MONITORING SUSTAINABLE HUMAN DEVELOPMENT OPTIONS

USER INTERFACE

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Introduction and Summary[1]

The SHD model is an instrument to account for *sustainable human development (SHD)* interventions and impacts at the meso and macro level. Using the latest technology it provides government and other stakeholders in SHD with consistent numerical information for assessing inter-related trends, evaluating options and framing policy. This is done using high resolution mathematical models based on *consistent country data* within a simulation environment which track process change starting with time intervals as small as half-a-year and building up to one, five, ten and for long-run processes, such as, population stabilization and universal literacy, to fifty years and more! Version - 1 of the model was completed in December 1998 and evaluated in August 1999 while version -2 was completed during 2000-2003.

Following up on the very positive recommendations of the evaluation mission, the Government of Bangladesh (GoB) has established a SHD Unit in the Planning Commission. As part of its functions the SHD Unit is expected to provide the quantitative analysis required for the formulation of the 6th five-year plan under the overall supervision of a Policy Working Group. Technical backup is provided by the Institute of Social Studies, The Hague and Swedish International Services, Stockholm.

Although more than 30 professionals were trained ix three batches between 1998 and 2003, at the moment the SHD Unit is staffed by 15 professionals trained by formal teaching and on-the-job. During their training they developed case studies relating to the macro frame, resource envelope, alternate growth scenarios and distributional implication for rural and urban household groups - necessary to assess the situation and prospect for poverty containment and reduction. During 2001-2004 these professionals provided the required quantitative analysis to assist policy and plan formulation in key areas of concern which should include: employment, gender equity, child well-being, technology and infrastructure constraints, primary education, reducing the burden of disease, training and labour force quality, industrial policy – privatization of manufacturing and the promotion of small and medium industry, financial sector development, fiscal policy, trade policy, rural development – intensification of agriculture and rural non-farm sector development, urban migration, delivery of basic services in rural and urban locations – health, education, public utilities, transport, sanitation, drinking water, housing, etc..

Acting on the recommendations of the evaluation mission version 1 of the model has been revised and extended. Notable is the increase in resolution from fourteen to forty five activities, one household group to nine household groups and one composite consumption good to nine basic need consumption categories. Further, a multipurpose *User Interface* has been developed which provides a 'friendly' environment to use, communicate and learn the model. As yet the SHD model does not include quantification of environmental considerations or those of local-level planning initiatives and programs. However, if the meso-level impacts of local-level programs are quantified[2] the wider ramifications in scaling-up programs may be explored using appropriate extensions of the SHD model. Version -2 was implemented during 2000 and December 2003 and the model system was updated to 2000 and upgraded with poverty modules and with an MDG costing and tracking features. In

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[1] The present version is a revised version of the one published in 2000, although the monitor has been updated with the module regarding the MDG tracking and measurement, it is not included in the present document, however the presentation will include the MDG module.
[2] This may be done by program managers, funding agencies, evaluating agencies and/or data producers.

March 2004 the project underwent its second external evaluation by two modelling and systems experts from UK universities and one local national accounts expert.

The user interface is menu driven with on screen prompts. Operations at the most basic level simply requires familiarity with using a computer mouse. More sophisticated levels of use will require familiarity with WINDOWS 95 or 98, Microsoft Office, VENSIM, SPSS and also the underlying modelling theory and practice. Deriving valid inferences would require all of the above.

CHAPTER I. **Overview of the SHD Model - Version 2, 2000-2003**
`Conceptual framework and Salient features`
_____

A simple but effective way to communicate the features of a fairly large and evolving computer model dealing with issues of sustainable human development is through answers to frequently asked questions. We would like to acknowledge the Evaluation Mission report of August 1999 which adopted this approach to communicate its findings.

Frequently asked questions about the model may be grouped into three sets of concerns:
- What is the SHD Model? … Context, Scope, Features
- How is it built? … Feedback Mechanisms, Specification, Technicalities
- How is it used? … Scenarios … Comparative Dynamics

What is the SHD Model? … Context, Scope, Features

The following screen presents an overview.

SHD MODEL

■ CONTEXT *Quantify change in human development and sustainability thereof*
SHD in Bangladesh = Survival, Equity and Efficiency

■ SCOPE

Quantitative mapping of transitions in
- Economic, Demographic and Environmental Balances
  ● *for assessments of alternative development interventions*

- Household Income and Basic Needs Consumption Distributions
  ● *for monitoring poverty situation*

- Fulfilment of Development Norms
  ● *such as, child survival, food security, …*

■ FEATURES
Decision support system to

- Identify feasible devlopment options

- Aid policy formulation

- Evaluate potential impact of alternative interventions

- Monitor inter-related trends and indicators

Screen 1 Context, Features and Scope of the SHD Model

1. *What are the theoretical foundations?* The SHD Model is based on theories and existing models which are widely accepted and respected. The SAM, CGE, cohort component population model, household consumption pattern, income distribution pattern, and entrance-dropout education model are all known to and respected by professionals in development partner organisations.

2. *Describe the model structure*? The SHD Model is a dynamically linked set of components[3], consisting of a CGE economic model, a cohort component population model, gender disaggregated education model and a household income distribution model. The use of an monitor module within the overall SHD Model permits easy modification and updating of indicators as the concepts of SHD are refined both internationally and in the specific context of Bangladesh.

