Ravallion, 2004; Tanzi and Chu, 1997; White and Anderson, 2000).

In addition, the degree of inequality can influence the rate of growth. We have sometimes worried that greater equality (or excessive efforts in seeking equality) might prejudice growth by decreasing the motivation of entrepreneurs to create companies and jobs. A compromise was therefore suggested between equality and growth when elaborating strategies for fighting against poverty. Most recent studies (Alesina and Perotti, 1993; Alesina and Rodrik, 1994; Persson and Tabellini, 1994; and Stewart, 2000) show that greater equality (monetary and non-monetary) accelerates growth.

Several other studies (Forbes, 2000; Li and Zou, 1998) argue the contrary. Banerjee and Duflo (2003) demonstrate that these different results can be explained by the fact that the positive effect of equality on growth is concentrated in the poorest countries. Other studies make a distinction between the elements of inequality and reveal that the inequalities in assets (such as financing, land, training and jobs) have a much more important influence on growth (Birdsall and Londoño, 1997; Deininger and Squire, 1998).

In itself the growth process also leads to changes in terms of inequality: the same rate of growth can be associated with very different trends in inequality, with a return effect on the long term rate of growth.

In most developing countries, growth could certainly be significantly accelerated if policies were implemented to improve the distribution of income. These policies include changes in marginal rates and means of taxes, and increases in spending to promote micro-credit and small enterprises, policies for more egalitarian distribution of land, and additional spending to extend social services to the poor (Easterly and Rebelo, 1993; Perotti, 1996).

b) Two examples of sector-based distribution of growth:

- In countries in which the majority of the population lives in rural zones, **agricultural growth** drives back poverty. Effectively, when the income of poor farmers rises, the demand for goods and services that can be easily produced by poor people increases too. Various national or multinational studies (Dorward et al, 2004; Khan, 2001; and Kimenyi, 2002) show that growth in farming and tertiary sectors markedly contributes to alleviating poverty. However, this link would appear to be more complex in the long term. Rapid growth in farming can alleviate rural poverty in the short term. Nonetheless, the dependence on agriculture can also intensify the vulnerability to fluctuations in production or prices, which could contribute to worsening poverty. A more diversified economy with a dynamic industry is more likely to lead to a sustainable increase in the standard of living.
- **Growth in activities requiring a large workforce** also has a greater impact on pushing back poverty. If growth increases the number of low-qualified jobs, the poor will be more likely to benefit from it.

c) Breaking down of the distribution of growth

National poverty indicators (monetary or non-monetary) are misleading because they hide the results for various categories, such as regions, socio-economic groups, gender, and ethnic groups. The link (in both directions) between growth and pushing back poverty becomes more complex as the national poverty indicators are broken down into groups. The same national rate of growth can have a very different effect according to the individuals, their quantity of goods, their jobs or lack of jobs, regional location, gender, ethnic groups, and whether or not there is a safety net. These differences must be taken into account in order to understand the specific characteristics of poverty and the specific measures intended to fight it.

Fourthly, some researchers have looked into the explanation of variations in poverty according to the elasticity of poverty with respect to average income (or spending) and inequality. These elasticities are measured based on the Lorenz curve,¹⁰ and make it possible to estimate the variations in poverty due at the same time to changes in income and to those of the Gini Index, using the decomposable FGT poverty indexes. They enable a marginal rate of substitution to be defined between these two factors and to determine the average percentage of increase in income (or in spending) so that poverty will not vary after a change of 1% in the Gini Index. This rate is the negative of the ratio between the elasticity of the inequality and that of income (or spending). This method has been applied by the Applied Economic Research Centre (CRÉA, Dakar University) to data from Senegal (see box 1) corroborating the interest of breaking down the indicators in order to grasp certain particularities.

The fifth item concerns the types of economic policies able to maximise growth and poverty reduction:

- **Macroeconomic stabilisation** is one of the cornerstones of economic growth. However, the literature indicates that there are levels of inflation (between 5 and 10%) and budget deficits (between 1 and 3% of the GDP, grants included), which favour growth while maintaining stabilisation (Adam and Bevan, 2003; Martin and Bargawi, 2004b), and therefore a stabilisation policy that is too strict may cause a decrease in growth. In addition, the literature indicates that there are alternative ways to maintain growth and stabilisation; all the more since an increase in the offer and in productivity can contribute to stabilisation as strongly as a decrease in demand.
- **Promotion of the private sector, savings, and national private investment** is essential to sustainable growth, which does not depend on outside resources. Nonetheless, the experience of the poorest countries—which was only a freeing up of funds by the public sector (through a net reimbursement by government to the banking system)—is not sufficient to increase private investment, because of the structural problems in the financial system and in the real private sector. In addition, the development of the private sector and the financial system is not in itself always beneficial to the poorest strata of society: specific measures are necessary to promote and finance small enterprises. Consequently, a model must enable those in charge of orienting policies to define the development of the private sector (and the financial sector) more specifically, including micro-finance, with a separation of the needs in terms of resources by the public and private sectors and the impacts of the policies envisaged for the two sectors.
- **The results of structural reforms and sector-based policies** have a very significant influence on growth prospects and poverty reduction. A model can therefore help simulate the impact of key policies. However, there are already several more specific tools dedicated to a deeper analysis of the sector-based or micro-economic impact of these policies. The most important thing is to incorporate the results of these impacts into the macroeconomic modelling.

These discussions lead to the following conclusions in favour of modelling:

- Economic growth is the factor that has the most influence on poverty, but this influence varies a great deal according to the country. According to multinational studies, each model must consequently simulate in detail the sources of growth, as well as its impact at the national level, without foreseeing this impact in advance.
- Causality may also run from poverty reduction to growth, and therefore models must enable this causality to be simulated.
- The positive effects of growth can be lesser if the economy is volatile. The models should integrate the simulation of economic shocks.
- Growth is a necessary but insufficient condition to fight against poverty. The impact of growth on poverty varies according to the initial degree of inequality, the quality of the growth and the policies adopted to guarantee 'pro-poor' growth, i.e. growth that benefits especially the poor by attempting to improve the distribution of income. Therefore, the preferred models should integrate simulations of:
 - the interactions between growth, inequality, and poverty reduction;
 - the impact of policies targeting a better distribution of income;
 - sector-based distribution of growth and how it uses labour;
 - the breaking down of growth by region, socio-economic group, gender, and ethnic group.
- Macroeconomic stabilisation must be elaborated so as to encourage growth. Therefore, it is vital to create a model that allows decision makers to determine the combination of macroeconomic targets the most appropriate for each country. Such a model would make it possible to combine macroeconomic stability and growth.

BOX 1 – DETERMINERS OF VARIATIONS IN POVERTY IN SENEGAL

The analysis was carried out by the CREA at two levels: for the Senegalese economy as a whole, and with a breaking down of poverty according to whether it is rural or urban. Tables 1 and 2 present the results from indexes of poverty and elasticities of these indexes with respect to average income per adult equivalent, and the Gini Index, as well as the marginal rates of substitution.

In addition, Table 2 highlights the differences between rural and urban settings. The incidence of rural poverty, which is 80%, is determined by inequality, while urban poverty (29%) is more determined by per adult expenditures per year. The depth and severity of poverty in the two settings are more influenced by the Gini Index, but the reduction in inequality has a greater influence in the rural zone than in the urban zone.

Table 1 – Elasticities of poverty indexes with respect to average income per adult equivalent, the Gini Index, and the marginal rates of substitution

Poverty Indexes	Poverty line: 143, 080 CFAF/year/adult equivalent and Average income: 204, 118.10 CFAF/year/ adult equivalent			
	Measure of poverty	Elasticity/average income per adult equivalent per year	Elasticities/ Gini Index	Marginal substitution rates
FGT0	0.5785	-0.89	1.02	1.14
FGT1	0.2160	-1.68	2.54	1.51
FGT2	0.1051	-2.11	4.37	2.07

Table 2 - Elasticities of indexes of poverty with respect to average expenditure per adult equivalent, the Gini Index, and the marginal rates of substitution

Poverty indexes	Poverty line: 143, 080.0 CFAF/year/ adult equivalent Average expenditure: Dakar: 381, 967.7 CFAF/year/ adult equivalent Other urban: 249, 602.3 CFAF Rural: 116, 237.7 CFAF Dakar + other urban: 322, 960.8 CFAF.				
	Zones	Measure of poverty	Elasticity/expenditure per adult equivalent per year	Elasticities/ Gini Index	Marginal rates of substitution
FGT0	Dakar	0.192	-3.43	1.06	0.31
	Other urban zones	0.386	-1.66	1.03	0.62
	Rural sector	0.800	-0.55	1.01	1.84
	Dakar +other urban	0.289	-2.20	1.05	0.48
FGT1	Dakar	0.043	-3.47	3.58	1.03
	Other urban zones	0.100	-2.85	3.22	1.13
	Rural sector	0.325	-1.46	2.42	1.66
	Dakar +other urban	0.069	-3.07	3.34	1.09
FGT2	Dakar	0.014	-4.28	5.62	1.31
	Other urban zones	0.037	-3.42	5.12	1.50
	Rural sector	0.165	-1.94	4.27	2.20
	Dakar +other urban	0.024	-3.71	5.29	1.43

Source: CRÉA, calculation based on data from the ESAM of 1995.

