Macroeconomic framework for the economy of Bangladesh

Khondker, Bazlul Haque and Raihan, Selim

South Asian Network on Economic Modeling (SANEM),
Department of Economics, University of Dhaka, Bangladesh

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ADP	Annual Development Programme
BBS	Bangladesh Bureau of Statistics
CGE	Computable General Equilibrium
CPI	Consumer Price Index
FMRP	Financial Programming Reform Project
FPM	Financial Programming Model
ICOR	Incremental Capital Output Ratio
MOF	Ministry of Finance
MTMF	Medium Term Macro Economic Framework
NBR	National Board of Revenue
PSBR	Public Sector Borrowing Requirement
RMSM	Revised Minimum Standard Model
SAM	Social Accounting Matrix
VAT	Value Added Tax

KNOWLEDGE SUMMARY

The Asian Development Bank (ADB) provided support to the MOF to formulate a user-friendly and easily transferable computable general equilibrium (CGE) model to reflect the effect of changes in various public policies and forecast changes of fiscal policy on different sectors of the economy. However, given the difficulties posed by institutionalization of the CGE model and the priorities of the Finance Division, it was agreed that the modeling exercise should be compatible with the financial programming framework. Furthermore, it was agreed that the consultant team would improve the existing macro-economic framework maintained by the Finance Division. In accordance to their recommendation, the following features are added to the existing framework.

- Introduce behavioral specifications for some key variables — namely production behavior, revenue functions, capital formation, private investment functions, private consumption etc.
- Improve the interdependence between variables of different blocks namely between real side and government budget; government budget, money and BOP; money and real side.
- Introduce policy instruments to expand the simulation possibility. The range of instruments may include direct and indirect tax rates, tax base, subsidy, exchange rates etc.
- It is argued that the transfer of technology to run the proposed model partly depends on the simplicity and user's friendly feature. Although, the simplification limits the simulation capability of the model, considering the important objective of technology internalization the model will be constructed in an 'Excel' spread sheet.
- The following provides specifications of the macro-economic framework. In accordance to the existing practice, the macro-economic framework contains blocks: Real side; Government Budget; Money; and Balance of Payment. In addition to these blocks, a debt block is appended to capture debt dynamics.

Data period considered in this framework is 2002 to 2007. Almost all data used in the macro-economic framework has been provided by the Finance Division and the FMRP project. Breakdown of value added (i.e. GDP) by labor value added and capital value added was obtained from the updated social accounting for Bangladesh for 2005. World Economic Outlook forecasts were reviewed to get parameters for external sector (e.g. world price of imports and exports, world inflation rate etc.).

It is important to note from the objective and purpose of the 'financing programming' that, it is essentially a framework to assess the financing options in accordance to a targeted economic growth and inflation rate. In contrast to the simulation feature of a CGE model, it is primarily an accounting framework limiting the scope to conduct policy simulations. Moreover, it is specified at the macro level restricting the scope of sectoral impacts analysis and output generation. Despite its' limitation as a simulation framework, a number of scenario generation capabilities are incorporated. A possible list of policy simulations available in the framework is given below:

- Altering indirect tax bases (both domestic and external) various types of indirect tax bases. For instance, these may include bases of VAT, excise duty, import duties, supplementary duty, and all other taxes.
- Altering indirect tax rates. For instance, these may include VAT rates, excise rates, import duties, supplementary duty and other rates.

- Expanding direct tax bases by raising the threshold, reducing the exemption and deduction levels.
- Changing the direct tax rates. For instance, these may include personal income tax rates, and corporate tax rates.
- Expanding non-tax revenue sources.
- Expanding the coverage of the government expenditure program both re-current and capital. For instance, full or partial indexing of pay-allowance item to CPI.
- Re-setting world price of imports.
- Re-setting the growth rates of various components of money and credit. They include private credit growth; net other asset growth etc. Variations in them affect net domestic assets leading to changes in money supply.
- Re-setting the growth rates of various balance of payment. For example, they include current transfer; loan disbursement, grant disbursement. Variations in them affect current account balance and resources for deficit-financing implicating the requirement for bank borrowing.

The projection outcomes cover period 2008 to 2015. Outcomes coverage include: (i) incomes and prices; (ii) government income, expenditures, budget deficit and their financing sources; (iii) money supply and usage by components; and (iv) receipts from and payments to the external sectors and balances of current and capital accounts. An indicator table is always available for each simulation.

CHAPTER 1
BACKGROUND

The Asian Development Bank (ADB) provided support to the MOF to formulate a user friendly and easily transferable computable general equilibrium (CGE) model (more specifically a macro-economic framework) to reflect the effect of changes of various public policies and forecast changes of fiscal policy on different sectors of the economy. In this context two rounds of meetings took place between the consultant team and the officials of the MOF before the implementation of the framework. The first meeting was held on 22 January 2008 where Mr. Arastoo Khan, Joint Secretary, MOF introduced the consultant team to the officers of the budget wing and reviewed the different elements of the Terms of Reference (TORs). During the meeting it was discussed that a CGE model is different from the financial programming frameworks of the Bank[1] and the Fund[2] with respect to objective, structure, data need, simulation possibility and outcomes. Moreover, the features of these two different types of frameworks (i.e. CGE and financial programming) usually are not possible to accommodate into an integrated framework. This aspect was pointed out by the consultant team during their meeting with the Finance Division. Considering the above-mentioned difficulties and the priorities of the Finance Division, it was agreed that the modeling exercise will be compatible with the financial programming framework. Thus it was agreed that the first item of the TORs will not be covered in the study. Other item of the TORs will be retained. It was further decided to add features to the exiting macro-economic framework of the MOF. Accordingly a review of the macro-economic framework of the MOF involving the consultant team and the officials of budget wing was proposed. An in-depth review of various components of the MOF framework took place on 29 January 2008. Md. Abdur Rahim Khan and Md. Habibur Rahman, Senior Assistant Secretary, MOF presented the MOF macro-economic framework to the consultant team.

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1 The Bank's model examines the overall amount of resource that a country required to meet its target economic growth rate. Having estimated likely investment from domestic taxation and savings plus foreign investment it determines how much additional finance is required from development agencies. The so-called "financing gap" is then filled by aid grants and loans.

2 The Financial Programming Model (FPM) is a dynamic monetarist framework developed by IMF to study the effects on income and balance of payments of two important policy variables- changes in exports and bank credit i.e. foreign and domestic additions to a country's money supply.

CHAPTER 2
A BRIEF ASSESSMENT OF EXISTING 'FINANCIAL' PROGRAMME AT MOF

The MOF in Bangladesh, among others, is entrusted to formulate short and medium development plans to enhance welfare and reduce poverty of the people. The short-term plan and the medium term plans are respectively known as the annual budget and medium term macro economic framework (MTMF). The Budget wing of the MOF has been maintaining a Macro-economic Framework to assist the preparation of short and medium term macro-economic frameworks. The framework falls into the well-known class of financial programming framework used by the Bretton Woods institutions. The framework consists mainly of four major blocks: (i) Real Side; (ii) Government Budget; (iii) Money and Credit; and (iv) Balance of Payment. In addition to these four blocks, the MOF framework contains few extra worksheets to assist a more thorough understanding of the expenditure budget and preparation of the monetary survey component. Moreover it shows projection of sectoral GDP. The sector classification follows the sector classification adopted the Bangladesh Bureau of Statistics (BBS).

An examination of resource requirement consistent with the target growth rate is the starting point. Once the policy-makers/analysts reach consensus on the rate of economic growth for the short and medium term, the next question that comes up is, how much investment is needed to achieve the targeted economic growth? Using the ICOR criteria, the investment requirement are ascertained.

Given the projection of national savings, it provides an assessment of the extent of resource gap or the savings-investment gaps. The overall savings-investment gaps are further broken down by institutions e.g. private and public sectors. Given the projections of revenue, private income, foreign direct investment, extent of public credit, and external assistance, it then assesses, whether the resource requirement can be realized. Depending on the extent of resource gap covered, further modifications of the targeted economic growth rate may take place. The iterative process continues until satisfactory outcomes are achieved. A Medium Term Working Group was formed with representatives from various institutions such as Bangladesh Bank, National Board of Revenue, Comptroller General of Audit, Bangladesh Bureau of Statistics, External Resource Department, National Savings Department, Programming and General Economics Divisions of the Planning Commission and Ministry of Finance. The members of working groups are actively involved in the formulation of the medium term macro outlook. More specifically, the frameworks provide:

- An assessment of the overall resource requirement to achieve target economic growths. Institutions -- private and public, further classify the savings-investment gaps.
- A projection of government revenue and expenditure and implied resource gap of the public sector. Explore various options to bridge the public sector resource gap through domestic and external resource mobilization.
- Detailed description of re-current and development budgets in other word, detail description of the public sector expenditure by major categories.
- An estimation of money supply and other correlates of money market in line with targeted growth, resource gaps and inflation.
- A detailed delineation of the various components of the balance of payment to capture trade-gap, current account balance, remittance flow, availability of net loan and reserve position.

The framework, however, can be improved by additions and modifications that are pointed out below:

- Introducing behavioral specifications to describe the behavior of key macro economic variables such production, capital formation, consumption and investment.
- The weak linkages between the four blocks with respect to their interdependence may be enhanced. For instance, domestic revenue generation critically depends on two components: (a) revenue base and (ii) tax rate. The normal growth of revenue base depends on the growth of the economy i.e. the revenue base should be linked to the estimated GDP and imports.
- Expanding the simulation capability by introducing policy instruments. As mentioned earlier, since the equations are not specified behaviorally, the scope to incorporate policy instruments is limited, thus restricting the simulation possibility. With the introduction of behavior specification of revenue function, money, credit, prices simulation possibilities may be expanded.

CHAPTER 3
PROPOSED MODIFICATION TO EXISTING FRAMEWORK

The Finance division categorically indicated that they would seek extensions to the existing framework to add the following attributes:

1. Introduce behavioral specifications for some keys variables — namely the production behavior; revenue functions; capital formation; private investment functions; private consumption etc.
2. Improve the interdependence between variables of different blocks namely between real side and government budget; government budget, money and BOP; money and real side.
3. Introduce policy instruments to expand the simulation possibility. The range of instruments may include-direct and indirect tax rates, tax base, subsidy, exchange rates etc.
4. It is argued that the transfer of technology to run the proposed model partly depends on the simplicity and user's friendly feature. Although, the simplification limits the simulation capability of the model, considering the important objective of technology internalization the model will be constructed in an 'Excel' spread sheet.
5. The following provides specifications of the macro-economic framework[3]. In accordance to the existing practice, the macro-economic framework contains blocks: Real side, Government Budget, Money, and Balance of Payment. In addition to these blocks, a debt block is appended to capture debt dynamics.