**Screen 2 Overview of SHD Model - Version 2, 2000-2003**

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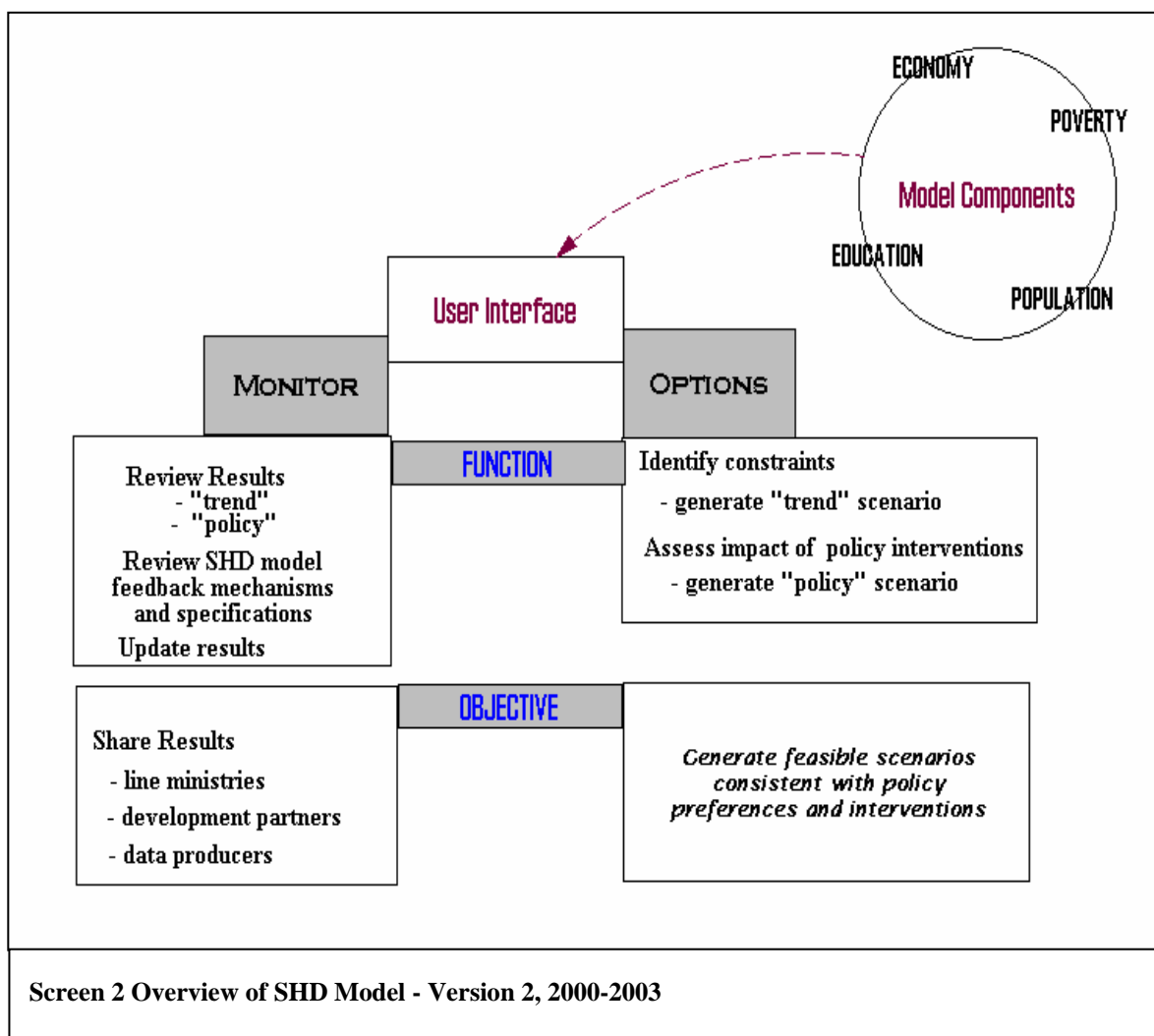
[3] For the technical reader it may be mentioned that the SHD system currently has, not including auxiliaries, around twenty thousand equations; and the computer code is over 20,000 lines. Mathematically the system of equations is simultaneous non-linear differential and integral equations with varying parameters.

3. *What is the utility of this model*? It provides a system capable of supporting consistent and disciplined analysis over time of concerns related to the SHD issues of income distribution, poverty alleviation, economic growth, population dynamics, education outcomes and productivity, and gender equity. Thus, use of the SHD Model will allow GoB to explore consistently and holistically alternative strategies for sustainable human development of Bangladesh. There will be many benefits:

✿ Policy justification and effectiveness: The SHD Model can serve as a solid background for the Ministry of Planning and GoB to support their decision making, justify their policies, and make sure these policies are consistent.

✿ International relations: Using a model based approach in national planning will strengthen and enhance the position of GOB in dealing with international donors and agencies, and earn respect from other countries.

✿ Efficiency: With a good, transparent model, it is possible to identify differences among opinions and test them, so that consensus can be reached. The SHD Model will provide a new, participatory tool to facilitate substantive, consistent, and disciplined dialogue among ministries, development partners, and interest groups.

✿ Comprehensiveness: Humans are limited in their ability to think consistently through the many interrelated consequences of change in a complex national system. With an interactive computer model, it is possible to think through the vitally important connections among economic development, social development, and potentially environmental development in ways that become increasingly apparent, actionable, and effective.

4. *What is the quality of the model*?. An in-depth evaluation has assessed the model as follows:
"The work performed under the SHD Project is of world class quality and provides the Planning Commission, the Ministry of Planning, the Government of Bangladesh, and the peoples of Bangladesh with a powerful analytical tool for assessing and monitoring development options for bringing Sustainable Human Development to Bangladesh."