3. MODELLING POVERTY REDUCTION

According to the previous chapter, modelling poverty requires the simulation of the following items:

- the specific sources (offer and demand) of strong and sustainable economic growth;
- the distribution of this growth—if it is 'pro-poor'—and its impact on poverty, disaggregated especially for employment, and by region, socio-economic group, gender, and ethnic group;
- the dynamic and positive interaction between poverty reduction and growth;
- the optimal level of macroeconomic stability to maximise economic growth;
- the promotion of the private and financial sector, savings and national private investment;
- the impact of structural reforms and sector-based policies on growth and poverty;
- the kinds of shocks and risks to which the economy may be confronted.

Preferably, models must also integrate links between macroeconomic policy and non-monetary aspects (living conditions and potentialities) of poverty, emphasising the contribution of reducing these other kinds of poverty on monetary poverty as well as economic growth.

With these types of simulations, political decision makers can have a clear vision of the effect of the *alternative scenarios* on poverty, in all of its forms, according to their policy decisions and any eventual shocks.

This chapter reviews the existing models in order to identify their capacity to respond to these needs.

3.1 TRADITIONAL MACROECONOMIC MODELS

Developing countries have had access to five classical ways of modelling the economy.

1. the IMF's financial programming framework;
2. the World Bank's RMSM model and its RMSM-X/XX variants;
3. economic budget models (TABLO, PRESTO, etc.);
4. the 'three-gap' model and various structuralist models;
5. the CGE models and other models of financial flows and dynamic econometric models.¹¹

The *IMF's financial programming model* is purported to be an integrated model (Bolnick, 1999; Mikkelsen, 1998). However, this model emphasises the budget and the Government flow-of-fund table (TOFE), the balance of payments, and the monetary situation. The financial programming focuses essentially on narrowing the gap in the TOFE, by ensuring that the trends in terms of current account, reserves and general

¹¹ The CGE models are dealt with in section 3.2, since they are more adapted to the requirements for analysing poverty.

balances are satisfactory, and by verifying the fundamental consistency with respect to the monetary targets and an objective for growth in GDP (determined exogenously). This behaviour is justified if the main preoccupation is macroeconomic stability and the financial viability of the country. However, from this perspective, no analysis is made of the sources or distribution of growth, nor of the other economic agents, such as households, companies, and the financial sector, nor of the impact of structural or sector-based policies.

The main objective of the *World Bank's RMSM model* in its original version—as is true of the IMF's financial programming model—is to calculate the need in external financing. It enables a more specific analysis of the sources of growth and the evolution in saving and investment. This analysis describes the accumulation of capital using the incremental capital output ratio (ICOR); however, without analysing in detail the relationships between external financing and investment or saving at the national level through the behaviour of the private sector or the financial sector (Granville and Mallick, 2003; Tripathi, 2003). In addition, this model does not discuss either the distribution of growth or poverty reduction or the impact of structural and sector-based reforms.

Economic budget models, such as PRESTO (Collange and Jourcin, 1995) and TABLO (Leenhardt and Olive, 1994), have in particular been used in the countries of the Franc Area and in Central America. PRESTO is a simple model that requires a limited amount of information, and has therefore been used in almost all of the countries in which the CFD performs actions. TABLO is a multi-sector model—almost an accounting model—based on an IOT, which requires national accounts that are sufficiently well elaborated; therefore, it has only been applied to a limited number of countries. These models adhere to logic of demand with GDP linked to jobs. They describe the economy according to Keynesian-type dynamic relations. They are based on accounting relations and are quite well suited to budget analysis and the formulation of a medium-term expenditure framework (MTEF). However, these models are very conservative in terms of the offer structure and are not appropriate for taking into account modifications to the offer. Furthermore, they do not provide a description of accumulation. Thus, in their current state, they cannot take into account long-term preoccupations, whose aim is to radically transform economic structures, the distribution of growth, or the details from the private or financial sector.

'Three-gaps' models and various other structuralist models (Gazon, 1979; Taylor, 1983 and 1990). Several countries developed models of this type for economic planning objectives in the 1970s and 1980s. In the beginning, these models were more adapted to the countries' needs and economic realities, taking into account the behaviour of the economic actors and a more disaggregated vision of growth (in terms of sources and distribution). However, since the 1980s, most of these models have not been developed due to a lack of funding, so they have not been adapted to the new ways in which economies behave after stabilisation and structural adjustment reforms, and therefore are unable to simulate the impact of these reforms. Consequently, most of them have had very little impact on how economic policies have been defined.

As soon as structural adjustment programmes (SAPs) were implemented, the first three models were most often used in the underdeveloped countries, because of the close relations these countries had maintained with the IMF and the World Bank or the related institutions that organised the training sessions attended by a large number of the technical

managers from these countries. In addition, these different models embodied the short term vision of the international community of donors, in particular the IMF and the World Bank, on the priority measures to be taken in order to establish macroeconomic equilibrium and encourage growth. The simplicity of these models (especially the financial programming model) gave them exaggerated weight within the framework of discussions on economic policy between the Bretton Woods institutions and the governments of poor countries, because they required little data to work and were easy to understand and apply.

In general, these four groups of classical models describe a short term vision of the economy and only analyse financial stability within the framework of a monetary approach to balance of payments. For this reason, the problems linked to sustainable development and the fight against poverty have not been well integrated into these models, or even not at all. In addition, the aggregate nature of these macro-econometric models does not enable the behaviour of specific agents in the equilibrium to be highlighted. Therefore, the analyses of the offer and of the distribution of income are not explicit in almost all versions of these models,¹² and therefore do not enable analysis of the dynamic and positive interaction between poverty reduction and growth. Their analyses of the labour market, the behaviour of the private and financial sectors and the impact of structural or sector-based reforms are very often limited to a strict minimum. In addition, these models focus solely on income, and do not include living conditions or individual potentialities. Except for a few variants or adaptations of models developed at national levels, the structures and hypotheses of most of the models were poorly suited to the circumstances and characteristics of the specific countries. On the other hand, their simplicity and the availability of the data that makes them work rendered them credible in discussions with Bretton Woods institutions, until those institutions wanted to simulate a true example of poverty reduction in a more detailed way.

3.2 MODELS MORE APPROPRIATE TO POVERTY REDUCTION

In recent years, the international community seems to have become more preoccupied by questions relating to poverty. Governments are mobilising to attain the Millennium Development Goals (MDGs) and reduce poverty by 50% by the year 2015. To that effect, some are currently trying to integrate the analysis of poverty into traditional modelling tools, with varying degrees of success.

Several approaches have been developed in the economic literature to analyse the effects of economic policies on poverty, within the context of strategic frameworks for poverty reduction,¹³ in particular:

- adapting current models, such as RMSM, 123, or economic budget models;
- computable general equilibrium models, accompanied by social accounting matrixes;
- tools for simulating poverty reduction.

¹² Many individuals or country teams of the Bretton Woods Institutions have realised that the financial programming (FP) and RMSM models are too simplistic, and have developed more complex versions. For example, to make growth endogenous in the FP model (Chand, 1989; Khan *et al.*, 1986 and 1990; IME, 1987) or to combine the RMSM model with a more detailed sectoral analysis (Muradova *et al.*, 2001; and Pereira da Silva *et al.*, 2002). Independent researchers (for example Briken and Tarp, 1996) have adapted them using some complementary hypotheses and analyses for medium-term studies. However, the use of these variants has never been generalised, and there are only a few countries in which these models have had an important impact on the elaboration of economic policies.