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[3] Some of the specifications are adapted from Riched Barth and William Hemphil (2000) edited "Financial Programming and Policy: The Case of Turkey", IMF Institute.

CHAPTER 4
SPECIFICATION

Specification of the macroeconomic framework is discussed in this section. These are discussed in terms of five sub-sections such as (a) Production, Supply and Demand; (b) Government Income and Expenditure; (c) Balance of Payment; (d) Money and Credit; and (e) Government Debt.

Following notations are introduced for identification and references.

Symbol		Description
r	=	Real Variable
−1	=	Previous Year
g	=	Growth Rate
t	=	Tax Rate
Δ	=	Change over previous year
T	=	Time

Production, Supply and Demand

Specifications of nominal and real variables of supply and demand components are presented here. Moreover, generation of various prices is also discussed in this section.

Nominal Variables

Real GDP (r_GDP) is multiplied by GDP deflator (PGDP) to derive nominal GDP. The specification is shown below.

1.   Nominal GDP $GDP = r\_GDP * PGDP$

Derivations of r_GDP and GDP deflator are provided in equations (6) and (26) respectively.

Private consumption of the last year is augmented by growth rate to derive the current level of private consumption. The growth is specified as a product of the growth of real private consumption and consumer price index (CPI). The specification is shown below.

2.   Private Consumption $Cpv = (Cpv\text{-}1 * (r\_Cpv / r\_Cpv\text{-}1) * (1+CPI))$

Derivations of real private consumption (r_Cpv) and CPI are provided in equations (12) and (18) respectively.

Combined growths of pay and allowance and purchase of good and services recorded in the expenditure head of the government budget is used to adjust lagged government consumption to derive the current level of government consumption. This is specified below.

3.	Government Consumption	Cg = (Cg-1 * ((PAL + GDS)/(PAL-1 + GDS-1))
		Allocations for Pay-allowances and good-services are found in current expenditure component of government budget (see equations 44 and 45)

Lagged private investment is adjusted by a growth rate to derive the current level of private investment. The growth is specified as a product of the growth of real private investment and investment price index (PI). The specification is shown below.

4.	Private Investment	Ipv = (Ipv-1 *(r_Ipv / r_Ipv-1)*(1+PI))
		Derivations of real private investment (r_Ipv) and PI are provided in equations (9) and (25) respectively.

Growth of annual development programme (ADP) and Non ADP allocations recorded in the expenditure head of the government budget is utilized to adjust lagged pubic investment to derive the current level of public investment. This is specified below.

5.	Public Investment	Ipb = (Ipb-1 * ((ADP + Non-ADP)/(ADP-1 + Non-ADP-1))
		ADP and Non-ADP allocations are found in expenditure component of government budget (see equations 51 and 52)

Real Variables

Two alternative specifications are employed to specify the real production of good and services. In the first specification, labor and capital factors are organized in a Cobb-Douglas production function to generate real value addition (i.e. r_GDP). The specification is shown below.

6.	Real GDP	$r\_GDP = AL^{\alpha}K^{\beta}$
		Where, α and β denote labor and capital shares respectively. Separation of real value addition between labor and capital factors is not readily available for all years of the data period (i.e. 2003 to 2006). As an alternative data on the distribution of real value added between labor and capital factors found in the input-output table (IOT) of

Bangladesh for 2000 has been used to separate the real value added between labor and capital[4].

Once the values of α and β parameters are known, the only unknown parameter (i.e. A— shift parameter or intercept term) is calculated using the following specification.

$$A = \frac{r\_GDP}{L^{\alpha} K^{\beta}}$$

6.1	Real GDP	r_GDP = r_GDP-1*(1+g r_GDP)

Alternatively real GDP or real value addition can be specified to grow at assumed rates or rates based on observed (reported) ICOR. A 'switch' function (i.e. logical option attribute available in Excel) is used to switch between the endogenous specification (equation 6) and exogenous specification (equation 6.1).

7.	Capital Stock	K = Ks *(1— κ)

Gross Capital is depleted annually by the depreciation and obsolescence to provide net capital stock available for production. Here κ refers to the rate of depreciation and obsolescence.

Gross capital stock is specified as: Ks = K0 + r_I-1. The specification envisages one year lag between planned and realized investment (given the experience of Bangladesh this appears a reasonable assumption).

8.	Labour Demand	$L = \dfrac{\alpha}{\beta} \dfrac{r}{w} K$

Labour demand is usually derived from the solution of the first order cost minimization condition involving the production function and the cost function (i.e. C = wL + rK). Here w and r denote returns to labor and capital respectively. The demand function suggests that, given the ratios of factor share and factor return, increase in capital led to a proportionate rise in labor demand. For instance, doubling of capital will double the labor demand.

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[4] Values of all parameters (including production function) are contained in the five worksheets of the macro economic framework.

Such a strong proportionate relationship can be modified by imposing labor absorption elasticity with respect to capital. Such a modification may allow us to invoke feature the observed condition of jobless growth or growth with less than proportionate employment. The modified labor demand function may take the following form[5].

$$L = \frac{\alpha}{\beta} \frac{r}{w} K^{1/\rho}$$

Alternatively, constant elasticity substitution (CES) function or generalized Leontief function may also be adopted to specify the production behavior.

Real private investment is determined by lagged real GDP or real income, real private credit and average lending rate. Variations in real income and credit tend to influence real private investment positively while higher lending rates depress current investment implying negative association between them. The specification is shown below.

9. Real Private Investment $\quad$ r_Ipv = ψ0 + ψ1* r_GDP-1 + ψ2* r_CRpv − ψ3* ALR

Although a number of explanatory variables may explain the real private investment, a review of estimated equations (please see Annex 2) suggests above specification to be the appropriate one given data constraints, statistical significance and relevance (or linkages) to other variables used in this framework.

Lagged public investment is augmented by an adjusted growth rate to calculate the current level of real public investment. Growth of public investment is deflated by investment price (PI) to derive the adjusted growth. This is specified as.

10. Real Public Investment $\quad$ r_Ipb = (r_Ipb-1 * (Ipb / Ipb-1) / (1+PI))

Derivations of public investment (Ipb) and investment price (PI) are provided in equations (5) and (25) respectively.

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[5] Alternatively, labor demand may assume to grow at the observed growth rate reflecting a steady state. According to labor force statistics labor demand grew at 4 percent between 200o and 2003 and by 5 percent between 2003 and 2005. In this exercise, scope to adopt alternative specifications – modified labor demand and steady state is allowed to assess impacts of these specifications.

Real investment is composed of real private investment and real public investment. This is specified below.

11.	Real Investment	$r\_I = r\_Ipv + r\_Ipb$

Real private consumption has been found to be determined by real GDP or real income, change in real income (ΔGDP) and the average time deposit rate (ATD). Variations in real income tend to influence real private consumption positively while higher deposit rate depress current consumption implying negative association between them. The specification is shown below.

12.	Real Private Consumption	$r\_Cpv = \lambda0 + \lambda1 * r\_GDP + \lambda2 * \Delta GDP - \lambda3 * ATD \text{ Rate}$

Although a number of explanatory variables may explain the real private consumption in Bangladesh, a review of estimated equations (please see Annex 2) suggests above specification to be the appropriate one given data constraints, statistical significance and relevance (or linkages) to other variables used in this framework.

Lagged public consumption is augmented by an adjusted growth rate to derive the current level of real public consumption. Growth of public consumption is deflated by CPI to calculate the adjusted growth. The specification is shown below.

13.	Real Government Consumption	$r\_Cpb = (r\_Cpb\text{-}1 * (Cpb / Cpb\text{-}1) / (1+CPI))$

Derivations of public consumption (Cpb) and CPI are provided in equations (3) and (18) respectively.

Excess demand shows the difference between potential real income (i.e. r_GDP) and actual (i.e. realized) real income or real GDP. The variations between the potential and realized real income influence the imports and exports. Calculation of the excess demand requires estimated values of real GDP and potential real GDP. Estimation of real GDP is described above (equation 6), while specifications of trend and excess demand are shown below.

14.	Potential real GDP	$r\_TGDP = \gamma0 + \gamma1 * T$

Where, γ0 and γ1 denote intercept and slope parameters.

Difference between real GDP and real trend GDP (i.e. potential) defines the excess demand. The specification is shown below.

15.	Excess Demand	Excess Demand (GAP) = $r\_TGDP - r\_GDP$

Real import has been found to be determined by real GDP or real income, excess demand or gap between the potential and realized income and real remittance. The specification is shown below.

16.   Real Imports $r\_M = \mu0 + \mu1 * r\_GDP + \mu2 * GAP + \mu3 * r\_Remit$

Although a number of explanatory variables may explain the real private imports in Bangladesh, a review of estimated equations (please see Annex 2) suggests above specification to be the appropriate one given data constraints, statistical significance and relevance (or linkages) to other variables used in this framework.

Real export has been found to be determined by real GDP or real income, excess demand or gap between the potential and realized income and average of export to domestic price relatives. The specification is shown below.

17.   Real Exports $r\_E = ή0 + ή1 * r\_GDP + ή2 * GAP + ή3$
                             $((EPI/(PGDP/AER)) + (EPI\text{-}1/(PGDP\text{-}1/AER\text{-}1)))$

Although a number of explanatory variables may explain the real private exports, a review of estimated equations (please see Annex 2) suggests above specification to be the appropriate one given data constraints, statistical significance and relevance (or linkages) to other variables used in this framework.

Prices

Consumer price index has been found to be explained by import price, money supply (M2) and remittance[6]. Positive associations have been found between these explanatory variables and CPI. The specification is shown below.

18.   Consumer Price Index $CPI = \varphi0 + \varphi1 * PM\text{-}1 + \varphi2 * M2 + \varphi3 * Remit -$
                             $\varphi4 * (Subsidy + Food\ Allocations)$

Although a number of explanatory variables may explain the consumer price index in Bangladesh, a review of estimated equations (please see Annex 2) suggests above specification to be the appropriate one given data constraints, statistical significance and relevance (or linkages) to other variables used in this framework.

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[6] It was suggested that the aim of subsidy is to depress the consumer price index. However, the hypothesis could not be tested due to paucity of subsidy data. An assumed response value of 0.15 is used to capture the association between CPI and allocations for subsidy and food.

Import price index (MPI) is multiplied by the period average nominal exchange rate (AER) and import tariff rate (Tm) to derive import price. The specifications of import price and import price index are shown below.

19.   Import Price   PM = MPI *(1+ AER + Tm)

20.   Import Price Index   MPI = MPI-1 * (1+ gM_Deflator)

Following small country assumption, Bangladesh is a price taker and thus import and export indices are exogenous. Lagged import price index is adjusted by growth of import deflator (gM_Deflator). Growth of import deflator is based on the estimates of the 'World Economic Outlook'.