How is it built? … Feedback Mechanisms, Specification, Technicalities

5. *How is the model designed*? Briefly, the SHD modelling system like other planning or policy models, builds a computable general equilibrium model on the input-output framework and on a social accounting matrix. However, unlike most planning models, this system includes for the first time ever a dynamically linked cohort-component demographic model which provides inputs to the economic CGE model and computes distribution outcomes over time within a consistency framework. The SHD Team has used a modular design which permits multiple programmers to work simultaneously, a special advantage in model maintenance. Also, programmers can easily add new sectors and extract existing sectors for modification and updating.

The following four screens provide an overview of the principal feedback mechanisms captured in model specification.

Screen 3 Basic Economic Feedback Mechanism
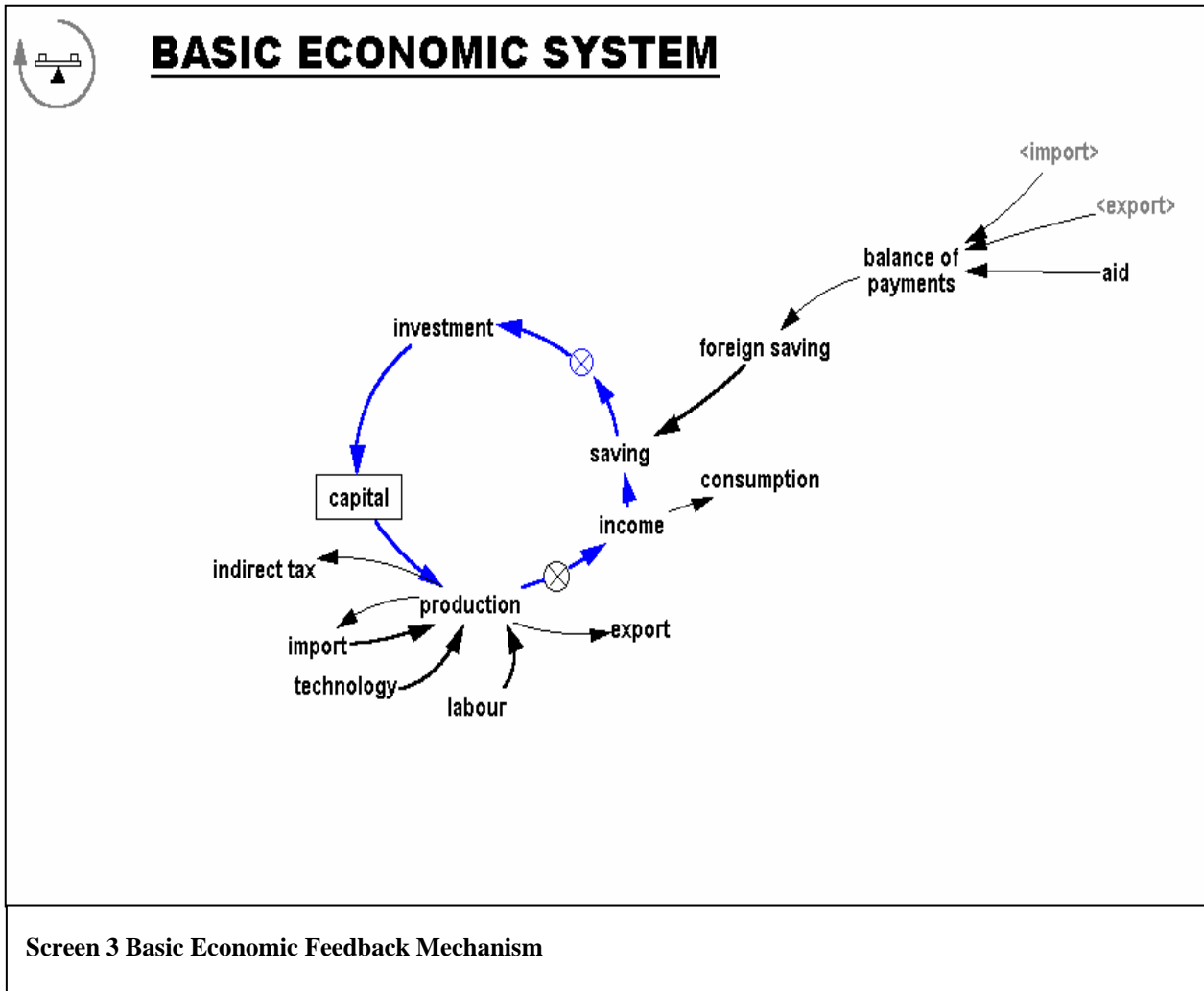
The well known basic macro economic feedback mechanism is depicted in the adjacent screen.. The blue circle depicts production, powered by factors labour and capital along with technology and import, generating income which is used for consumption and the balance is saved. Then foreign saving plus domestic saving are mapped to investments and capital formation and back to production. This mechanism is also embedded in the SHD model

Distinction is made between the variables on the circle and the rest. The former are termed jointly dependent or endogenous and the rest referred to as predetermined or exogenous variables. Model specification and properties vary depending on this classification.