¹³ Partial equilibrium models (modelling the reaction in the offer, models of household behaviour, multi-market models) are greatly limited because they cover only one sector. In addition, the repercussions and retroactive effects on the other sectors are not taken into account by them. Therefore, these models are not dealt with in detail in this study.

3.2.1 Adaptations of Current Models

3.2.1.1 RMSM-X + P Model¹⁴

Starting from the foundations of the original RMSM-X model, the World Bank developed an instrument for analysing poverty. Notably, it introduced an equation for poverty into the model. This equation links the poverty rates to macroeconomic and structural factors represented by inflation, the general level of education, the standard of living, economic growth, the opening up to international trade, and inequality of income.

The variables in the model are as follows: the inflation rate, the real per capita GDP, the rate of growth of the real per capita GDP, imports, exports, GDP and public expenditures, which were already included in the original RMSM-X. The additional hypotheses concern how much the government spends on education and the effect of this spending on illiteracy. In addition to this, there are the indicators on the rate of illiteracy and the Gini Index, which are generally derived from household surveys. The underlying hypotheses are as follows: (i) inflation; (ii) the real per capita GDP; (iii) economic growth; (iv) the opening up to international trade; (v) the general level of education; and (vi) inequalities in income.

The macroeconomic and structural factors are first estimated empirically. A panel regression of 22 low-income countries is used to calculate the coefficients with which the projections of macroeconomic and structural variables are used in the poverty equation to project a poverty rate. This model has been used in several countries with the support of the World Bank.

The World Bank has also developed the RMSM-X + LP version of the original model. This one deals in a more detailed way with the job sector, and is currently being used in Namibia and other countries.

3.2.1.2 Poverty Analysis Macroeconomic Simulator

The World Bank has created another simulation tool capable of linking the results of household consumption surveys (ECAMs) to the existing macroeconomic models, such as financial programming or RMSMs. The 'Poverty analysis macroeconomic simulator' (PAMS)¹⁵ contains three modules: a macroeconomic framework, a labour market module, and a module for simulating growth in income. It can simulate multiple growth scenarios with various combinations of inflation, and fiscal and current account balances, multiple sector-based distributions of growth, and taxation, and fiscal transfer policies. To analyse the variations in poverty, this model uses several representative households—therefore, it is not able to analyse intra-group changes. In addition, given that all of these macroeconomic results come from the existing models, the problems inherent within these models persist—for example, the limitations of relative price effects and limited substitution between professional categories.

3.2.1.3 Models Adapted to Economic Budgets

At the beginning of the 2000s, several countries adapted their economic budget models¹⁶ to some of the needs for simulating the fight against poverty. They integrated several improvements, such as:

¹⁴ See Addison, 1989; Chen and Storozhuk, 2001; and Holson, 1989.

¹⁵ See Pereira da Silva *et al.*, 2002.

¹⁶ Short-term economic forecasts that generally accompany finance laws.

- (i) a refinement of the description of public expenditures to better distinguish between expenditures that have an impact on the fight against poverty, while at the same time maintaining elements that make it possible to check the macroeconomic consistency and impact on the stabilisation objectives;
- (ii) a differentiation of the income-consumption closure by socio-economic category and different income levels; and
- (iii) a refinement of data on employment in order to better define the impact of different policies on employment.

Adaptations of existing models are the first steps toward modelling poverty. They have helped several countries to calculate first estimates of the possible impacts of several types of structural reforms on poverty, and to ensure the consistency of their spending policies for fighting against poverty with their macroeconomic guidelines. Several of these adapted models permit a deeper analysis of the offer and demand and of the labour market. However, they do not take account of the interaction between poverty reduction and growth or the non-monetary dimensions of poverty. The simplicity of these models has enabled several countries to adopt them rapidly. However, these countries also recognise that these models are very rarely appropriate to realities in their country (for example in terms of the labour market), and that they have to resort to more complex and better adapted models in order better to formulate how their policies should be oriented.

3.2.2 Computable General Equilibrium

3.2.2.1 Social Accounting Matrixes¹⁷

Social accounting matrixes (SAMs) have been used as a framework for analysing the effects of economic policies for nearly two decades. This tool was developed to make up for the limitations of the previous national accounting systems. A SAM is based on double entry accounting. Its main objective is to keep track of all of the income and expenditures of the economy in order to make the distribution mechanisms become apparent. As a whole, a SAM groups together accounts of institutional officials, of sectors of production of goods and services, and of factors of production.

The SAM is different from traditional systems for national accounting because of the following characteristics:

- the links between the SAM and the economic policies: the economist creating the model acts right from the start in the definition of the accounting framework so that institutional characteristics of the field of study can be integrated therein;
- the SAM does not often correspond precisely to the breakdown of the national accounts: it is created by integrating statistics from various origins. It can be created for the national, regional or local level.

In general, six accounts are presented in a basic SAM: (1) the factors of production account, which integrates work and capital sub accounts; (2) the households account; (3) the enterprises account; (4) the public administrations account; (5) the capital account; and (6) the rest of the world account.

¹⁷ For a complete discussion of SAMs, see Round (2003). The SAMs of 15 developing countries can be found on the IFPRI website (see bibliography).

The SAM makes it possible to track the interdependencies that exist within the economic system. Depending on the level of disaggregation, it can provide the interrelations between the sectors of the economy, the flows between regions, the distribution of income among groups, and the relations between one country and the rest of the world.

In addition to being simple to read, SAMs make it possible to disaggregate accounts in function of research objectives and offer a direct view of the impacts of shocks (economic policies, technological changes, growth in the offer or demand of a productive activity, variation in the volume of aid) on the economy (activities, factors, households, capital, exchanges with the outside).

In this way, production can be disaggregated in terms of the level of technology used by making a distinction between the informal and formal sectors, the size of companies, the capital possessed, the zone and sector of the activity, the kind of goods and services produced, and the market (local, exterior). A distinction of the status of the enterprises—nationally- or foreign-owned, public or private, personal, partnerships or family businesses—also appears to be essential in describing economic flows.

For studies concerning poverty, it might be useful to take account of its characteristics within the country. For employment, a distinction by level of qualification, job status (salaried employee, employer, family helper) type (formal/informal), sector (agriculture, export), and kind of job appear to be pertinent. In terms of households, disaggregation can be by place of residence (rural/urban), capital contribution, and occupation of the head of the household. Poverty is essentially rural, and this disaggregation makes it possible to distinguish among those without land and the small and large landowners. It also helps make a distinction between people with different levels of education.

The SAM is not a model in itself. Nevertheless, once the SAM has been created, one can resort to the methodology developed by Thorbecke and Jung (1996) and applied in Senegal by Dansokho (1997) for modelling based on multipliers.¹⁸ This exercise contains three steps: i) determining the fixed-price SAM multipliers; ii) choosing indices for measuring poverty; iii) determining the linkages between the poverty indices and the SAM impact multipliers.

The SAM can also be used to analyse the impact on the socio-economic system of exogenous modifications of certain variables such as exports, public expenditure, and investment, making it possible to determine the consequences on the production unit, the allocation of factors, and the distribution of income.

In addition, the SAM framework can be used either to study the impact of macroeconomic policies on poverty (Rich *et al.* 1997) or on the distribution of income (Thorbecke for Indonesia, 1994; and Dansokho (1997) and (2000) for Senegal).

Several studies can be cited as concrete examples:

- Adelman, Taylor and Vogel (1988) created a SAM to analyse the impact of income from immigration on the economy of a village in Mexico;
- Hazell, Ramasamy and Rajagopalan (1991) used a SAM created at the regional level in India to study the impact of agricultural growth on the local economy;

- Subramanian and Sadoulet (1990) analyse the effects of the fluctuation of production and technological changes on a village in India;
- Tarp *et al* (2002) analyse the effects of trade on income in Vietnam.

The methodology described above has been applied to the social accounting matrix created by the Economic Policy Division (EPD) of the Ministry of Economy and Finance, Senegal. The data from the Senegalese household survey (ESAM) made it possible to calculate the elasticities of poverty with respect to income.

The SAM shows great adaptability, making it possible to use it at several levels (village, region and country) based on operations carried out by each of the actors.