Variation in world price import will thus transmit to the domestic economy via these two prices (i.e. PM and MPI).

Export price index (EPI) is multiplied by the period average nominal exchange rate (AER) to derive export price. The specifications of export price and export price index are shown below.

21.   Export Price   PE = EPI * (1+ AER)

22.   Export Price Index   EPI = EPI-1 * (1+ gE_Deflator)

Lagged export price index is augmented by growth of export deflator (gE_Deflator) which is based on the estimates of the 'World Economic Outlook'.

Average exchange rate (AER) is as a function of domestic and foreign inflation, and real effective exchange rate. Derivation of average exchange rate is shown below.

23.   Average Exchange Rate

$$AER = AER_{-1} \cdot \left(\frac{1+gCPI}{1+gFPI} \right) \cdot \left(\frac{\operatorname{Re}R}{\operatorname{Re}R_{-1}} \right)$$

Where, gCPI= domestic inflation; gFPI = foreign inflation which is exogenous and based on world economic outlook; ReR = Real effective exchange rate. Values of real effective exchange rate are exogenous.

24.   Exchange Rate End Period

$$ERP = \left(AER \cdot 2 \right) - ERP_{-1}$$

Where, FRP$_{-1}$ = lagged value of end period exchange rate.

Investment in Bangladesh consists of imported capital goods and domestically produced capital goods. Thus variations in import price and CPI influence the investment price. The specification of investment price index is shown below.

25.   Investment Price Index   PI = ζm * PM + ζd * CPI

Where, ζm = share capital goods import; ζd = share domestic capital goods.

The accounting identity equating nominal GDP to the sum of different spending categories has been used to derive the GDP deflator. The derived GDP is consistent with projected GDP; as other components of supply and demand, CPI and other prices. Derivation of GDP deflator is shown below.

26.   GDP Deflator

PGDP = CPI *(r_Cpv / r_GDP) + CPI *(r_Cg / r_GDP) + PI *(r_Ipv / r_GDP) + PI *(r_Ipb / r_GDP) + PE *(r_E / r_GDP) − PM *(r_M / r_GDP)

Accounting identity states GDP = Cpv + Cpb + Ipv + Ipb + E − M.

Dividing both sides by r_GDP gives:

$$\frac{GDP}{r\_GDP} = \frac{Cpv}{r\_GDP} + \frac{Cpb}{r\_GDP} +$$
$$\frac{Ipv}{r\_GDP} \frac{Ipv}{r\_GDP} + \frac{E}{r\_GDP} - \frac{M}{r\_GDP}$$

The terms on the right-hand side may be decomposed into two factors as follows:

$$\frac{GDP}{r\_GDP} = \frac{Cpv}{r\_Cpv} \frac{r\_Cpv}{r\_GDP} + \frac{Cpb}{r\_Cpb} \frac{r\_Cpb}{r\_GDP} + \frac{Ipv}{r\_Ipv} \frac{r\_Ipv}{r\_GDP} +$$
$$\frac{Ipb}{r\_Ipb} \frac{r\_Ipb}{r\_GDP} + \frac{E}{r\_E} \frac{r\_E}{r\_GDP} - \frac{M}{r\_M} \frac{r\_M}{r\_GDP}$$

This gives us the specification for GDP deflator as follows.

$$PGDP = CPI \frac{r\_Cpv}{r\_GDP} + CPI \frac{r\_Cpb}{r\_GDP} + PI \frac{r\_Ipv}{r\_GDP} +$$
$$PI \frac{r\_Ipb}{r\_GDP} + PE \frac{r\_E}{r\_GDP} - PM \frac{r\_M}{r\_GDP}$$

Fiscal Side: Government Income and Expenditure

Revenue

Revenue mobilization is usually classified under three heads in Bangladesh-NBR tax; Non-NBR tax and Non-tax revenue. Almost all major tax sources are covered under the NBR tax head and thus constitute the major revenue source. All types direct and indirect taxes are covered under this head. In order to provide scopes to assess implication of tax base change as well as tax rate change on revenue, revenue specifications are defined in terms of estimated legal tax bases and effective tax rates. Legal bases of a particular tax system constitute a smaller segment of the corresponding economy-wide bases (i.e. GDP for domestic taxes, imports for trade taxes, etc.), which are considered as the tax bases for levying tax rates. Legal bases (for instance the base of domestic VAT) are usually significantly smaller than the economy-wide bases (the economy-wide base for domestic VAT is GDP or consumption) due to exemptions, exclusions and deductions. Following example describes the relationship between economy-wide base and the legal base.

> **Tax Revenue = Legal Tax Base x Tax Rate.   Where, Legal Tax Base ≤ Economy Wide Base.**

The advantages of this specification are briefly discussed.

- It allows endogenous adjustment of the legal bases due to variations in the corresponding economy-wide bases.
- It thus shows, with fixed tax rates, revenue changes due mainly to the endogenous legal base change.
- The size of legal bases can be altered by introducing new measures to change coverage.
- It thus captures, with fixed tax rates, revenue changes due to the endogenous legal base change and new measures led coverage change.
- It also captures, with varying legal bases (either due to endogenous change or due to new coverage measures), revenue changes due to the imposition of new tax rates.

The major problem with the above specification is the non availability of legal base data by various tax systems. However, this information can be obtained from the records of the National Board of Revenue (NBR)[7]. An illustration of tax revenue sources and proxy bases is presented in Annex 3.

As mentioned above, according to the adopted classification, total revenue is composed of tax revenue and non tax revenue. Tax revenue is generated from two broad heads: NBR taxes and Non-NBR tax. NBR tax accounts for about 95 percent of tax revenue collection. It includes revenue mobilization from income bases; domestic production/consumption bases and international trade bases. The revenue generations are defined below.

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[7] In an earlier paper Mansur and Khondker (1994) estimated the legal base of the Bangladesh tax system. For details please see Ahsan H. Mansur and Bazlul Haque Khondker (1994), "Some Estimates of Tax Potential with Reference to Bangladesh", Dhaka University Journal of Business Studies, Vol. 15(1), 117-119.

27.	Total Revenue	Total Revenue = Tax Revenue + Non Tax Revenue

28.	Tax Revenue	Tax Revenue = NBR Tax + Non NBR Tax

29.	NBR Tax	NBR Tax = YTax + DoMTax + Trade Tax

Specifications of the NBR tax revenue related to the domestic sources are discussed below. They include six types of taxes-two direct and four indirect types. In all cases, tax revenue is defined to generate from imposing average effective tax rates on the respective legal tax bases. The economy wide bases for these taxes are the gross domestic product and household income. The specifications by each type of tax system are shown below.

30.	Income Tax	$YTax = YhTAX + YcorTAX$

Specifications of personal income tax (YhTAX) and corporate income tax (YcorTAX) are discussed below.

31.	Personal Income Tax	$YhTAX = b\_YhTAX \times tyh$

Where, $b\_YhTAX = [\upsilon1 \times Yh]$; $\upsilon1$ = current coverage; tyh = average income tax rate. Household income is defined as $Yh = GDP + Remittance$. **Household income generation is endogenous.**

32.	Corporate Income Tax	$YcorTAX = b\_YcorTAX \times tycor$

Where, $b\_YcorTAX = [\upsilon2 \times GDP]$; $\upsilon2$ = current coverage; $tycor$ = average corporate income tax rate. Appropriate base for the corporate income tax is corporate profit. Since data on the corporate profit is not readily available, as a proximate base GDP is used.

33.	Taxes on Domestic Production	$DoMTax = DoMVAT + DoMSUP + ExciseDuty + OtherTax$

Specifications of these taxes are discussed below.

34.	Domestic VAT Revenue	$DoMVAT = b\_DoMVAT \times tvat$

Where, $b\_DoMVAT = [\alpha1 \times Cpv]$; $\alpha1$ = current coverage; $tvat$ = vat rate. **The economy wide base private consumption (Cpv) is derived endogenously in the real side.**

35.	Domestic Supplementary Duty	$DoMSUP = DoMVAT \times tsd$

Where, tsd = supplementary duty rate

36.	Excise Duty	$ExciseDuty = b\_ExcDuty \times texcise$

Where, $b\_ExcDuty = [\alpha2 \times GDP]$; $\alpha2$ = current coverage;

texcise = excise duty

37.	Other Tax Revenue	OtherTax= b_OthTax x tothtax

Where, b_OthTax = [$\alpha 3$ x GDP]; $\alpha 3$ = current coverage; texcise = other tax rate

Specifications of the NBR tax revenue mobilized from import base are discussed below. They include three types of taxes. In all cases, tax revenue is again defined to generate from imposing effective tax rates on the respective legal tax bases. The economy wide bases for these taxes are import values. The specifications for each type of tax are shown below.

38.	Taxes on International Trade	Trade Tax = CustomDuty + MVAT + MSUP

Specifications of these taxes are discussed below.

39.	Custom Duty	CustomDuty= b_CuSDuty x tcd

Where, b_CuSDuty = [$\sigma 1$ x M]; $\sigma 1$ = current coverage; tcd = Custom Duty. **The economy wide base import (M) is derived endogenously in the real side and BoP side**.

40.	Import VAT	MVAT= b_MVAT x tvat

Where, b_MVAT = [($\sigma 2$ x M) + (CustomDuty)]; $\sigma 2$ = current coverage; tvat = vat rate

41.	Supplementary Duty	MSUP = MVAT x tsd

Where, tsd = supplementary duty rate

Non tax revenues and non NBR tax revenues are generated from various heterogeneous sources. The economy wide as well as legal bases of these various types are very difficult to ascertain and hence specification based on legal bases is not considered for the non-NBR tax and non-tax revenue categories. Growth rate specification has been adopted, where revenue is assumed to grow at specified rates. The specification for these two types of tax is shown below.

42.	Non NBR Tax Revenue	Non NBR Tax = NonNBRTax-1 * (1+gNonNBRTax)

Where, gNonNBRTax = Non NBR tax growth. Non NBR tax growth adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

| 43. | Non Tax Revenue | Non Tax = $NonTax_{-1}$ * (1+gNonTax) |

Where, gNonTax = Non tax growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

Expenditure

Government expenditure is classified into four different categories. These are (i) pay-allowances and purchases of goods and services; (ii) interest payment on domestic and external debt; (iii) subsidies and transfers; and (iv) capital and development expenditure.