Macro models are often used to compute the investment requirements for alternate growth paths. This requires "solving" the model for the endogenous variables given feasible values of the exogenous variables, such as labour or technology, which are determined outside the model.
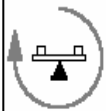
Price Signals in the Economic System

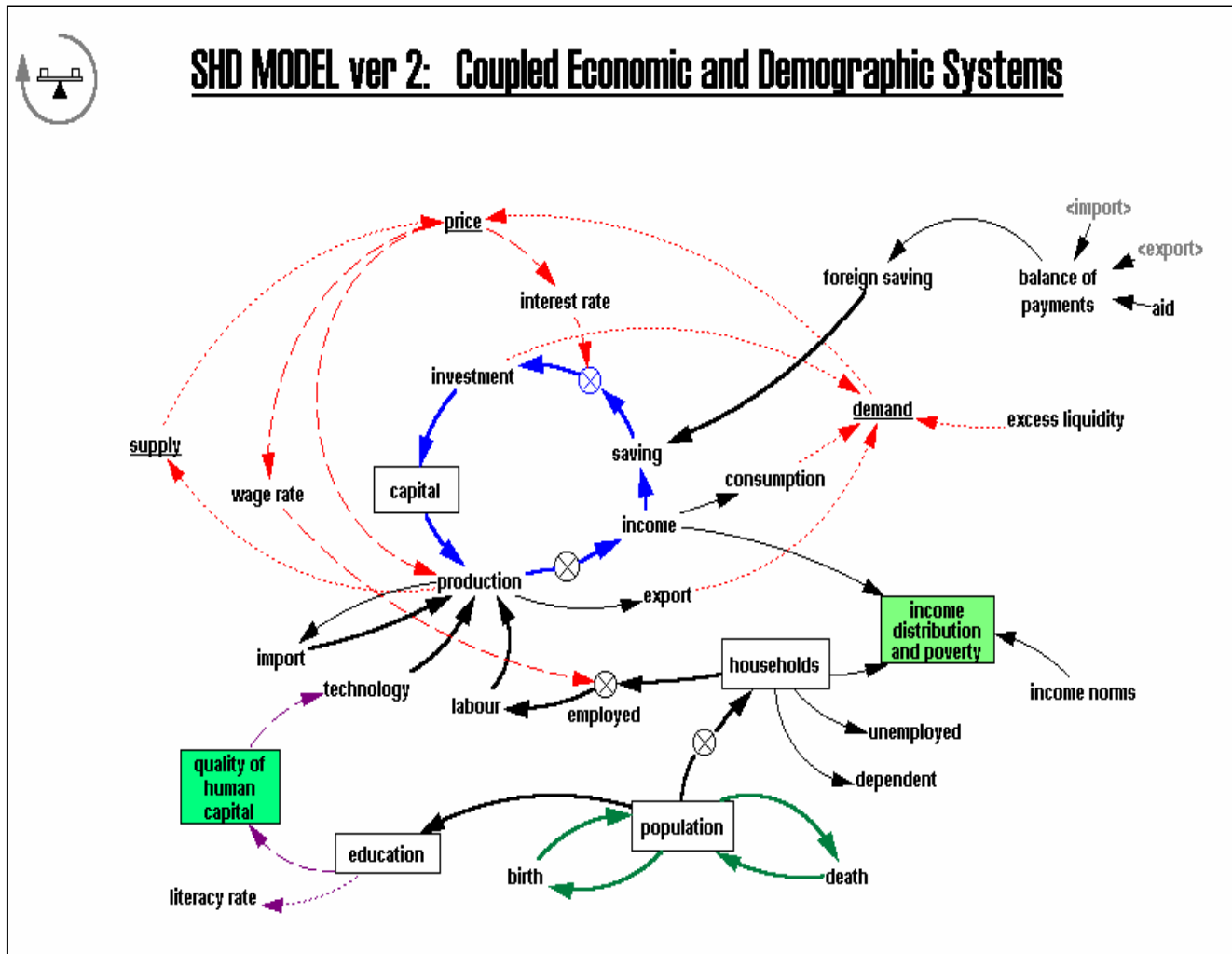Screen 4 Price Signals and the Basic Economic System
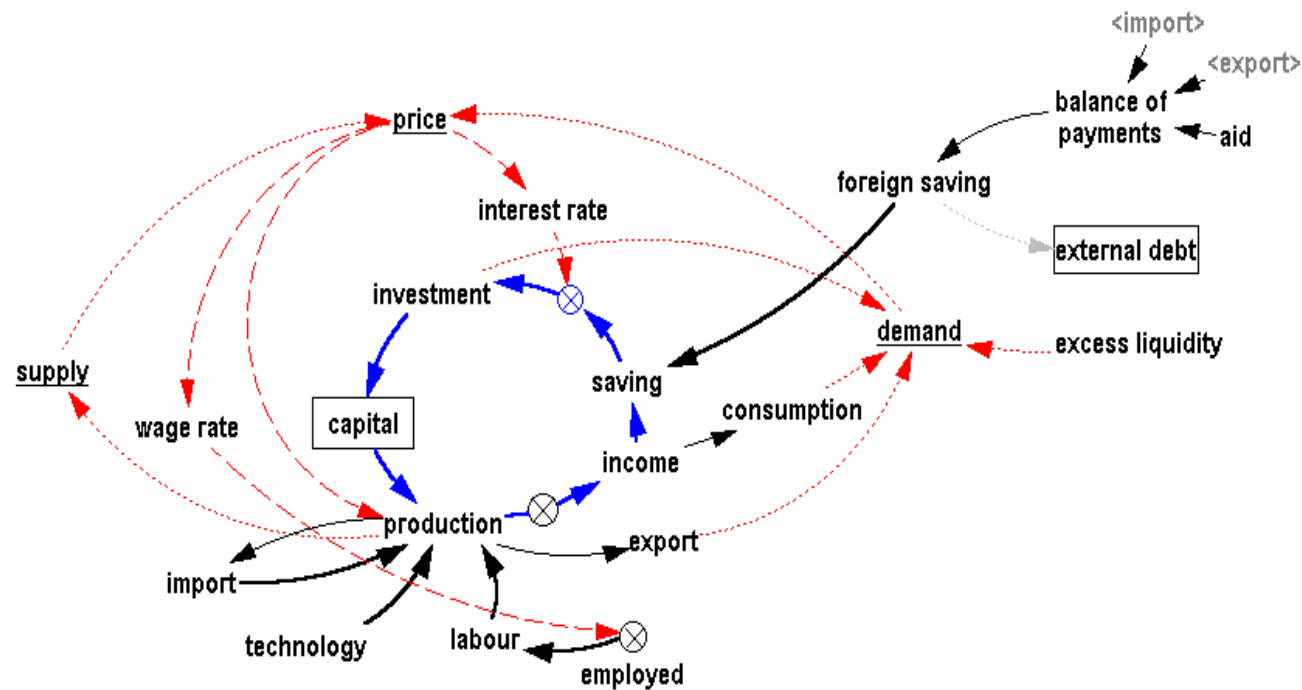
In computable general equilibrium models the price signals are endogenously generated by the demand-supply balance for each activity sector. This extension is shown in the adjacent diagram for the basic economic mechanism.