However, while SAMs make it possible to view the structure of an economy, their application is limited. In effect, these are models whose technical coefficients are constant, which implies technology, a structure, and yields whose scale is constant. In addition, prices are not explicitly taken into account. Thus, SAMs are of limited use for studying how a market economy functions.

More importantly, the lack of a coherent analytical framework does not allow for the *ex ante* or *ex post* evaluation of the policies implemented. For example, the government may select from the various orientations of a programme, a macroeconomic growth strategy rooted in the poor people's production system through investments that prioritise the agropastoral sector and the urban economy at the same time. However, it is impossible to say ahead of time which production activities will be the most effective in improving the living conditions of poor people in rural or urban settings. Nevertheless, to rank productive activities according to their relative capacity to reduce poverty, an order of priority must be established, with a distinction made between direct effects on the income of poor households and indirect effects on the purchases of intermediate items of consumption. To identify the areas that should benefit in priority from the resources allocated to the fight against poverty, it is necessary to evaluate the potential impact of an increase in investments on each of these areas.

3.2.2.2 Computable General Equilibrium Models

Recourse to computable general equilibrium models (CGEMs) helps to bridge this gap. Simulation models such as CGEMs describe the offer, the demand and the interaction between them on the markets of goods and services and factors, in a static or dynamic way. They describe the departures from the reference situation and proceed by aggregating agents into relatively homogenous groups.

However, discrepancies also exist within groups (for example farmers who are landowners and those who have no land). Differences are observed in the degree and nature of poverty as well as in the repercussions of macroeconomic policies and economic shocks on sub-groups. These examples of microeconomic behaviour are analysed using micro-simulations. The microeconomic models of agents help to obtain a specific representation of reality and determine the rules governing the agents' behaviour. However, they do not take account of direct or indirect interactions (though production or exchange for example) that exist between different categories of households within the same economy. It is impossible for these models to detect the indirect impact of an economic policy.

The use of CGEMs to track flows and the behaviours of an economy helps to integrate SAMs and microeconomic models, with a statistical basis represented by a SAM. These models exploit the advantages of these two categories of approaches within an analytical framework close to field observations (Parrot, 1997). The CGEMs broaden the analytical framework of the microeconomic models by providing a more complete structure of the economy. The basic idea of micro-simulations is to work directly on data from surveys and to describe the results of a modification of policies on the well-being of households and/or individuals. They make it possible to measure the effects of specific policies without oversimplifying the complexity of socioeconomic relations and without excessive aggregation, because they use a classification adapted to the situation of the economy. Contrary to linear models that deal with the economy partially, CGEMs are based on a general equilibrium and take into account the interactions of various measures and the complexity of relations between the micro- and the macro-economy. According to Rust (1997), CGEMs help gain an overall understanding and make a detailed representation of reality. They allow an evaluation of the deepest implications to be made as well as comparisons between the theoretical results and the real observations. A CGEM is an evaluation and simulation model whose aim is to provide a representation of all transactions (Shoven and Whalley, 1984).

Several approaches are used to analyse questions concerning the distribution of income and poverty, in particular:

1. Disaggregating the agent as much as possible according to socioeconomic criteria or ones having to do with location. In this case, it is possible to evaluate and compare the impact of economic policies on the well-being of different groups. This approach makes it possible to study inter-group inequalities, but can not be used to evaluate intra-group effects, which may be more relevant (Sahn, 1996). Among the forms of disaggregation, one finds the use of quintiles and deciles of income, socio-economic groups, gender, and urban or rural zone.
2. Integrating poverty indices into the CGEM. This approach makes it possible to estimate the prevalence of poverty. The CGEM provides new values for the average income of each of the groups. If we suppose the intra-group distribution to be unchanged and integrate these averages into this model, the poverty indicators can be calculated. It is also possible to use the results concerning relative prices to re-evaluate the cost of the basket of essential goods and thus the new poverty line (Décaluwé *et al*, 1999).
3. Endogenising intra-group variance. To accomplish this, all of the households that were surveyed are taken into account in the model. For this reason, the effects of individual differences have an effect outside of any hypothesis of aggregation, whether in terms of the initial donations or the preferences. This exercise consists in using CGEMs for performing microsimulations.

Microsimulation research has been progressively improved. The initial research was essentially partial equilibrium studies (Bergmann *et al*, 1980). Modelling specialists limited their actions to linking the microsimulation exercise to a macroeconomic model, from which they extracted the pricing system (Dixon, Malakellis and Maegher, 1996) to include it simply in a macroeconomic closure without disaggregating the sectors. General

equilibrium studies with disaggregation of sectors are still rare in developing countries. The first were those carried out by Cogneau (1997) on the labour market in Antananarivo, Cogneau and Robillard (1999) on Madagascan agriculture, and Dansokho (2000) on Senegalese agriculture.

3.2.2.3 Lessons Drawn from Experiments in Applying CGEMs

The large number of economic questions that can be dealt with using CGEMs has resulted in a favourable opinion of them in academic circles as well as among politicians in developing countries. During the 1980s, CGEMs were frequently used to analyse problems linked to structural adjustment, trade policies, and distribution of income. Initial research focused more on analysing trade policies and fiscal issues. As far as the analysis of the consequences of economic policies on the distribution of income is concerned, the initial research was performed in 1979. The following studies are among the most significant ones carried out recently:

- Devarajan and van der Mensbrugge (2000b) use a CGEM with 24 kinds of households identified according to ethnic criteria and income level, with labour being disaggregated into 13 different categories, to analyse the impacts of unprotected pricing on the income of households and the distribution of income in South Africa. Their general conclusion is that price reform will greatly improve the well-being of black households while reducing that of whites; however, the distribution of income among blacks could get worse while it might improve for whites.
- The OECD (1991) applied a CGEM to several countries, based on a common architecture, to try to understand the long-, medium- and short-term effects of stabilisation and adjustment policies on the distribution of income. These studies helped broaden our knowledge of the effects on equity and the effectiveness of structural adjustment programmes.¹⁹ The results of the simulations are different and vary according to the country. For Chile and Ecuador the results are not favourable, while for Indonesia and Malaysia improvement was noted due to the adjustment made. Simulating the effects of alternative policies enables one to obtain a solid basis for comparing costs and benefits. All of these studies show that the impact of different policies on the distribution of income depends on hypotheses relating to institutional structures and to market adjustment mechanisms.
- Sahn, Dorosh and Younger (1996 and 1997) carried out a broad study of the impact of structural adjustment policies in poor African countries, in particular Madagascar and Tanzania, using CGEMs. They study the liberalisation of tariffs and prices, the elimination of subsidies, price reforms and exchange rate. They find that in most countries, in which reforms were carried out in a sustained manner, the distribution of income improved and the poor were not affected. They recognise, however, that the real gains are marginal. These conclusions have been criticised by Maio, Stewart and van der Hoeven (1999), who think they do not reflect reality at all.
- Arndt *et al* (2000) used a CGEM to analyse three potential strategies for sustainable development in Mozambique: (i) a strategy based on farming, (ii) an industrialisation strategy, based on agricultural development, and (iii) a strategy based on the export of primary products. Depending on the results, the first strategy could have the most impact on the poorest households.

¹⁹ See the country studies by de Janvry, Fargeix and Sadoulet (Ecuador), Demery and Demery (Malaysia), Morisson (Morocco), and Thorbecke (Indonesia).

Besides these studies, there are currently four important capacity building programmes for poor countries based on CGEM modelling: the MIMAP, the IFPRI, the IMMPA and the 123 PRSP – see Box 2.

BOX 2 – FOUR KEY CGEM MODELLING PROGRAMMES

1. Micro Impacts of Macroeconomic and Adjustment Policies (MIMAP)

The MIMAP project is mainly financed by the Canadian government through the IDRC. The particular goals of the research are to:

- understand the interactions between macroeconomic policies, the distribution of income, and poverty;
- identify how macroeconomic policy reforms affect the poor;
- identify effective procedures that help trace out the best path for the future;
- help make judicious long-term decisions, which benefit all and protect the environment;
- reinforce the capacities of researchers in poor countries to formulate economic policies.