Specifications for pay and allowances and purchases of goods and services are provided below.

| 44. | Pay and Allowances | PAL = PAL_{-1} * [1+ (gPAL+ θgCPI)] |

Where, gPAL = pay and allowance growth; θgCPI = inflation indexing subject to the value of θ. The value of θ ranges between 0 and 1. Condition θ = 0 implies no inflation indexing whereas condition θ = 1 delineates full inflation indexing. CPI is derived endogenously. Value of gPAL captures rise in pay and allowances due to new employment and measures.

| 45. | Goods and Services | GDS = GDS_{-1} * [1+ (gGDS+ θgPGDP)] |

Where, gGDS = good and services growth; θgPGDP = general price indexing subject to the value of θ. The value of θ ranges between 0 and 1. Condition θ = 0 implies no indexing whereas condition θ = 1 delineates full inflation indexing. GDP deflator is derived endogenously. Value of gGDS captures increased allocation for new purchases.

A significant part of resources is spent to pay for interest accrued to domestic and external debt. The size of interest payment depends on debt dynamics. Interest payment projections are derived in the debt block and hence are obtained directly from the debt block.

46.	Domestic Interest	DoMInTPay
		Derived in the debt block. See equation 69.
47.	External Interest	ExTInTPay
		Derived in the debt block. See equation 70.

Allocations for subsidies and various transfer program have been increasing in recent years to mitigate real income loss of various vulnerable groups as; income loss of public enterprises and to restrict full incidence of world prices of key importable on the domestic economy[8]. The specifications for transfers and subsidies are provided below.

| 48. | Subsidy and Transfers | $SAT = SAT_{-1} * [1+ (gSAT+ \chi 1PM)]$ |

Where, gSAT = subsidy and transfer growth; χ1PM = indexing to rise in import prices of other than food items (i.e. fuel and fertilizer) subject to the value of χ1. The value of χ1 ranges between 0 and 1. Condition χ1 = 0 implies no indexing whereas condition χ1 = 1 delineates full indexing. Value of gSAT envisages trend rise as well as rise due to new measures.

| 49. | Block Allocation | $BAC = BAC_{-1} * (1+gBAC)$ |

Where, gBAC = block allocation growth.

| 50. | Food Account | $FAC = FAC_{-1} * [1+ (gFAC+ \chi 2PM)]$ |

Where, gSAT = subsidy and transfer growth; χ2PM = indexing to rise in food import prices subject to the value of χ2. The value of χ2 ranges between 0 and 1. Condition χ2 = 0 implies no indexing whereas condition χ2 = 1 delineates full indexing. Value of gFAC envisages trend rise as well as rise due to new measures.

The main objectives of development and capital expenditures are to create opportunities for economic growth in line with the overall development perspective. Thus allocations may vary in accordance to the development goals. Such decisions although consistent with the development goals and other key parameters, they are usually exogenous to the system. The specifications of the development and capital expenditures are shown below.

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[8] Although it is expected that subsidies restraint full transmission of world import prices the association between subsidy and CPI could not tested due to lack time series data. We could collect data for 10 years i.e. 1989 to 2007.

| 51. | Annual Development Programme | ADP = ADP-1 * (1+gADP)

Where, gADP = ADP growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook. |
|---|---|---|
| 52. | Non ADP Capital Expenditure | NonADP_CAP = NonADP_CAP -1 * (1+gNonADP_CAP)

Where, gNonADP_CAP = Non ADP capital expenditure growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook. |
| 53. | Net Lending | NeTLend = NeTLend -1 * (1+gNeTLend)

Where, gNeTLend = Net lending growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook. |
| 54. | Extra ordinary | ExOrd = ExOrd -1 * (1+gExOrd)

Where, gExOrd = Extra ordinary expenditure growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook. |

The difference between government income (i.e. total revenue) and total government expenditure (i.e. total expenditure) shows the balance of the government budget. This is defined as:

55.	Budget Balance	Deficit = Total Revenue — Total Expenditure

Due to low tax effort and higher demand for expenditures balance of government account is usually in deficit. Budget deficits are covered by borrowing from the domestic and external sources. Net availability of foreign borrowing (i.e. NetLoan of the BOP account) is generally obtained from the BOP account and exogenous to the system. This is usually the first source sought to cover the deficit.

There are two domestic borrowing sources- banking system and private sector (i.e. non bank borrowing). Given the assessment of the borrowing from the private sector (i.e. in the form of savings certificates and government bonds), the remaining budget deficit amounts are covered by borrowing from the banking system. Thus lower borrowing from external and non bank sources the higher the borrowing from the banking system. The financing dynamics are captured below.

56.	Deficit Financing	DeficitFinance = NetLoan + Non Bank + Bank

Where, Netloan amounts are taken from BOP and are exogenous. Derivation of domestic borrowings is shown below.

57.	Non Bank Borrowing	Non Bank = ωYh

Where, Yh is household income and defined as Yh = GDP + Remit. Parameters ω denote propensity of household to allocated money for non bank savings instruments. This is derived from the data of non bank borrowing amounts (d non Bank) and estimated household income data (dYh). More specifically, ω = dNon Bank / dYh. Propensity observed for the data period is maintained for the projection period in the trend case. Given the constancy of ω, it is endogenous since household income generation is endogenous.

The propensity may be varied for the projection period in line additional measures covering introduction of new instruments and deposit rates.

58.	Bank Borrowing	Bank = Deficit ─ (NetLoan + Non Bank)

Bank borrowing act as the balancing item and established the link with monetary system. Given the constancy of monetary variables, the higher the bank borrowing requirements the higher could be the pressure on money supply.

Money Side: Money Supply and Domestic Credit

The money stock (or supply) is an important policy instrument. Authorities influence the macroeconomic dynamic by changing the size of the money supply. Changes in money supply lead to changes in liquidity, which may affect expenditure, production, employment, as well as the balance of payments. The liquidity position also affects factors such as real incomes, prices and interest rates, which usually influences the behavior of how money is held. Furthermore, in a resource scarce economy under conditions of declining external inflows, governments usually turn to the banking sector for funds to bridge budget and resource gaps. Thus, the size of the money supply and the behavior of other related monetary variables determine the size of government borrowing.

Furnished by its member countries, the International Monetary Fund (IMF) presents monetary and financial data on three levels. The balance sheets of the monetary authority (MA), usually central banks and deposit money banks (DMB) are included in this first level. In the second level, the balance sheets of MA and DBM are consolidated into a Monetary Survey. A monetary survey provides a statistical measure of money and credit. Finally, the third level data consolidates the balance sheets of a monetary survey and non-bank

financial institutions (NBFIs) into a Financial Survey. In creating the macroeconomic framework described in this paper, the focus is on the monetary survey or banking system[9] since it provides sufficient information concerning money and credit.

Money supply (M_2) is determined by the combined sizes of the net domestic assets and net foreign assets. The money supply function is specified as:

59.   Money Supply   M2 = NDA + NFA

> As mentioned above, NDA is based on public and private credit. Public credit requirement is generated in the fiscal side as a result of endogenous revenue generation and policy driven as well as endogenous expenditures. It thus established linkages with fiscal side. Moreover, since generations of revenue, expenditure and deficit are influenced by movements of real variables and prices, money supply is endogenous, consistent and interdependent.

Net foreign asset is a policy variable determined with respect to the overall money and credit situation. This is defined as:

60.   Net Foreign Asset   NFA = NFA -1 x (1 + g NFA)

> Where, g NFA = NFA growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

The stock of net domestic asset (NDA) is defined by the combined sizes of the domestic credit (DCR) and nets other asset (NOA).

61.   Net Domestic Asset   NDA = DCR + NOA

In this exercise, the required level of money supply is contingent on the size of domestic credit in particular the required size of public credit (CRg) from the baking system. The required size of public credit is equal to the gap between the budget deficit amount and combined resources expected from foreign loan and non bank borrowing. Credits to the private (CRpv) and non financial sector (CRnonfin) are policy variables determined with respect to the investment planning. Domestic credit flow at a particular time is composed of flows of all types of credit. This is defined as:

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[9] Three reasons are cited for focusing on the banking system rather than the entire financial system. (1) Empirical evidence suggests a strong association between the monetary liabilities of the banking sector and aggregate nominal expenditure in an economy thereby affecting inflation, balance of payments and growth. (2) Ready availability of banking sector data for monitoring and analysis. (3) For most of the developing and transition economics, where the financial markets are still not well developed, the banking system accounts for a major segment of the economy's financial assets and liabilities.

62.   Domestic Credit   DCR = CRpb + CRpv + CRnonfin

Where, public credit is determined in the fiscal side and is defined as CRpb = Budget Deficit ─ (Loan + Non Bank). The established the like to fiscal side.

As mentioned, the required size of public credit is equal to the gap between the budget deficit amount and combined resources expected from foreign loan and non bank borrowings. Variations in public credit requirement based on the size of budget deficit, foreign loan and non-borrowing may likely to influence the size of money supply[10]. The association between fiscal and money sectors is depicted in Figure 1.

Figure 1: Linkage between Fiscal side and Money side

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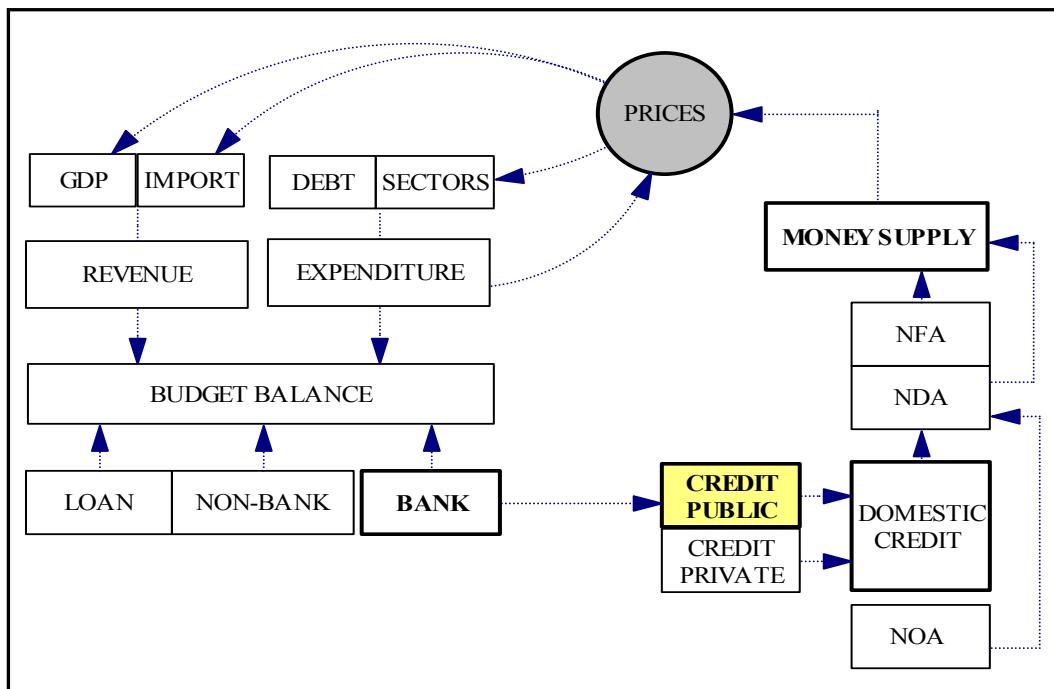
[10] The association may be governed by the liquidity positions of the banking system. In a situation of high liquidity required public borrowings may be covered from the existing liquidity leading to negligible impact on the growth of money supply. In other situation, the impact may be significant.