The demand-supply balance is checked for each interval of time for which the model is solved which is half a year for the SHD model.

In various ways these price signals influence economic decisions for the next half-year time period.

SHD MODEL ver 2: Coupled Economic and Demographic Systems

The SHD model (version 2), as the adjacent flow chart indicates, includes two major feedback systems – an economic system and a demographic system. The latter is specified as a cohort-component model with rural-urban migration and annual age cohorts (0 to 80) disaggregated by gender. Consequently, it is possible to

✿ Map population to the nine household categories considered

✿ Refine the specification of labour supply to include labour force participation decisions by household category

✿ Allocate available labour supply to labour demand in various production activities depending on wage rates and other labour market characteristics.

✿ Derive income and income distribution by household category and by 40 subgroups within each category in ascending order of average income.

✿ Link an education model with the demographic model to compute the persons with primary (formal and non-formal); secondary and adult education; and thereby the literacy rate. This may further extend to labour by skill categories and refinements in specification of production functions.

Screen 5 SHD Version 2, 2000

The above extensions to the economic and demographic model focus the changing human development situation.

SHD MODEL ver 3: Human Capital Formation and Well Being
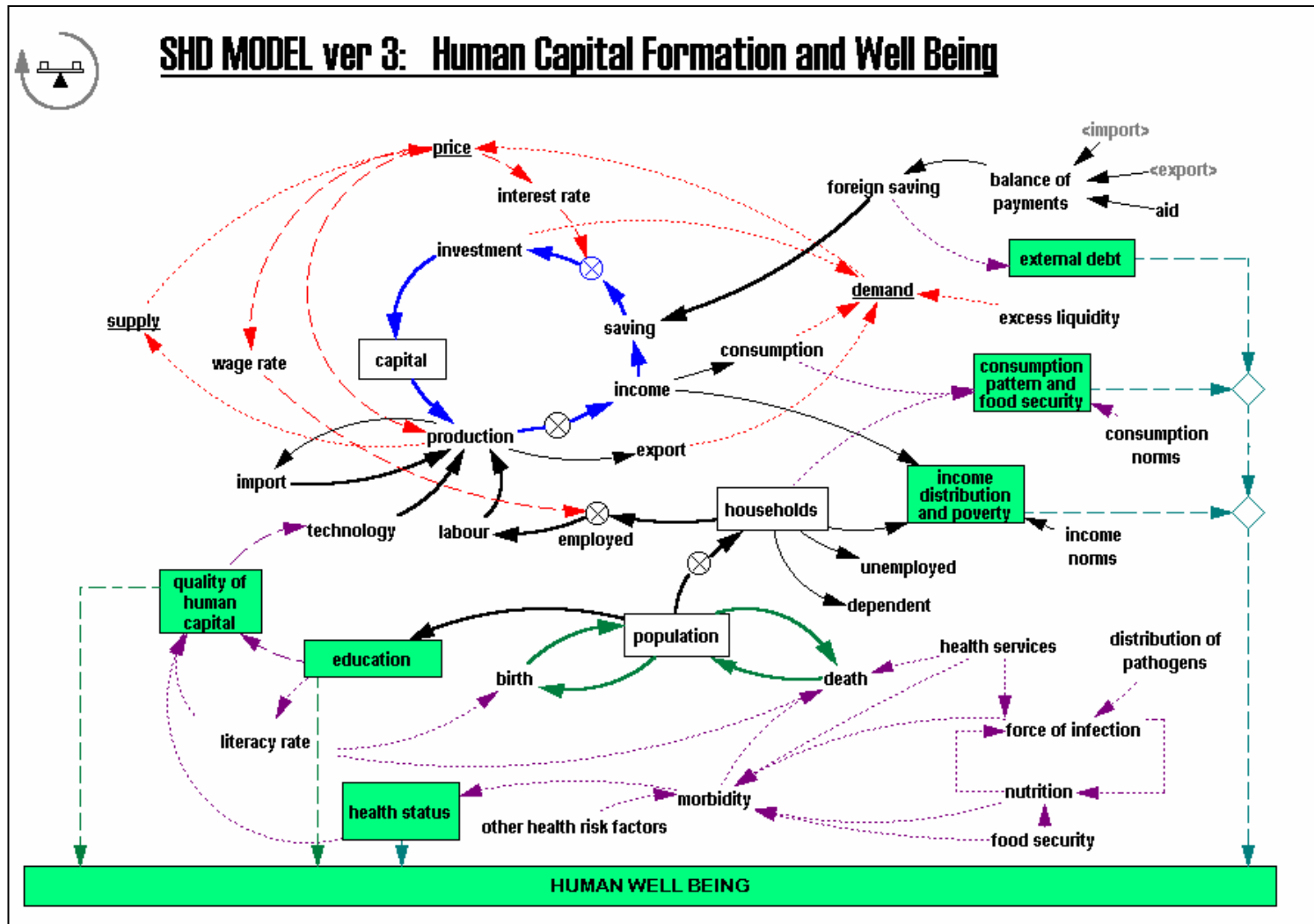
SHD Model version 3 may incorporate some or all of the features in the accompanying chart. Why?