The studies link microsimulation and macroeconomic modelling using CGEMs. This methodology has already been implemented, at various levels, in 13 countries, particularly in Bangladesh, Benin, Burkina Faso, Ghana, India, Laos, Morocco, Nepal, Pakistan, Philippines, Senegal, Sri Lanka and Vietnam. The following are among some of the most recent studies:

- **Bangladesh:** Mujeri and Khandaker (1998) on income elasticity due to demand for common consumer goods and the effects on nutrition of changes in prices and income;
- **India:** Mathur et al (2001) on interlinkages between the number of years of schooling, health and earnings;
- **Madagascar:** Cogneau and Robilliard (2000) on growth, income distribution and poverty;
- **Nepal:** Cockburn (2001) on the liberalisation of trade and poverty;
- **Pakistan:** Iqbal and Siddiqui (2000) on the impact of lowering taxes on income distribution, Naqvi (1997) on energy taxation policy, and Vos (1998) on the flows of aid and the Dutch syndrome;
- **Philippines:** Reyes (2003) on the impact of economic policies on poverty;
- **Vietnam:** Chan et al (1999) on the impact of VAT on reforms in the export sector.

In Senegal, the studies in progress within the framework of the MIMAP (Cissé and Kane, 2001) emphasise three aspects of poverty: the spatial aspect (rural/urban), the status of the head of the household in the labour market (employer/employee) and other socioeconomic characteristics (size of household, gender, level of education, etc.) by applying the FGT indexes to the results from household surveys.

The advantage of this programme was, from the start, the way it identified problems linked to CGEMs. It emphasised adapting the functionality, structure and closure of the model to the needs and opinions of the countries, often using less neo-classical approaches, short-, medium-, and long-term periods, the maximum amount of disaggregation of households and the estimation of parameters with data from the country. For more detailed information, consult the IDRC website: <http://web.idrc.ca/mimap>.

2. The IFPRI programmes

During the 1980s, the International Food Policy Research Institute (IFPRI) extended its mandate to the analysis of macroeconomic policies. The IFPRI has made important advances in formulating CGEMs, more particularly thanks to including multiple alternatives for balancing markets in terms of different factors and for closing the macroeconomic accounts. These items, as well as the dynamic extensions of the Institute's models, are available on the website www.ifpri.org. The models use representative households. They require less data, time, and capabilities at the national level, and therefore help provide responses more rapidly to questions having to do with the analysis of the impact of macroeconomic policies on poverty (see Lofgren *et al*, 2003).

3. The Integrated Macroeconomic Model for Poverty Analysis (IMMPA)

The IMMPA, developed by the World Bank (Agénor *et al.*, 2003; Agénor and Haddad, 2003; Chen *et al.*, 2001), is a simplified CGEM, which helps analyse the impact of policies and external shocks on the distribution of income and consumption. The theoretical contributions of the IMMPA are in several areas, particularly:

- the treatment of the output structure and the labour market;
- taking into account the financial system and the credit market;
- the consequences of the external debt on internal private investment;
- the reallocation of public expenditures from infrastructure expenditures to health and education;
- the systematic linkage between household income and expenditures, for a better understanding of the effect of shocks on poverty;
- the dynamics of intertemporal analyses in relation to the succession of policies undertaken;
- the financial part of the social accounting matrix, which allows the calibration of the model; and
- the integration of data from household surveys for which six categories are distinguished and a representative sample for microsimulation.

The IMMPA enables the effects of three main shocks to be simulated: a temporary shock on the terms of exchange variation in the internal credit to the government, and a decrease in the debt stock. The IMMPA is currently being elaborated, in particular, in Brazil, Cameroon, and Senegal. For more detailed information, see the website http://poverty.worldbank.org/files/14542_25_IMMPA.pdf.

4. The 123PRSP Model

The original 123 model is a CGEM, which includes a simplified representation of the national economy (Devarajan *et al.*, 2000a; Devarajan, Go and Li, 1999; Dansokho and Faye, 2001b). The economy is divided into two sectors of production (export goods and domestic goods). The model considers there to be a single labour market, which is competitive. With these hypotheses, as the domestic good is neither exported nor imported, the relative price of the domestic good compared to the exports or imports is the real exchange rate. Specification of the 123 model is based on two fundamental economic principles: optimisation and equilibrium. Likewise, the 20 equations constituting the structure of the model describe the behaviour of the agents, the constraints they face, and the equilibrium conditions in the markets. This model has a basic structure made up of five blocks: a block of real flows, a block of prices, a block of nominal flows, a block of equilibrium conditions, and a block of accounting identities relating to external offer and demand and the balance between savings and investment. This model enables a rapid quantification of the consequences on the national economy of modifying the terms of exchange and of government expenditures. It also makes it possible to simulate the impact of two shocks (variation in public expenditures and variation in terms of exchange on the real growth of the GDP).

In 2000, the model was modified to include the 'PRSP' element (123PRSP) enabling a distinction to be made concerning the impact of results on the most vulnerable categories of households. By using data from ECAMs, the 123PRSP makes it possible to track the changes in consumption by decile or quintile, in income by decile or quintile, and in distribution of household income by using the Gini Index.

In Francophone Africa, this model is currently being elaborated in Benin, Burkina Faso, and in Mauritania. In Senegal, the 123PRSP is already operational. It has been developed in a joint effort by a mixed team whose members are from the Forecasting and Statistics Department (FSD) of the Ministry of Economy and Finance and the Applied Economic Research Centre of the Cheikh Anta Diop University of Dakar (UCAD). It has been used within the framework of preparatory research for the Senegalese PRSP and for identifying price policies for simulating the effects of terms of exchange on the growth of the GDP, consumption and household income, for various deciles of the population and on the Gini Index. The simulations have thus made it possible to understand the effects of modifications of relative prices and those of income from the first decile (the poorest) to the last decile.

The conclusions of most of these CGEM studies have been strongly criticised by several researchers, in particular for the following reasons:

1. As is the case for any type of particularly detailed model, the structure, functionality and macroeconomic balancing of CGEMs can vary a great deal (for more information on the balancing of the model, see box 3). The details of the technical coefficients of the input-output table (IOT) and of the production functions (CES), of the structure of the labour market, and of the general approach (neo-classical or more heterodox) can vary a great deal, according to the opinions of the researchers who construct and use the model. The less the structure of the model reflects the economic reality of the country, the less its results will be reliable.
2. Many CGEMs use an exclusively long-term approach for the period modelled, which would not be appropriate for analysing poverty in unbalanced economies, such as those of Sub-Saharan African countries, nor for an inter-temporal analysis of a succession of different policies.
3. The disaggregation of households is often too homogenous, especially in multi-country studies, and does not reflect the key groups touched by poverty in some countries.
4. Reliable data are essential for each country to make the model work, especially for the estimation of parameters and coefficients. Sometimes, multi-country cross-sectional studies tend to use panel data, which does not reflect the reality in each country considered in its own right.

To conclude, CGEMs have many advantages over other kinds of models. They make it possible to perform simulations of multiple and varied macroeconomic policies and to analyse their impact on the distribution of income and poverty reduction. When they are properly elaborated, CGEMs are well adapted to the realities of each country and to the availability of reliable national data. They can also be used to analyse short-, medium- and long-term periods, and a maximum disaggregation of households to reconcile macro- and micro-simulations, as well as different sectors, such as the labour market, the financial system, or the credit market for a deeper understanding of the sources of growth. The most advanced versions of these models make it possible to analyse the dynamic interactions between poverty reduction and economic growth.

However, despite their pertinence, CGEMs study poverty only from a monetary point of view. As they are currently formulated, they do not make it possible to take account of the non-monetary dimensions of poverty. In addition, they require very detailed data for the purposes of disaggregating different accounts and economic agents. Even if these data are sometimes available, they can not often be collected on a regular basis, which would make it possible to monitor and evaluate on a perennial basis the policies and results from simulations derived from the models, nor can they be compared to the budgetary cost of actions that must be performed. The usefulness of CGEMs has therefore been reduced in several countries because of this lack of 'rapid response' to the economic problems that require an immediate decision.

However, in countries having accurate data and more developed modelling capacities, CGEMs are often adapted to the new national economic problems, and can therefore be used as rapid decision-making tools for defining economic policies with a rather high rate of reliability in terms of results. Therefore, we can conclude that it is essential to accompany the introduction of these models in the poorer countries with capacity building

actions for data collection and modelling (see box 2).