Credit to private sector (CRpv) and non financial (CRnonfin) is a policy variable determined with respect to the investment planning. Domestic credit flow at a particular time is composed of flows of public and private credit. This is defined as:

63.   Private Credit   CRpv = CRpv-1 x (1 + gCRpv)

Where, gCRpv = private credit growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

64.   Credit Non Financial   CRnonfin = CRnonfin -1 x (1 + g CRnonfin)

Where, CRnonfin = credit growth of the non financial sector. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

Net other asset is a policy variable determined with respect to the overall money and credit situation. This is defined as:

65.   Net Other Asset   NOA = NOA -1 x (1 + g NOA)

Where, g NOA = private credit growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

Stock of Debt and Interest Payment

Allocation for interest payment essentially depends on the size of debt stock and effective rate of interest. Although a detail debt stock model is usually used to estimates stock of outstanding debt, here a simplified framework is adopted to capture debt dynamics and corresponding interest payment liabilities. Current levels of borrowings are added to their outstanding debt to estimate stock of debt. Effective interest rates are then applied to the debt stock to calculate interest payment liabilities of the current year[11]. The estimated interest payment liabilities are directly linked to expenditure component of the government budget to capture allocation for interest payment. Debt and interest payment specifications are shown below.

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[11] As mentioned, a detailed debt model may be used to capture dynamics. A detail debt model usually captures debt by different agencies and differential interest rates and maturity period. The results of such a detailed debt framework can easily be linked to the other blocks of the existing framework.

66.	Domestic Debt: Bank Borrowing	Debt_Bank = Debt_Bank0 + Bank (Fiscal)

Where, Debt_Bank0 = initial outstanding domestic debt from the bank sector. In this case debt at year 2002 (i.e. the initial year); Bank = borrowing from the banking system (observed for years 2002 to 2006; estimates for projection years) to cover the budget deficit. These estimates (i.e. bank borrowings) are found in the expenditure component of the government budget. It thus established links to fiscal side. Variations in bank borrowing will implicate the debt dynamics and interest payment liabilities.

67.	Domestic Debt: Non Bank Borrowing	Debt_NonBank = Debt_NonBank0 + NonBank (Fiscal)

Where, Debt_Bank0 = initial outstanding domestic debt from the private sector; NonBank = borrowing from the private sector (observed for years 2002 to 2006; estimates for projection years) to cover the budget deficit. These estimates (i.e. non bank borrowings) are found in the expenditure component of the government budget. It thus established links to fiscal side as well as with the real side. Variations in non bank borrowing will implicate the debt dynamics and interest payment liabilities.

68.	External Debt: Foreign Loan	Debt_Loan = Debt_Loan0 + NetLoan (Fiscal/BoP)

Where, Debt_Loan0 = initial outstanding foreign debt. NetLoan = net borrowing from the external which is calculated by deducting 'amortization' from 'loan disbursement'. The figures for years 2002 to 2006 are observed and for projection years they are estimated. These estimates (i.e. net loan) are found in the BoP as well as in the expenditure component of the government budget. It thus established links to fiscal side as well as with BoP. Variations in net loan will affect the debt dynamics and foreign interest payment liabilities.

Interest payment liabilities reported for the data periods are divided by their respective outstanding debts to derive the average effective interest rates for the domestic and external loan. The estimated average effective rates are also adopted in the projection years to estimate the interest payment liabilities.

69.	Domestic Interest Payment Liabilities	DoM_IntPay = (Debt_Bank + Debt_NonBank) x dom_rate

Where, DoM_IntPay = domestic interest payment liabilities; dom_rate = average effective domestic interest rate. The average effective domestic interest rates may be varied for the projection periods capturing outlook changes.

70.	External Interest Payment Liabilities	FoR_IntPay = Debt_Loan x for_rate

Where, FoR_IntPay = external interest payment liabilities; for_rate = average effective foreign interest rate. The average effective foreign interest rates may be varied for the projection periods capturing outlook changes.

Balance of Payment: External Account

Trade balance is defined as the difference between the exports and imports. The specification is shown below.

71.	Trade Balance	$TradeBal = E - M$

Derivations of E and M are shown below.

Lagged Exports is augmented by growth rate to derive the exports of goods and services. The growth is specified as a product of the growth of real exports and export price index (EPI). The specification is shown below.

72.	Exports	$E = (E_{-1} * (r\_E / r\_E_{-1}) * (1 + EPI))$

Derivations of real exports (r_E) and EPI are shown above. Variations in real side as well as prices will effect exports and hence balance of trade.

Lagged Imports is augmented by growth rate to derive the imports of goods and services. The growth is specified as a product of the growth of real imports and import price index (MPI). The specification is shown below.

73.	Imports	$M = (E_{-1} * (r\_M / r\_M_{-1}) * (1 + MPI))$

Derivations of real exports (r_M) and MPI are provided above. Variations in real side as well as prices will effect imports and hence balance of trade.

Service balance is defined as the difference between the receipts and payments. This is specified as:

74.	Service Net	$SrvNet = SrvReceipts - SrvPayments$

Derivations of receipts and payments are shown below.

75.	Service Receipts	SrvReceipts = SrvReceipts-1 x (1 + g SrvReceipts)

Where, g SrvReceipts = receipts growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

76.	Service Payments	SrvPayments = SrvPayments-1 x (1 + gPayments)

Where, gPayments = payment growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

The Balance of Income component is defined as the difference between the receipts and payments. This is specified as:

77.	Income Net	YNet = YReceipts — YPayments

Derivations of receipts and payments are shown below.

78.	Income Receipts	YReceipts = YReceipts-1 x (1 + gYReceipts)

Where, gYReceipts = receipts growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

79.	Income Payments	YPayments = YPayments-1 x (1 + gPayments)

Where, gPayments = payment growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

Current transfer is composed of official and private transfers. Inflow of remittance is included in the private transfer flows. Their specifications are shown below:

80.	Current Transfer	CuRTransfer = PbTransfer + PvTransfer

81.	Public Transfer	PbTransfer = PbTransfer -1 x (1 + gPbTransfer)

Where, g Public Transfer = public transfer growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

82. Private Transfer PvTransfer = PvTransfer -1 x (1 + gPvTransfer)

Where, g PvTransfer = private transfer growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

82.1 Remittance Remit = Remit-1 x (1 + gRemit)

Where, gRemit = remittance growth. Growth rates adopted for the projection period in the trend case may be varied under scenario simulation indicating changed policy outlook.

Balance of current account composes of balances of trade, service, income and current transfers. This is defined as:

83. Current Account Balance CAB = TradeBal + SrvNet +YNet + CuRTransfer

Capital account is defined to move in line with the observed growth rate. The growth rate may be varied to capture changes in the account with consequent impacts on the overall balance of the BoP account. The specification of the capital account is shown below.

84. Capital Account Balance CpAB = CpAB-1 x (1 + gCpAB)   Where, g CpAB = growth.

Financial account consists of a number of elements. They include foreign direct investment; foreign portfolio investment; net foreign loan; other long and short term loans; other assets; trade credit; net of commercial bank activities. In the trend case, these elements are defined to move in line with their observed growth rates. Each of growth rates may be varied to capture changes in the respective component with consequent impacts on financial balance and the overall balance of the BoP account. Specifications of all components of financial accounts are shown below.

85. Financial Account Balance FAB = FDI + FPI + NetLoan + NetLongLoan + NetShortLoan + OthAsset + TrdCredit + ComBank

86. Foreign Direct Investment FDI = FDI-1 x (1 + gFDI)   Where, gFDI = growth.

87. Foreign Portfolio Investment FPI = FPI-1 x (1 + gFPI)   Where, gFPI = growth.

88. Net Loan NetLoan = Disbursement — Amortization.

89. Disbursement Disbursement = Disbursement -1 x (1 + gDisbursement)

Where, gDisbursement = growth.

| 90. | Amortization | Amortization = Amortization -1 x (1 + gAmortization) |
| | | Where, gAmortization = growth. |

| 91. | Net Long Term Loan | NetLongLoan = NetLongLoan -1 x (1 + g NetLongLoan) |
| | | Where, g NetLongLoan = growth. |

| 92. | Net Short Term Loan | NetShortLoan = NetShortLoan -1 x (1 + g NetShortLoan) |
| | | Where, gNetShortLoan = growth. |

| 93. | Other Assets | OthAsset = OthAsset -1 x (1 + gOthAsset) |
| | | Where, gOthAsset = growth. |

| 94. | Trade Credit | TrdCredit = TrdCredit -1 x (1 + gTrdCredit) |
| | | Where, gTrdCredit = growth. |

| 95. | Net Commercial Bank | CoMBank = CoMBank-1 x (1 + gCoMBank) |
| | | Where, gCoMBank = growth. |

Balance of the BOP is captured in the overall balance. It is derived from the sum of all the three balances discussed above.

| 96. | Overall Balance | OVB = CAB + CpAB + FAB |

The overall balance is covered by resource from the central bank. Any further discrepancies between the balance and the central bank resource are put into the error and omissions head.

| 97. | Financing | BoPFinance = BBank + Errors and Omissions |

98.	Bangladesh Bank	BBank = BbAssets + BbLiabilities
	Bangladesh Bank Assets	BbAssets = BbAssets-1 * (1+gBbAsset)
	Bangladesh Bank Liability	BbLibility = BbLibility-1 * (1+gBbLibility)

| 99. | Errors and Omissions | Errors and Omissions = OvBalance ─ BBank |

CHAPTER 5
DATA AND PARAMETERS

Data period considered in this framework is 2002 to 2007. The figures for 2007 were quick estimates. Almost all data used in the macro-economic framework has been provided by the Finance Division and the FMRP project. Data sets (e.g. from mid-eighties to current years) for regression analyses were obtained from various officials documents such as Economic Review and Bangladesh Statistical Year Books. The deficit data covering 1980 to 2006 have been provided by the Finance Division. Breakdown of value added (i.e. GDP) by labour value added and capital value added was obtained from the updated social accounting for Bangladesh for 2005. World Economic Outlook forecasts were reviewed to get parameters for external sector (e.g. world price of imports and exports, world inflation rate etc.).