✿ Human development includes, at least education and health. Modelling the latter would imply embedding another feedback mechanism in the model relating to force-of-infection-nutrition-morbidity-health services - health status – mortality. This impinges on human well-being, directly and also with multipler effects.

✿ Threre are at least two important links from education: *first,* to quality of the skilled labour force and refinement in the production function; and *second*, to more informed choices and decisions about family size and child survival.

✿ Inadequate nutrition (poverty of consumption) may be associated with adequate income. Also food security considerations play an important role in managing a security net for vulnerable groups. Both suggest the need for policy intervention which in turn would require extension of the distribution model to include nutritional status by household categories.

Screen 6 SHD Version 3, Human Capital Formation and Well Being

6. Fundamental Classifications?

    Time: 1994, 1994.5, 1995, ….

<u>Demographic Accounts</u>

Age cohorts: 0 to 80 (annual)
Location: rural and urban
Sex: female, male

Cohort-Component Population Model

Screen 7 Demographic Account
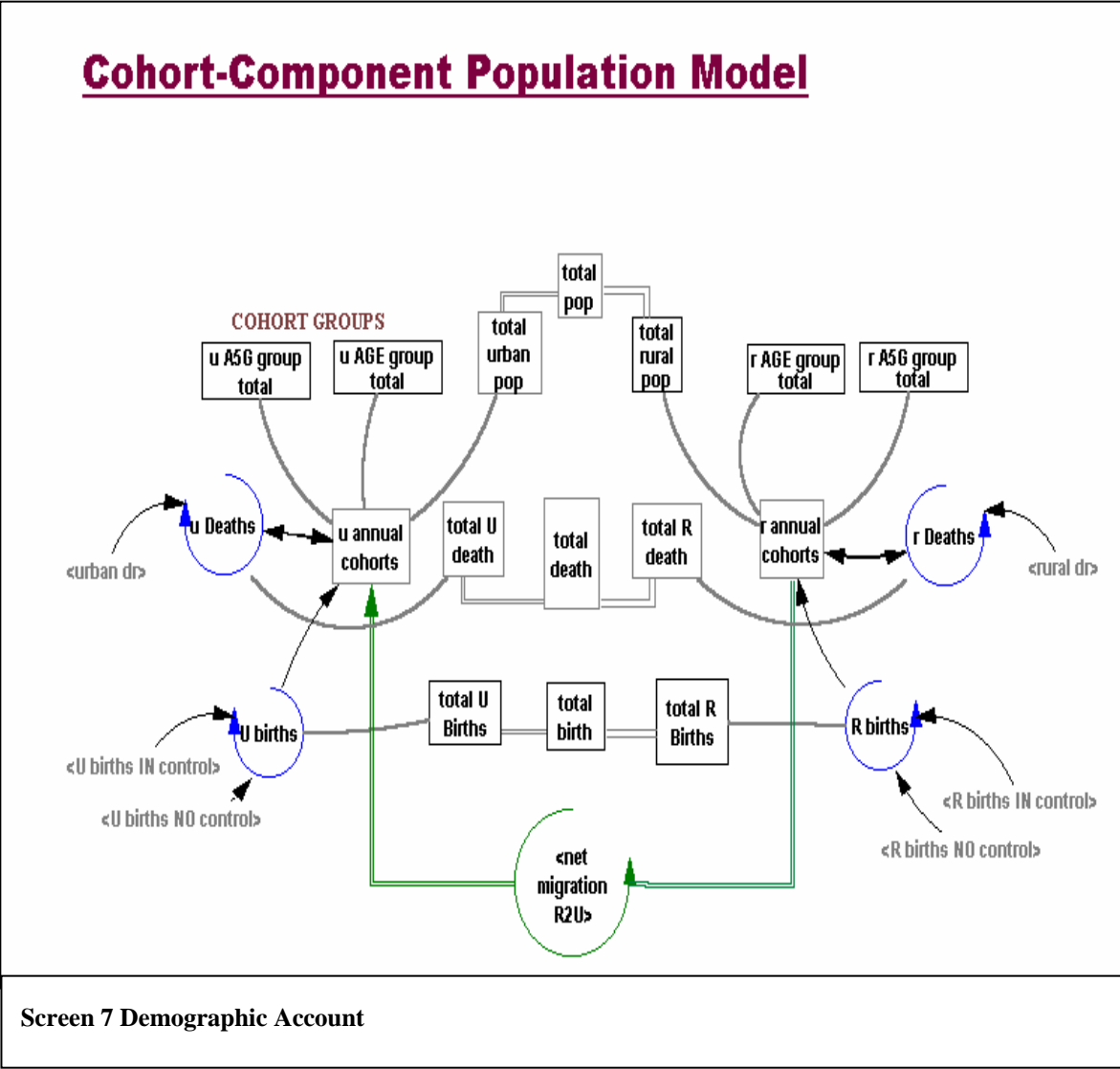
Social Accounts

Activity: 45 production sectors
Factors: labour and capital
Institutions: household, corporations, government and rest of the world.
Rural households classified by land holding: landless, marginal farmer, small farmer, large farmer, non agricultural households.
Urban households classified by education of household head: illiterate, low education, medium education, high education.
Basic needs: nutrition, clothing, education, health, housing, energy, transport, entertainment, rest.