Box 3 – CGEM CLOSURE RULE

In the elaboration of the CGEM, as soon as the structure of the economy is identified using a SAM, the significant operating rules must be determined. These rules (hypotheses, constraints, behavioural functions, etc.) can be progressively introduced into the model in order to have good control over their effects on the entire economy. When the agents are identified, it is necessary to determine the behaviours which best reflect their motivations, then translate them analytically. The agents make their decisions based on the signals they perceive: it may be a question of prices, potential demand, etc. The rules of the game must be determined in function of the interactions among agents and realistic limits and constraints must be introduced, such as decreasing production yields, elasticities, etc. Finally, the equilibrium conditions must be defined in function of the constraints in the system.

Since the structure of the CGEM is specified, to attain equilibrium, one is generally confronted with a situation in which the number of variables is greater than the number of equations. At this point, the model must be balanced, that is the exogenous variables must be identified that will be made or supposed to be functions of other endogenous variables, in such a way that the number of equations be exactly equal to the number of endogenous variables so that there is a solution for the model. The choice of the closure rule determines the way in which the variables in the model will be adjusted to attain equilibrium, which is at the core of theoretical controversies. Depending on the closure rule used, this debate shows there are two major approaches: a Keynesian monetary approach, and a structuralist approach (de Janvry, Fargeix and Sadoulet, 1991).

If the hypothesis of a fixed nominal salary is introduced, the neoclassical model becomes a traditional IS-LM model. In effect, for a given level of prices, the model determines the demand and the offer in function of the price / salary ratio. Likewise, expansionist fiscal and monetary policies lead to an increase in demand, in prices, and in the offer. In this model, a hypothesis of imperfect substitution between foreign and domestic goods leads to behaviour similar to that in IMF stabilisation models described by Khan and Knight (1985). Inflation and production are positively influenced by the excess in the currency offer.

It is possible to go to a Keynesian model by adding the principle of marginal cost pricing to the hypothesis of a fixed nominal salary. In this case, the adjustment is done in terms of quantities. As far as the structuralist models are concerned, the salary rate is no longer determined by a confrontation between labour offer and demand, but by a negotiation process. Consequently, a situation in which there is under employment arises. The closure rule shows to what an extent CGEMs can be used to respond to a variety of macroeconomic problems.

Besides taking into account the microeconomic behaviour of agents in modelling, two main types of progress have been made in computable equilibrium modelling: the introduction of dynamics and currency.

Dynamic modelling within a CGEM framework consists in a series of equilibrium states. These states are linked by updating certain variables between successive periods. These variables can be the capital stock, the attribution of the work factor, changes in the socio-economic composition, and the technological variables.

As Taylor (1983) has demonstrated, the absence of currency has limited the applicability of CGEMs, because currency has a strong effect on real variables in the short- and medium-term. Since 1989, attempts have been made to incorporate the interactions between the real and the monetary (Bourguignon *et al*, 1989; de Melo, 1988; Thorbecke, 1992; de Janvry and Sadoulet, 1995).

While specifications and the closure rule for the model do not present any specific difficulties for CGEMs, the determination of the model's parameters raises problems. In effect, for a SAM with specified data, there is an infinite number of parameters that are compatible with the closure rule. It ensues that there is no one-to-one correspondence between the vector of endogenous variables and that of the parameters. Consequently, an infinite number of parameters can possibly determine the endogenous variable. In other words, an infinite set of partial equilibrium curves for offer and demand can be compatible with the equilibrium values (de Janvry, Sadoulet and Fargeix, 1991).

Adelman and Robinson (1988) study the effect of the macroeconomic closure rules of CGEMs on the distribution of resources. They establish that the level of distribution is insensitive to these rules, while the functional distribution depends on them. They discover that balancing through balance of payments is at least as important for the distribution of income as balancing by savings and investment.

Let us remember that CGEMs attempt, among other things, to make up for the impossibility of determining these parameters by using econometric estimates. This leads the modelling expert to adopt two possible solutions: set the value of the parameter himself or herself based on results from research or deduce the values of the parameters from the model. In the latter case, the data from the reference year represent the model's initial solution.

3.2.3 Poverty Indicator Simulation Tools

The final kind of approach consists in presenting tools that simulate the evolution of poverty, using elasticities between poverty, economic trends, and the forecasts of budgetary spending in the fight against poverty, in empirical models.

3.2.3.1 SimSIP

The simulations for social indicators and poverty (SimSIP) tool was developed in Albania and Honduras by the World Bank, when it was elaborating their poverty reduction strategies (Wodon *et al*, 2001; Ramadas *et al* 2002). It starts from the main objectives for poverty reduction and goes on to define specific impact indicators, mainly monetary and ones relating to living conditions, such as:

- poverty and extreme poverty indicators (incidence, depth, severity, and inequality);
- indicators of access to basic infrastructures (drinking water, sanitation, energy);
- indicators of education (raw and net rates of primary, secondary and tertiary schooling, and rate of adult illiteracy);
- health indicators (infant-juvenile mortality, infantile malnutrition, life expectancy).

Determining indicators have been identified for each of the impact indicators and the elasticities linking them have been estimated on the basis of the hypotheses formulated based on data from a sample of 17 countries of which 14 provided data disaggregated into urban and rural zones. The tool integrates modules for computing the costs of the strategy by making hypotheses on the input indicators, which explain the determining indicators, as well as on the unit costs and the budgetary constraints, which take into account budget sustainability. The sectors treated by the model are analysed in depth, making it possible to create sector-based spending programmes. The tool is also capable of simulating the impact of changes on population growth and on sectors in the economy (see www.worldbank.org/simsip).

However, SimSIP does not include the elements in the 'objective / potentialities' approach to poverty (see section 2.1), nor several of the living conditions sectors (housing, rural roads, electrification). In addition, the choice of determiners and the computation of elasticities come from data from a panel of many countries instead of from more detailed data from a single country. These determiners may therefore not reflect the specific reality of a specific country.²⁰

3.2.3.2 Millennium Development Project Tools

The objective of the research project launched by the United Nations in 2000 concerning millennium development goals is to determine the development financing needed in order to attain these goals. For this reason, tools have been elaborated that enable Governments to calculate their needs as far as additional expenditures are concerned.

These tools cover the sectors of education, water, sanitation, hunger, infant and maternal health, and the most serious pandemic diseases (HIV/Aids, malaria, and tuberculosis), as well as expenditures for infrastructure and programmes for fighting against inequality- especially in terms of gender. See <http://www.unmillenniumproject.org/reports/needs03.htm>.

²⁰ PovStat is one of the other tools for linking growth to poverty reduction, see glossary and website http://poverty.worldbank.org/files/14930_21_Tool_PovStat.pdf.

These various tools are aggregated, in order to compute the financial needs for each particular country, and compared with the prospects of mobilising national resources, in order to compute the needs in international financing, while taking into account Official Development Assistance and debt relief.

3.2.3.3 Pôle-Dette Model

The 'Pôle-Dette model' (PDM) is a tool developed by representatives from 20 Francophone African countries during two seminars jointly organised by the BCEAO/BEAC Regional Debt Management Training Unit for Central and Western Africa (Pôle-Dette) and DRI (HIPC, CBP 2000 and 2001), and discussed with the representatives of 19 other African and Latin-American countries during four other HIPC CBP and AERC seminars between 2001 and 2003. It integrates three different approaches to poverty (monetary, living conditions, and potentialities, see section 2.1), and the determiners of these indicators, in a simulation of a programme to fight against poverty, identifying the actions to perform to respond to the preoccupations with an estimate of their budgetary costs.

- **Income approach:** the indicators include three thresholds of monetary poverty: (i) poverty, (ii) extreme poverty (income that only insures minimum nutrition), and (iii) a higher threshold (for example, the poverty threshold x 1.5), which makes it possible to check whether the household concerned has clearly risen above the poverty line. A relative poverty indicator is also used, according to which the two poorest deciles of the population should receive at least 10% of the total income. The determiners come from surveys and studies carried out in poor African countries, particularly on the rate of economic growth, the rate of population growth, rainfall and agricultural productivity, the inflation rate, competitiveness, and the unemployment rate.
- **Living conditions approach:** this tool uses one output indicator per sector.
 - Health: life expectancy is the best overall indicator, but it changes very slowly over time. It is therefore preferable to use infant mortality, because it changes more rapidly and its impact is relatively important in terms of life expectancy.
 - Education: the literacy rate was chosen as the only output indicator because it covers the quality of education for all generations. It can be determined by other indicators, such as the raw rate of schooling and the dropout rate, which describe the efforts made and the quality of teaching.
 - Water and sanitation: the indicator used is 'the use of drinking water', because of the pertinence of its impact on health.
 - Housing: the indicator used is the percentage of households living in precarious housing, which reflects the living conditions of the poorest populations.
 - Roads: the amount of roads is fundamental for access to services and markets.
 - Rural electrification: this is the percentage of households using electricity, because this indicator enables the poor to increase their productivity as well as their living conditions.