As mentioned above, the time series data covering the period between the mid 1980s and 2006 (in most cases thereby providing 20 to 25 five year-series) were available to assess the regression coefficients (i.e. response parameters) of the explanatory variables. Regressions were conducted for real private investment; real private consumption; real exports; real imports; and consumer price index. The values of response parameters (i.e. estimated regression coefficients) are then linked to the relevant explanatory variables to first assess the generation of a series of the explained variable in question. For instance, using the estimated coefficient values (e.g. $\lambda 1$ for real GDP; $\lambda 2$ for income change and ($\lambda 3$) for time deposit rate) and the values of real GDP, income change and time deposit, the real private consumption series is estimated[12]. The procedure may not always ensure re-production of observed values. In such cases, an accepted technique is to adjust the values of the constant term[13] of the regressions to recover the observed series (when observations are available) or a consistent series (e.g. consistent with other observed values). The constant term values were adjusted for real exports, real imports and consumer price index.

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[12] This is specified in equation 9. For easy reference it is shown here again. The specification is
r_Cpv $=\lambda 0 + \lambda 1 * $ r_GDP $ + \lambda 2 * \Delta$ GDP $- \lambda 3 * $ ATD Rate.
[13] In multiple regression, the values of constant term are usually treated as mechanical and do not provide useful insight. The purpose of multiple-regression is to get the values of response parameters.

CHAPTER 6
MODEL ESTIMATES VERSUS DATA

Estimates from the model solution are verified against the data series. A super imposition of model estimates on observed data indicated validation of data by model estimates. Model estimates of six variables are checked against their respective data series. The outcomes suggest satisfactory validation.
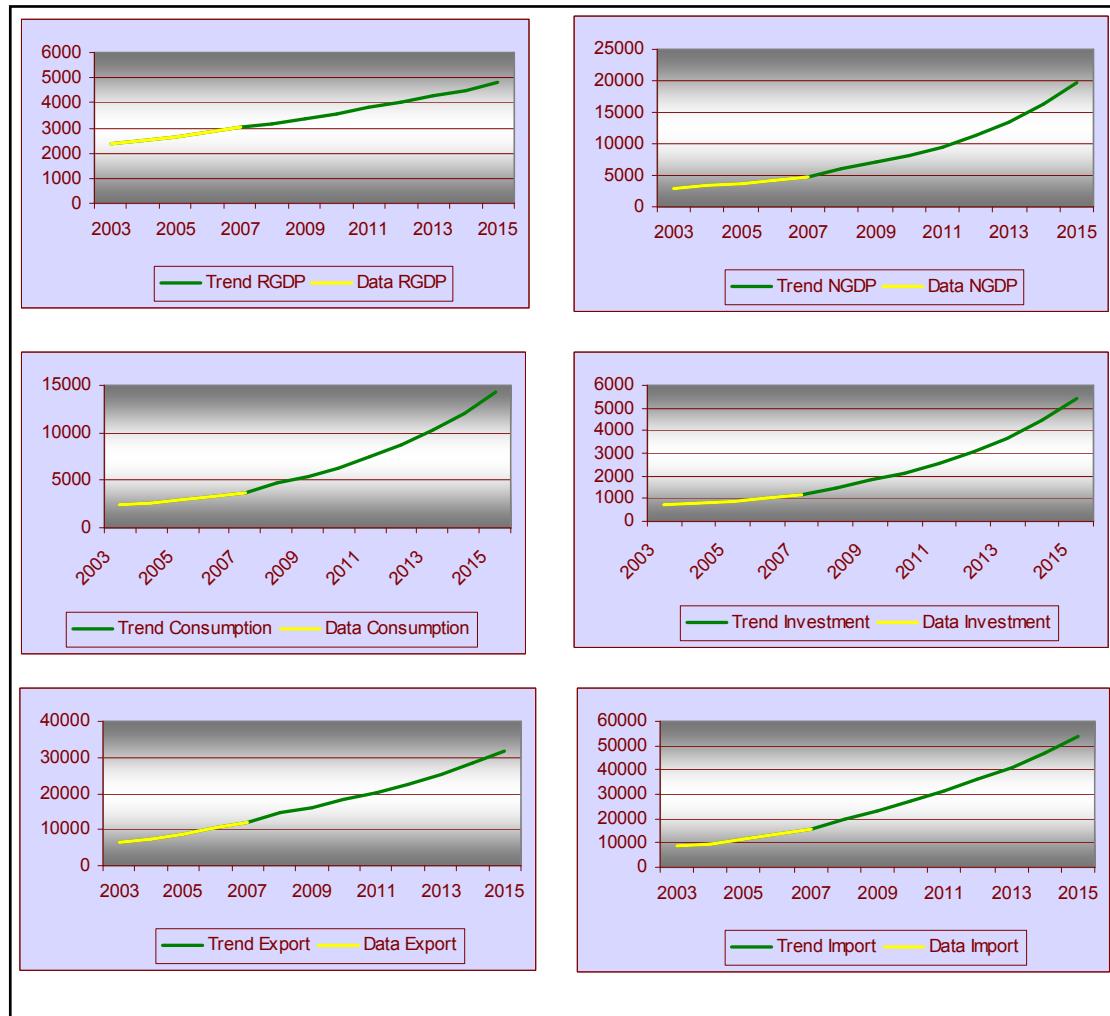
CHAPTER 7
MACRO OUTLOOK: TREND SCENARIO

The outcomes of the modelling exercise are summarized in the form of an indicator table of key variables. The table is designed in line with the structure adopted in the MOF framework. The outcomes refer to the trend scenario (i.e. trend scenario)[14].

	2008	2009	2010	2011	2012	2013	2014	2015
Growth: Nominal GDP	12.4%	12.3%	12.3%	12.6%	13.8%	13.6%	13.8%	13.6%
Growth: Real GDP	6.1%	6.6%	6.8%	6.9%	6.9%	6.9%	7.1%	7.2%
GDP Deflator	6.3%	5.4%	5.2%	5.4%	6.5%	6.3%	6.3%	6.0%
Inflation	9.7%	7.6%	7.8%	8.1%	8.2%	8.2%	8.3%	8.3%
Investment and Savings								
Gross Investment	1199.1	1581.8	1817.2	2095.3	2456.7	2863.8	3369.7	3970.4
Private	861.6	1225.3	1421.7	1654.3	1964.8	2315.2	2757.8	3288.1
Public	337.5	356.5	395.4	441.0	491.9	548.6	611.8	682.3
National Savings	1256.8	1535.6	1743.9	2024.9	2376.0	2785.7	3294.4	3926.1
Total Revenue	601.0	699.4	812.1	936.2	1085.4	1267.1	1486.9	1757.8
NBR Tax	460.8	544.8	641.4	747.7	877.0	1036.5	1231.6	1474.9
Non-NBR Tax	22.5	26.4	31.0	36.3	42.5	49.8	58.3	68.4
Non-Tax Revenue	117.7	128.3	139.7	152.3	165.9	180.8	196.9	214.6
Total Expenditure	931.2	1032.8	1156.9	1280.0	1432.6	1628.4	1875.1	2177.3
Revenue Expenditure	710.5	787.0	883.2	975.3	1093.4	1250.7	1454.6	1709.0
Development Expenditure	220.7	245.8	273.6	304.7	339.2	377.7	420.6	468.2
Overall Balance	**-330.2**	**-333.3**	**-344.8**	**-343.7**	**-347.2**	**-361.4**	**-388.2**	**-419.4**
Primary Balance	-184.0	-149.8	-125.8	-87.9	-55.6	-32.8	-22.3	-11.1
Financing	330.2	333.3	344.8	343.7	347.2	361.4	388.2	419.4
External	109.4	130.8	128.6	133.8	128.9	135.9	130.6	139.0
Grants	42.6	63.8	63.8	63.8	63.8	63.8	63.8	63.8
Disbursement	104.8	108.7	109.4	123.4	120.4	140.6	138.5	166.7
Amortization	-38.0	-41.8	-44.6	-53.4	-55.3	-68.6	-71.7	-91.6
Domestic	220.8	202.6	216.2	210.0	218.3	225.5	257.6	280.5
Bank	172.2	154.0	161.6	154.8	162.1	171.1	207.9	235.1
Non-Bank	48.6	48.6	54.6	55.2	56.2	54.4	49.7	45.4
Money and Credit (Growth %)								
Domestic Credit	20.65	17.84	16.85	15.64	15.12	14.75	14.99	14.91
Private Credit	15.12	15.12	15.12	15.12	15.12	15.12	15.12	15.12
Money Supply (M2)	22.06	21.47	21.19	20.52	20.02	19.76	18.80	18.09
Balance of Payment (Billion $)								
Exports	14.0	15.6	17.1	19.6	22.0	25.2	28.8	33.7
Imports	20.2	21.6	23.9	27.5	31.2	36.0	41.4	48.6
Current Account Balance	-0.85	0.68	1.07	0.98	1.08	0.99	0.91	0.50
Remittance	6.71	7.53	8.46	9.49	10.66	11.96	13.43	15.08
Income and Poverty								
Per Capita Income (Taka/Person)	36939	40962	45421	50511	56751	63647	71499	80200
Growth PCY (%)	11.09	10.89	10.89	11.21	12.35	12.15	12.34	12.17
Real PCY (Taka/Person)	22307	23466	24732	26091	27531	29060	30722	32497
Growth Real PCY (%)	3.44	5.20	5.40	5.49	5.52	5.55	5.72	5.78
Head Count Poverty (P_0)	38.95	37.52	36.08	34.67	33.31	32.00	30.70	29.44

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[14] Trend scenario refers to a scenario close to 'business as usual'. This is usually generated by using the parameters observed in the data period in the projection period.

POVERTY OUTLOOK: TREND SCENARIO

In this section a brief description of the methods followed to estimate head count poverty over 2000 to 2015 is provided. According to the methodology one has to start with following givens such as elasticity of poverty reduction with regard to growth and real income or expenditure growth.

Given:

Elasticity of Poverty Reduction to Growth $\overline{e}_{p2g}$

Real GDP or Income Growth $gPcy_t$

Where, t=0…..15; 2000…..2015

Given the above two sets of information following steps are followed to estimate head count poverty.

Step 1: In step one the product of growth poverty elasticity and real income or expenditure growth is calculated. The value of the product for the initial year will always be zero as $gPcy_t = 0$ for the initial year. For other years of the time period the value of the product is less then zero. The product is specified below as:

$$\pi_t = \overline{e}_{p2g} * gPcy_t$$

With the condition that $\pi_{t0} = 0$ for the initial year; and for other years $\pi_t < 0$.

Step 2: Head Count Poverty rates (P_t^0) are estimated using the above information.