SOCIAL ACCOUNTING MATRIX FOR BANGLADESH

DIMENSIONS

	Activity	Factors K, L	Basic needs BN	Households HH	Government GOV	Corporation COR	Rest of World ROW	Consolidated Capital Account	DEMAND
Activity	intermediate 45x45 use (dem)		domestic 45x9		government expenditure 45x1		export 45x1	invest stock change 45x2	
Factors	value added (VA) 45x2								income K,L
Basic needs				BN consumption 9x9					satisfaction
Households		income from factors 9x2		transfer 9x9	transfer 9x1	dividend 9x1	remittance 9x1		income HH
Government	tax & tarrif 45x2	income from capital 1x1	tarrif on BN 1x9	income tax 1x9		corporate tax 1x1		investment tax 1x1	income GOV
Corporation		income from capital 1x1							income COR
Rest of World	intermediate import 1x45		imported BN 1x9					capital goods import 1x1	income ROW
Consolidated Capital Account				SAVING					national saving
	SUPPLY	payment to: L, K by producers'	BN expenditure	HH expenditure	GOV expenditure	COR expenditure	payment by ROW to Bangladesh	investment expenditure	TOTAL

INSTRUMENTS

164 GOVERNMENT Taxes -Tarrifs -- Expenditures-Transfers
81 HOUSEHOLD Transfers

MULTISECTOR-MULTIPROCESS FRAMEWORK FOR
CONSISTENT DATA STRUCTURES & MODELS

Screen 8 Social Accounts

7. *What data does the model use*? The model uses the following types of data.

   ✿ *Derived data* such as, the SHD-SAM (Social Accounting Matrix) and input-output (IO) tables. Consistent demographic and social accounts are the two principal data bases on which the SHD model is built

   ✿ *Primary data*, such as, household expenditure surveys, labour force surveys, education survey, health survey, population census, demographic surveys etc.

   ✿ *Secondary data*, such as, national accounts, monetary statistics, financial statistics, price statistics, trade statistics and balance of payments, external debt etc.

8. *How are parameters determined*? Estimated from primary and secondary data. These include, price elasticities, mapping from households to activities, propensities to save and consume, productivity, fertility rates, infant mortality rates, under-five mortality rates, enrollment and dropout rates, labour force participation rates, etc.

9. *Equations*? Specifications are as per theoretical foundations.

10. *What software is used*? The SHD model is implemented using a fourth generation simulation language (VENSIM) which is the latest and most advanced technology available for computer simulation to support policy analysis. VENSIM is the most transparent and programmer friendly software of its kind available today.

How is it used?… Scenarios … Comparative Dynamics

11. *How can the model be used?* The SHD Model is intended to serve the national planners of Bangladesh as a decision support tool to integrate sustainable human development issues into national planning. In its <u>current state of development</u>, the SHD Model can answer a number of policy questions within a consistency framework. They are:
    ✿ Reduction of poverty
    ✿ Income disparity by location
    ✿ Impact of growth on poverty
    ✿ Population stabilization and its interrelated issues
    ✿ Education module
    ✿ Time frame for achieving literacy target by gender
    ✿ Health module : infant mortality, under five mortality and life expectancy
    ✿ Circular flows: income, expenditure, saving, investment, production, income …
    ✿ Taxes, tariffs and transfers
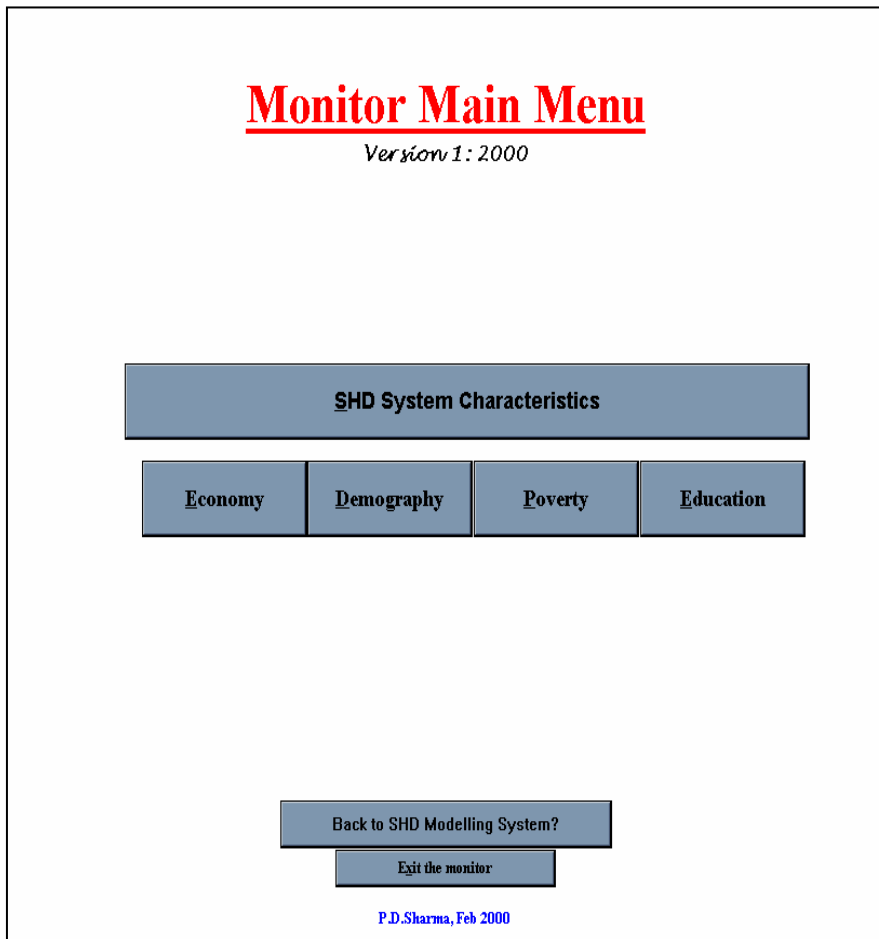
CHAPTER II.   Using the Interface