- **Potentialities approach:** the most important indicators selected are listed below.
 - Access to credit: the percentage of the local population using a decentralised financing system, because these systems are less constraining, therefore easier for the poor to access.
 - Access to land: the percentage of households having access to land. Problems having to do with land have a great impact on poverty, because it is the main factor of production in the rural world.
 - Access to markets: concerns non only physical access (the presence of roads and shopping centres), but also elements having to do with competition and the negotiating power of poor people, which depends on their access to information and whether or not they are consulted.
 - Two indicators of governance were judged to have priority: (i) the level of satisfaction of users of public services (households and private companies), as determined by satisfaction surveys; (ii) the percentage of external resources allocated to expenditures to fight against poverty, which makes it possible to appreciate the improvement in the coordination of aid.

The use of the tool begins with the choice by the country of the most pertinent impact indicators for each of the approaches to poverty (taking account of the specificities of the country and the availability of data). Determining indicators are linked to each of these impact indicators, and can be selected from a partial list, taking account of the specificity of each country and their availability. It is then possible to establish the parameters for the tool econometrically (by using series or points of data from several surveys disaggregated by region or according to other criteria, or if there is not much data, using elasticities estimated with national data or coming from a panel of countries), and the coefficients of relations between the impact indicators and the determining indicators. In this way, partial elasticities are applied to the indicators in order to forecast the situation if the recent trends continue, as well as the changes in variables necessary to attain the various objectives for reducing poverty. Each of the determining indicators can be explained in terms of inputs from economic policy changes or budgetary expenditures, based on hypotheses concerning the unit costs and the budgetary constraints that take account of fiscal sustainability and the amount of expenditures allocated for the fight against poverty in the budget. It is also possible to simulate increases in the effectiveness of expenditures, based on international standards.

For all of these indicators, it is possible to:

- disaggregate, at the regional level, gender and whether it concerns rural or urban poverty, as long as data is available;
- take account of the volatility / variation of indicators by adding specifications to the model and carrying out robustness tests;
- adapt the indicators to the needs and circumstances of each country.

The availability of data that can be fed into it and its overall coherence, since it groups together the three approaches to poverty and defines their interrelations, confers upon this

tool an important analytical capacity and makes it convincing to decision makers. In addition, in the PDM, the indicators linked to the income approach provide natural links with the macroeconomic models. For this reason, the PDM is considered to be a complementary tool that can be coupled with the different macroeconomic models used in the countries.

Globally speaking, simulation tools are certainly less rigorous than CGEMs. They are unable to simulate the impacts of all the macroeconomic policies on poverty reduction, and are limited instead to several items, especially public expenditures. Nonetheless, the best examples adapt very easily to the realities of each country, and enable coverage of all the aspects of poverty, an analysis of short-, medium- and long-term periods, and a disaggregation of households and sectors. When they fit the data available and the capacities of each country, these tools can also provide quick answers to key economic policy questions. However, to ensure their pertinence and consistency with the macroeconomic guidelines, it is often necessary to link them to CGEM-type macroeconomic models.

4. CONCLUSIONS

During the most recent years, and especially since 2000, when the international community defined the fight against poverty as the primordial development objective, real progress has been made thanks to the development of tools enabling the governments of the poorest countries to simulate with increased confidence the possible impacts of their policies on poverty reduction. These actions consist essentially in adapting the already existing macroeconomic models by using CGEM models to improve analysis programmes by making them more dynamic, and developing simulation tools.

These actions have also taken place during international discussions-still in progress-on the definitions and determiners of poverty, and on the links between economic growth and poverty. These discussions have revealed the multidimensional nature of poverty, with:

- three approaches for defining poverty and inequality;
- many indicators for each approach, said to be 'objective' and 'subjective';
- many determiners for each indicator, which vary according to the country; and
- interrelations between the various indicators and determiners, which makes it difficult to make a distinction concerning their impacts.

The models must also take account of the different ways in which poverty has manifested itself over time, in space, and within the various groups that make up society. Likewise, they must be dynamic in order to measure fluctuations in the situation of the poor, and have the capacity to disaggregate households according to different criteria.

These discussions have also demonstrated the very complex interrelations between growth, economic policy, and the fight against poverty, which underscores the necessity to model poverty (and not only growth), including:

- the detailed sources (in terms of offer and demand) of wide-ranging and sustainable economic growth;
- the distribution of this growth and its impact on poverty—if the growth is 'pro-poor'—disaggregated especially in terms of employment and by region, socio-economic group, gender, and ethnic group;
- the dynamic and positive interaction between poverty reduction and growth;
- the optimal level of macroeconomic stability to maximise economic growth;
- the promotion of the private and financial sector, savings and national private investment;
- the impact of structural reforms and sector-based policies on growth and poverty;
- the kinds of shocks and risks with which the economy may be confronted.

Preferably, the models must also integrate links between macroeconomic policy and non-monetary aspects (living conditions and potentialities) of poverty, emphasising the contribution of reducing these other kinds of poverty on monetary poverty as well as economic growth.

These complications sometimes lead certain researchers in developed countries and some international institutions to become pessimistic as far as the prospects of being able to model poverty reduction accurately are concerned.

However, this pessimism is not always shared by researchers or technicians and decision-makers in developing countries. Some of these countries have enough data to make such models work, enough technical capacity to perform the modelling—after initial training and an adaptation of the models to their needs—, and a proven political commitment, which results in more accurate forecasts concerning the impact of governmental policies on poverty.

These countries have thus accepted several offers to set up and be trained to use these models, in particular because these models are sponsored by distinguished international institutions. For example, in Senegal teams are experimenting with several models: financial programming, an appropriate economic budget, 123, a SAM, MIMAR, IMMPA, and the Pôle-Dette tool. Nonetheless, the capacities of countries do not extend to the manipulation, adaptation, and maintenance of all of these different models for their decision-making needs to help them rapidly formulate economic policies.

Consequently, they are forced to choose between one or two models. How can they choose? Certainly by privileging the technical criteria defined at the beginning of this study, while emphasising their capacity to:

- measure poverty using the indicators for all of these approaches and definitions;
- identify and analyse the determiners of all of these indicators; and
- make links between stability, growth, and poverty reduction.

Nevertheless, what makes these poverty reduction strategies highly innovative is, in theory, that it is the countries themselves that are in charge of these strategies, through a dialogue with the civil society, and eventually in partnership with the international community. Consequently, the most important criteria for choosing the model and the directions for applying them in each country must be that all governmental organisations assimilate them and adapt them to the circumstances and characteristics of each country. This also implies an initial adaptation to the data and analytical capacities available at the national level.

However, the countries do not wish to limit their capacity for analysis to the existing data and studies. Therefore, when a model is introduced, this must be accompanied by a sustained effort in capacity building, data collection, and analysis of poverty reduction, within the government and among the main representatives of the civil society, which would make it possible to improve the national models.

Up until now, the primordial criterion for choosing a model has been its credibility as a tool of discussion with the international community. In the future, the most significant credibility should be with respect to the civil society, which itself needs capacity building to be able to judge whether or not a model can be applied to a country.

If we take all of these factors into account, it is obvious that the best adapted models are the CGEMs and the Poverty Analysis Macroeconomic Simulators (PAMS). The CGEMs (if they are designed within the framework of a capacity building programme for the government and civil society) allow for an in-depth analysis of monetary poverty, adapted to each country and credible at the national level. The simulation tools enable the non-monetary approaches for analysing poverty to be monitored, which could be linked to the CGEMs. The analyses done with traditional macroeconomic models are not very useful for analysing poverty reduction, and therefore should only be used as tests for analysing the consistency of the PRSP with respect to macroeconomic framework: they could be integrated into more appropriate models. Most countries will need to use CGEM models, poverty analysis macroeconomic simulators, and sometimes specific tools for simulating sectoral changes or the results of a specific policy. In addition, they will need a significant acceleration of capacity building actions for them in this area.