Year	Estimates
Initial Year t_0	$P_{t0}^0 = P_{t0}^0 \cdot (1+\pi_{t0}) = P_{t0}^0$ Since $\pi_t = 0$
Year t_1	$P_{t1}^0 = P_{t0}^0 \cdot (1+\pi_{t1}) = P_{t0}^0 - P_{t0}^0 \cdot \pi_{t1}$
. . .	
Terminal Year t_{15}	$P_{t15}^0 = P_{t14}^0 \cdot (1+\pi_{t15}) = P_{t14}^0 - P_{t14}^0 \cdot \pi_{t15}$

The values of real GDP, population and growth of real per capita income or GDP are presented above. The estimates of elasticity of poverty reduction with respect to growth are taken from Sen and Mujeri (2002)[15]. Taking into consideration of pattern of economic growth and rising income inequality of 1990s, values of growth elasticity to poverty reduction have found to be -0.74 for rural areas, -0.64 for urban areas and –0.71 for national level.

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[15] Sen, B. and M. K. Mujeri (2002), "Poverty in Bangladesh: Trends, Profiles and Determinants" (Mimeo), Background paper for preparing the National Strategy for Economic Growth, Poverty Reduction and Social Development, Economic Relations Division, Ministry of Finance, GoB.

A comparison of growth elasticity for Bangladesh with some Asian countries suggests that Bangladesh's growth-poverty elasticity is on the lower side compared to the selected Asian countries[16]. These are reported below.

Country	Elasticity	Country	Elasticity
India	-0.9	Indonesia	-1.4
Taipei, China	-3.8	Malaysia	-2.1
Thailand	-2.0	Philippines	-0.7

Given the observed (i.e. for the years 2000 to 2006) as well as estimated values (i.e. for the 2007 to 2015) of per capita real GDP growth and growth elasticity of poverty reduction, the head count poverty levels for 2000 to 2015 have been estimated. Estimates of Head Count national poverty between 2000 and 2015 are shown below. Estimated head count poverty estimates are compared with the targeted (i.e. in line with MDG) poverty reduction rate over 2000 to 2015. It is noted that head count poverty reduction under the trend or business as usual scenario may be off from the target rate by about 5 percentage points (i.e. 29.4 % against target rate of 24.5 % in 2015).
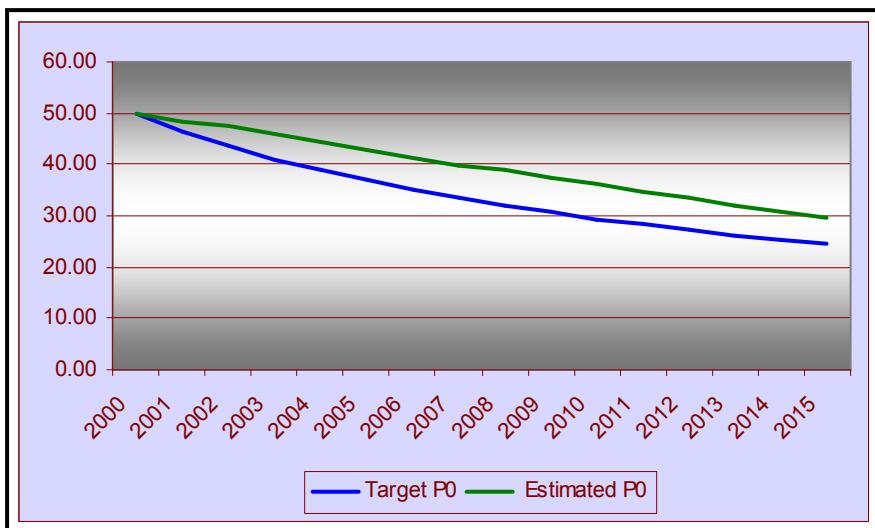
[16] P. Warr (2000), "Poverty Reduction and Economic Growth: The Asian Experience" in Asian Development Review, Vol. 18, No. 2, The Asian Development Bank, 2000.

CHAPTER 8
SCOPE OF SIMULATION

It is important to note from the objective and purpose of the 'financing programming' that, it is essentially a framework to assess the financing options in accordance to a targeted economic growth and inflation rate. In contrast to the simulation feature of a CGE model, it is an accounting framework limiting the scope to conduct policy simulations. Moreover, it is specified at the macro level restricting the scope of sectoral impacts analysis and output generation. Please see Table 2 for model comparison. A CGE model is numerically specified to a multi-sector, multi-factor and multi-institution 'social accounting matrix (SAM)' letting the way for performing wide range of policy simulations such as trade policy, tax policy, exchange rate variations and sectroral price fluctuations (e.g. oil price, rice price, utility price etc). For example CGE models numerically specified to the Bangladesh SAMs were applied to assess impacts of following issues:

- 'Poverty Impacts of Remittance and RMG in Bangladesh: A Computable General Equilibrium Analysis' Prepared for the World Bank by Bazlul Khondker and Selim Raihan in 2007.
- A note on 'Impacts of Oil Price Increase in Bangladesh' prepared by Bazlul Khondker (2007).
- Poverty and Welfare Consequences of Global Rice and Agricultural Trade Liberalization for Bangladesh, Prepared for Commonwealth Secretariat by Selim Raihan and Abdur Razzaque, 2007.

Given the restrictive character of the financing type programming framework, it may not be possible to conduct (i.e. satisfactorily) following simulations through a financing programming framework:

- Trade Liberalization (due to lack of relative prices by importable and exportable commodities)
- Oil Price and other sectoral price shock (as sectoral disaggregatrion is not considered)

A possible list of policy simulations available in the framework is given below:

- Altering indirect tax bases (both domestic and external) various types of indirect tax bases. For instance, these may include bases of VAT, excise duty, import duties, supplementary duty, and all other taxes.
- Altering indirect tax rates. For instance, these may include VAT rates, excise rates, import duties, supplementary duty and other rates.
- Expanding direct tax bases by raising the threshold, reducing the exemption and deduction levels.
- Changing the direct tax rates. For instance, these may include personal income tax rates, and corporate tax rates.
- Expanding non-tax revenue sources.
- Expanding the coverage of the government expenditure programme both re-current and capital. For instance, full or partial indexing of pay-allowance item to CPI.
- Re-setting world price of imports.
- Re-setting the growth rates of various components of money and credit. They include private credit growth; net other asset growth etc. Variations in them affect net domestic assets leading to changes in money supply.
- Re-setting the growth rates of various balance of payment. For example, they include current transfer; loan disbursement, grant disbursement. Variations in them affect current account balance and resources for deficit-financing implicating the requirement for bank borrowing.

CHAPTER 9
SIMULATION DESIGN

The worksheet design of the macro-economic framework is shown below. The framework consists of eight worksheets. Two of these five worksheets such as (i) indicator and (ii) simulator record outlooks by major variables corresponding to the trend scenario and simulation scenario. Data, parameters and specifications of equations are provided in five worksheet such as (iii) real side and prices; (iv) fiscal; (v) money and credit; (vi) balance of payment; and (vii) pubic debt. Simulation controls and setups are provided in the last worksheet. The data sets are contained in a separate worksheet and linked to these the five worksheets of the macro-economic framework.

Indicator				Simulator		
Outcome Worksheets						
Data and Variables by Blocks						
Real Side and Prices	Fiscal	Money & Credit	BoP	Debt	Poverty	Data (2002-06)
Assumptions and Parameters						
Simulation Control						
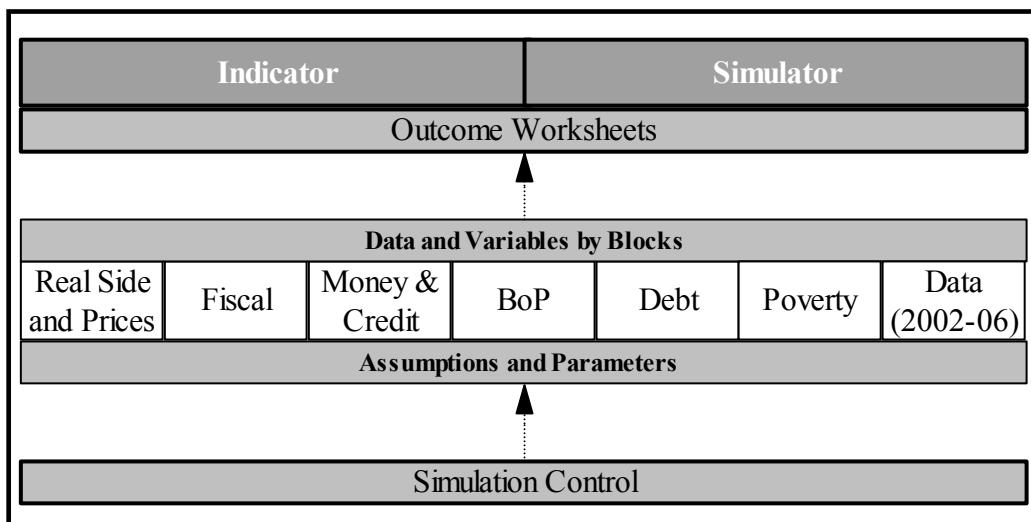
As shown above, parameters values of various rates (e.g. tax rates, tax bases, deposit rate et.) and growths (e.g. re-current expenditure, capital expenditure, private credit, loan-grant disbursement, import and export price indices) are provided in the assumptions/parameter sections of each of the five worksheets. All the key parameters are linked with multiplicative unity values contained in the 'simulation' worksheet. Any value other unity in the simulation worksheet translate into a change in the corresponding parameter value. A value of less than unity (i.e. 0.9) suggests a reduction whereas a value more than unity (i.e. 1.1) indicates an increase. The elements of the simulation worksheet are design in such a way that any value other unity will be highlighted as 'red' colour for easy identification. An example with respect of ADP of budget is provided below. More specifically it shows raising the allocations for ADP.

Table 1: Simulation Design and Impact

	2009	2010	2011	2012	2013	2014	2015
Simulation Control							
Trend	1	1	1	1	1	1	1
Simulation	1	1.03	1.07	1.09	1.11	1.13	1.15
Growth Rates							
Trend	0.113	0.113	0.113	0.113	0.113	0.113	0.113
Simulation	0.113	0.116	0.121	0.123	0.126	0.128	0.131
ADP Allocation							
Trend	230	256	285	317	353	393	437
Simulation	230	256	287	323	363	410	463

Figure 2: Simulation Design and Impact
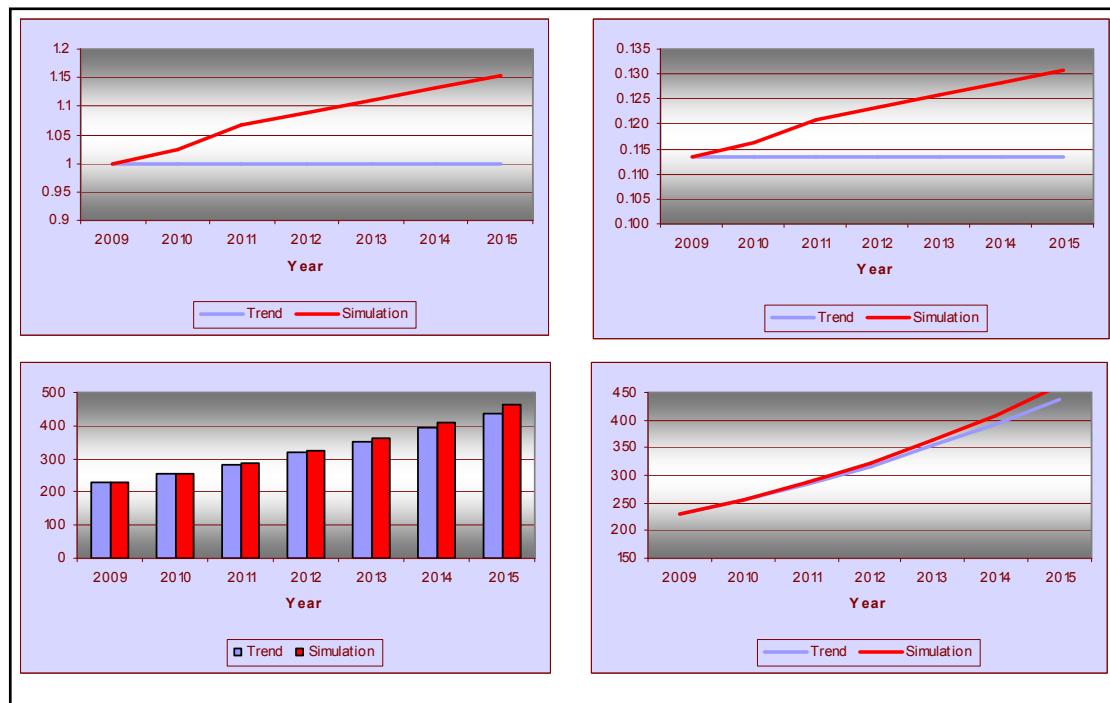
The four graphs contained in the above respectively capture simulation set up, resultant impact on growth rates of ADP and corresponding rise in allocation.

ANNEX - 1:   MODEL COMPARISON

Table 2: Framework Comparisons

	RMSM (World Bank)	**FPM (IMF)**	**CGE**
Objective	To simulate a financial resource plan for a country, given a proposed macro-framework.	To help understand balance of payments problems of a country.	To provide a rigorous and coherent micro-macro economic model for policy analysis.
Level of Desegregation	Structurally unable to capture distributional impact of policies.	A macro model, not designed to answer micro-questions.	Sophistication of households, activities and factor markets per data.
Data Requirement	Very little data needed.	Easily available banking and trade statistics needed.	Usual data required by CGE models in a social accounting matrix.
Economic Assumption	Growth rate and price level exogenous.	Balance sheet identities with little behavioral assumptions.	Standard CGE specification but adds important realistic features e.g. transaction costs.

Source: Table 1, Rati Tripathi (2003), 'Macro-models for Poverty Reduction Policies: comparison of key features', EPEP and Breton Woods Project.

ANNEX - 2:   RESULTS OF REGRESSION

Table 3: Regression Results Private Consumption

Equation No.	Dependent Variable	Constant	r_GDP	Δr_GDP	r_GDP-1	r_GDP-2	rTd	R^2	
1.	r_Cpv	219.47 (3.98)	0.71 (19.74)	-.0026 (-0.04)			-0.017 (-2.02)	0.996	27
2.	r_Cpv	219.47 (3.98)	0.707 (12.02)		0.0026 (0.04)		-0.017 (-2.02)	0.996	27
3.	r_Cpv	217.57 (3.39)	0. 667 (15.40)			0.048 (0.93)	-0.019 (-2.22)	0.997	26
4.	r_Cpv	107.03 (3.98)	0.701 (11.98)		0.055 (0.89)		-0.0228 (-3.47)	0.998	27
5.	r_Cpv	103.6 (4.39)	0.657 (15.40)			0.11 (2.19)	-0.023 (-3.97)	0.999	26

Note: in the first three equations nominal private consumption data was deflated by CPI GDP deflator to calculate the real series.
In other two equations nominal private consumption data was deflated by GDP deflator to get the real series.

Table 4: Regression Results Private Investment

Equation No.	Dependent Variable	Constant	r_GDP	Δr_GDP	r_GDP-1	Reer	Reer-1	Reer-2	Ria	R^2	
6.	r_Ipv	-83.98 (-1.66)	0.366 (21.52)	-0.061 (-1.52)			-3.196 (-4.11)		-4.525 (-1.44)	0.997	25
7.	r_Ipv	-83.98 (-1.66)	0.305 (7.73)		0.366 (21.26)		-3.196 (-4.11)		-4.525 (-1.44)	0.997	25
8.	r_Ipv	-165.76 (-2.28)	0.336 (7.7.6)		0.071 (1.64)			-3.29 (-2.87)	-9.59 (-2.25)	0.995	25
9.	r_Ipv	-192.14 (-1.92)	0.336 (5.96)		0.103 (1.80)	-3.903 (-1.91)			-8.11 (-1.55)	0.994	26
10.	r_Ipv	-165.76 (-2.28)		0.406 (14.22)			-3.29 (-2.87)		-9.59 (-2.25)	0.996	25

Note: in the first two equations nominal private investment data was deflated by GDP deflator to calculate the real series.

In other three equations nominal private investment data was deflated by CPI to get the real series

Table 5: Regression Results Export

Equation No.	Dependent Variable	Constant	r_GDP	r_GDP-1	r_Exdd	XPI	R²	
11.	r_E	-272.24 (-9.18)	0.238 (37.76)		0.067 (2.89)	0.89 (1.96)	0.994	25
12.	r_E	-261.92 (-9.11)	0.132 (2.63)	0.119 (1.81)	0.108 (3.40)	0.64 (1.40)	0.995	25

Table 6: Regression Results CPI

Equation No.	Dependent Variable	Constant	PM	PM-1	RREEM	BM	g_M2	M2	M2-1	PSBR	R²	
13.	CPI	-9.21 (-1.05)	1.12 (8.80)				-0.83 (-2.9)			0.106 (2.03)	0.976	20
14.	CPI	-25.57 (-1.65)	1.20 (4.0)					0.058 (0.95)		0.003 (0.24)	0.963	20
15.	CPI	35.38 (8,62)						0.0488 (5.74)		0.185 (2.54)	0.927	20
16.	CPI	34.98 (9,13)							0.056 (6.28)	0.187 (2.81)	0.935	20
17.	CPI	70.775 (3.21)		0.275 (1.74)	0.0926 (4.30)	0.162 (4.45)					0.923	25

Table 7: Regression Results Import

Equation No.	Dependent Variable	Constant	r_GDP	r_Exdd	r_Rerm	Intr	Erp	Aer	R²	
18.	r_M	7.49 (0.08)	0.104 (1.66)	0.195 (4.08)	0.479 (1.56)	-9.15 (-2.74)	5.48 (2.94)		0.985	26
19.	r_M	-41.41 (-0.46)	0.148 (2.40)	0.185 (3.41)	0.342 (1.06)	-9.46 (-2.66)		4.69 (2.26)	0.982	26
20.	r_M	-81.52 (-1.00)	0.182 (3.46)	0.188 (3.45)		-9.83 (-2.76)		4.61 (2.22)	0.982	26
21.	r_M	-17.41 (-0.29)	0.144 (2.40)	0.195 (3.33)	0.489 (1.71)	-7.18 (-2.58)	3.27 (1.66)	4.69 (2.26)	0.982	26

ANNEX - 3: SOME TAX REVENUE SOURCES AND THEIR PROXY BASES

	Tax Revenue Sources	Tax Bases, Proxies
A.	**Taxes on Net Income and Profits**	
1.	Corporate	Enterprise Profits on derived from National Account; Operating Surplus of the Enterprise; GDP
2.	Individual	Wages and Salaries and Other Private Income from the National Accounts ; National Income; GDP
B.	**Social Insurance Taxes or Contributions**	
3.	Employer	Wages and Salaries; GDP
4.	Employee	Wages and Salaries; and Non-wage Income of Self-employed persons
C.	**Taxes on Property**	
5.	Real Estate	Rents; Aggregate Value of Real Estate; Aggregate Wealth
6.	Personal Wealth	Property Income; National Income; Wealth
7.	Death and Gift Taxes	Demographic Incidence of Deaths and Number of Persons in the Highest Income Brackets; GDP
8.	Property Transfers	Value of Urban Properties and Number of Transactions
D.	**Taxes on Production, Consumption and Sales**	
9.	Sales, Turnover, or Value-Added Tax	Private Consumption; Retail Sales
10.	Selective Excises	Production or Consumption Figures on Major Excisable Commodities; Private Consumption
11.	Profits of Fiscal Monopolies	Value or Volume of Consumption of Fiscal Monopoly Commodities; GDP
E.	**Taxes on International Trade and Transactions**	
12.	Import Duties	Value and Volume of Imports
13.	Export Duties	Value and Volume of Exports
14.	Export Marketing Boards	Estimated Profits on Exports Handled by Boards; Total Exports
15.	Exchange Profits	Value of Exchange Transactions
F.	**Other Taxes**	
16.	Business and Professional Licenses	Number of Licenses Issued; Nominal Value Added in Retailing; GDP
17.	Poll Taxes or Personal Taxes	Demographic Data for Relevant Age Group
18.	Stamp Taxes	Value of Important Categories of Transactions Involved and Estimated Frequency of Transactions
19.	All Other Taxes on Income, Property, Production and Trade	National Income; GDP

Note: The Table is adapted from Sheetal Chand, "Some Procedures for Forecasting Tax Revenue in Developing Countries," DM/75/91, IMF, October 1975.

ANNEX - 4:   ACKNOWLEDGEMENT

ANNEX - 5:   TERMS OF REFERENCE (TOR)

(I)   Formulate a Computable General Equilibrium (CGE) model using commonly used software to make it user-friendly and easily transferable to Finance Division

(II)   Use the model to reflect effects of changes of various public policies especially fiscal policy on economic growth and poverty reduction

(III)   Forecast changes of fiscal policy on the real sector, monetary sector and external sector of the economy

(IV)   Predict the consequences of financing budget deficit on inflation, private sector credit growth and current account

(V)   Produce a detailed users' manual describing how to incorporate policy changes into the model and how to interpret results including all technicalities.

(VI)   Modeling exercise must be compatible with the Financial Programming type of models usually used by IMF and World Bank

(VII)   Organize a workshop to discuss and disseminate the findings of the study and conduct training sessions for the officers of Finance Division.