Five years after its political engagement in favour of poverty reduction, the international community has not yet succeeded in transforming the application of modelling, in each poor country, from a macroeconomic accounting tool into a tool for formulating 'pro-poor' economic policy. In the elaboration of economic policies, most countries continue to use models that have nothing to do with poverty reduction. Given that the basic poverty reduction simulation tools already exist, efforts must be made to accelerate the dissemination of this information and build capacity in this area for each government and civil society, in order to attain the Millennium Development Goals by 2015.

GLOSSARY

123 PRSP:²¹ The 123 model (one country, two sectors and three goods) is a static computable general equilibrium model (see *CGEM*). It can be used to analyse the impact of macroeconomic policy and external shocks on income distribution, employment, and poverty.

CES: Constant elasticity of substitution. The elasticity of substitution measures the impact of a variation (in percentage) in the relative price of factors on the relationship of the quantity of factors used. Constant elasticity of substitution is linearly homogeneous.

CGEM: Computable General Equilibrium Model. CGE models are completely-specified models of an economy or a region, including all production activities, factors, and institutions. The models therefore include the modelling of all markets and macroeconomic components, such as investment and savings, balance of payments, and government budget.

FGT: Foster, Greer and Thorbecke Indexes. Indexes of monetary poverty which measure respectively its incidence (P_0 : proportion of the population having a level of expenditure below the poverty line), its depth (P_1 : relative gap between the average expenditure of poor and the poverty line), and its severity (P_2 : gap indicator similar to P_1 , which gives more weight, however, to expenditures by the poorest).

Gini Coefficient. The Gini coefficient is a measure of income inequality developed by the Italian statistician Corrado Gini. The Gini coefficient is a number between 0 and 1, where 0 corresponds with perfect equality (where everyone has the same income) and 1 corresponds with perfect inequality (where one person has all the income, and everyone else has zero income). (See *Gini Index*.)

Gini Index. The Gini Index represents the *Gini Coefficient* as a percentage. It is equal to the Gini Coefficient multiplied by 100.

Hysteresis. A non-linear effect: a single input value will correspond to different output values according to whether the input is growing or declining.

ICOR. The **Incremental Capital-Output Ratio** is the ratio of the capital to the output obtained with the help of this capital.

IMMPA:²¹ **Integrated macroeconomic model for poverty analysis.** The IMMPA is a dynamic computable general equilibrium model. It can be used to analyse the impact of macroeconomic policies and external shocks on income distribution, employment and poverty.

IOT: Input-Output Table. An input-output table is a means of presenting a detailed analysis of the process of production and the use of goods and services (products), and the income generated in that production.

IS-LM: Investments and savings/Liquidity and money supply. IS/LM is a model proposed by John R. Hicks in 1937. This general equilibrium model is a synthesis of Keynesian and neo-classical theories. It makes it possible to analyse the interactions of the money market with the goods and services market. IS-LM helps to choose, by computing them, the effects of economic policies and then to carry them out.

Lorenz curve. The Lorenz curve was developed by Max O. Lorenz in 1905 as a graphical representation of income distribution. It can also be used to measure distribution of assets or other distributions. The Lorenz curve is used to calculate the Gini coefficient, which is the area between the line of perfect equality and the Lorenz curve.

MDG: Millennium Development Goals. Gathered together in September 2000 for the Millennium Summit, political leaders from the entire world established a set of measurable objectives along with target dates for the fight against poverty, hunger, disease, illiteracy, environmental degradation, and discrimination aimed at women. Placed at the core of a worldwide action programme, they are now called the Millennium Development Goals. The Millennium Declaration also plans for a vast range of commitments in areas such as human rights, good governance, and democracy.

MIMAP: Micro Impacts of Macroeconomic and Adjustment Policies. Launched in 1990 by Canada's International Development Research Centre (IDRC), the Micro Impacts of Macroeconomic and Adjustment Policies programme assists developing countries in their efforts to analyse and design policies that meet macroeconomic targets while limiting the social costs concerned therein.

MRS: Marginal Rate of Substitution. The marginal rate of substitution computes the way in which one product is given up by consumers for another one. The marginal rate of substitution is also the negative marginal utility of X over the marginal utility of Y. The two relationships are mathematically equivalent.

MTEF: Medium-term expenditure framework. The MTEF is a document that sheds light on the probable budgetary and macroeconomic situation for a pluriannual period. To that effect, it makes it possible to forecast the budget resources expected for the period and to project sectoral envelopes of resources in the form of programmed budgets. In this way, better planning of sectoral objectives and how to attain them can be done.

PAMS²¹: Poverty Analysis Macroeconomic Simulator. PAMS is an econometric model that links a macro-consistency model or macroeconomic framework to a labour-poverty module. PAMS can be used to address the impact of macroeconomic policies and exogenous shocks (such as an exogenous rise or fall in output growth, or a change in the sectoral composition of output) on individual households.

PDM: Pôle-Dette Model. Tool developed by DRI in Excel for HIPC CBP training workshops. This version has been adapted by the BCEAO/BEAC Regional Debt Management Training Unit for Central and Western Africa in order to comply with the convergence criteria of the CEMAC and the WAEMU.

Pôle-Dette: BCEAO/BEAC Regional Debt Management Training Unit for Central and Western Africa. Organisation that has been a partner of DRI since May 2000 for the implementation of the HIPC CBP in Francophone Africa and more specifically in the HIPCs which are members of the two central banks of the CFA Franc Area. The Comoros Union, potentially eligible for the HIPC programme in its quality as a Member State of the Franc Area,²² adhered to Pôle-Dette in December 2004.

Poverty. Absolute poverty is defined in terms of a threshold of resources below which people can not ensure their own subsistence. The poverty line (level of income or resources below which an individual or a family can not have access to a normal social life) varies not only from one country to another, and over time in function of the degree of national economic and social development, but also in function of the structure of the distribution of income among the various socio-professional groups (*relative poverty*).

PovStat. Developed by the World Bank, PovStat is an Excel based software programme that simulates the changes in poverty and inequality over time resulting from changes in output and employment growth.

PRESTO. a Keynesian type model designed and developed in Excel in 1993 by the *Caisse française de développement* (CFD) for elaborating the macroeconomic framework for countries falling within its scope of intervention.

RMSM: Revised Minimum Standard Model. The RMSM is a macroeconomic model developed by the World Bank for countries implementing structural adjustment programmes (1985-2000).

RMSM-X: Revised Minimum Standard Model Extended. This version of the RMSM is augmented by two modules: a flow of funds component and a foreign debt component.

RMSM-X + P. Revised Minimum Standard Model Extended plus Poverty. This version of the RMSM-X includes a poverty analysis module, which works by linking poverty rates to macroeconomic and structural factors.

RMSM-X + LP. Revised Minimum Standard Model Extended plus Labour and Poverty. The RMSM-X is modified by introducing a simplified labour market and a poverty module.

SAM:²¹ **Social Accounting Matrix.** Technique linked to national income accounting, providing a good conceptual basis for examining questions of growth and distribution within a single analytical framework.

SimSIP: Simulations for Social Indicators and Poverty. A model developed in Excel by the World Bank, SimSIP is a set of simulators that facilitates the analysis of questions relating to social indicators and poverty.

²² The Franc Area is made up of 16 countries, including 14 from Sub-Saharan Africa (the eight member States of the BCEAO and the six member States of the BEAC), the Comoros, and France. It emerged from the former French colonial empire and the common will of these countries to maintain an institutional framework, which has contributed to the stability of the macroeconomic framework. See the website of the *Banque de France*: <http://www.banque-france.fr/gb/eurosyls/zonefr/zonefr.htm>

TABLO. This model was elaborated by several agencies including the CFD, the UNDP, CADESCA (Action Committee for the Support of the Social and Economic Development of Central America), and some leaders of the plan or forecast for Sub-Saharan Africa. It is a multi-sector model based on an input-output table (see *IOT*). For this reason, it can only be applied to a limited number of countries, which have national accounts that are sufficiently well elaborated.

Theil Index. This index is based on a weighted average of the income of each individual or group of individuals. It can be decomposed to determine the influence of intra-group and inter-group inequality on total inequality.

VAT: Value-Added Tax. VAT means the taxes on goods and services collected in different steps by companies and completely paid in the final account by the end purchaser.

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