II.1.   Main Menu
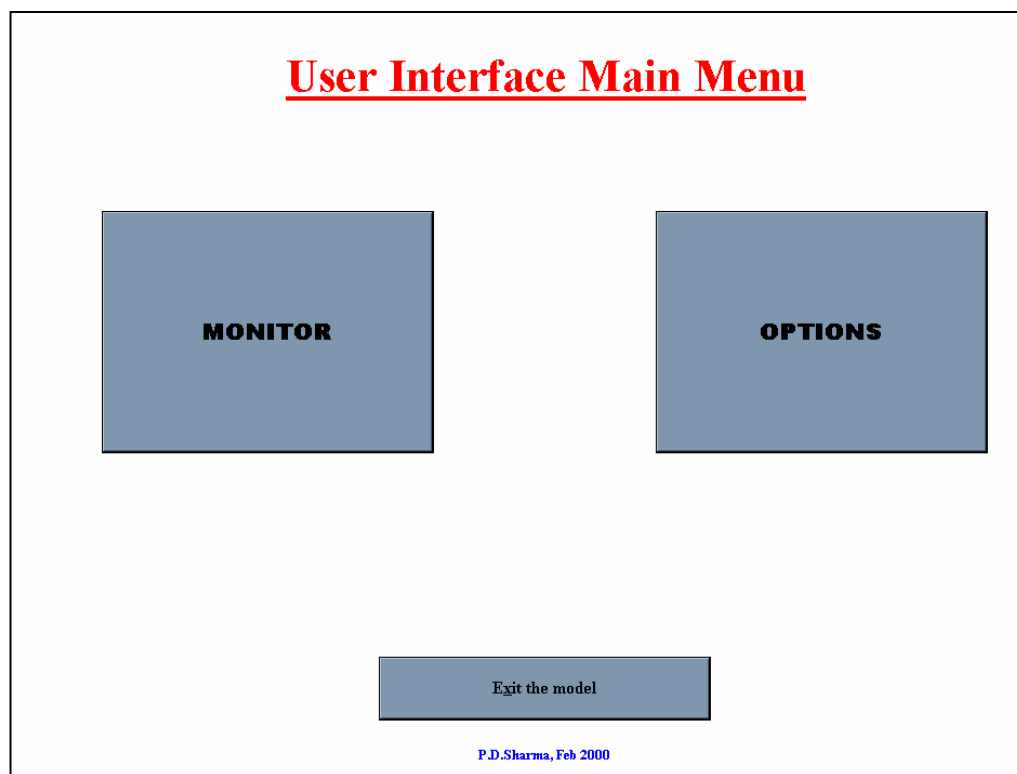
INTERFACE 1: Main Menu of User Interface

The *User Interface* is driven by a nested set of menus. The main menu of the user interface has three buttons which enable the user to access the menus of the *"monitor"* , *"option simulator"* and an *"exit"* sequence, respectively.

II.1.1. Monitor Menu

MONITOR 1: Main Menu of the Monitor

The *first* button of the monitor main menu *"SHD System Characteristics"* leads to screens which have been largely described in Chapter 1. The second row of buttons enables access to the monitor for each of the model components. Space has been left after this row to add more modules to the SHD system. The button *"Back to SHD Modelling System"* returns the user to the main menu of the interface while the last button is to exit.
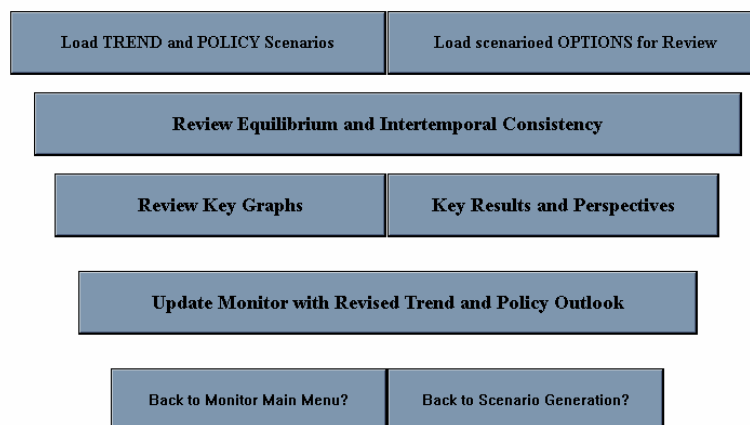
Design

Controlling menus of the component monitor menus have the following structure,
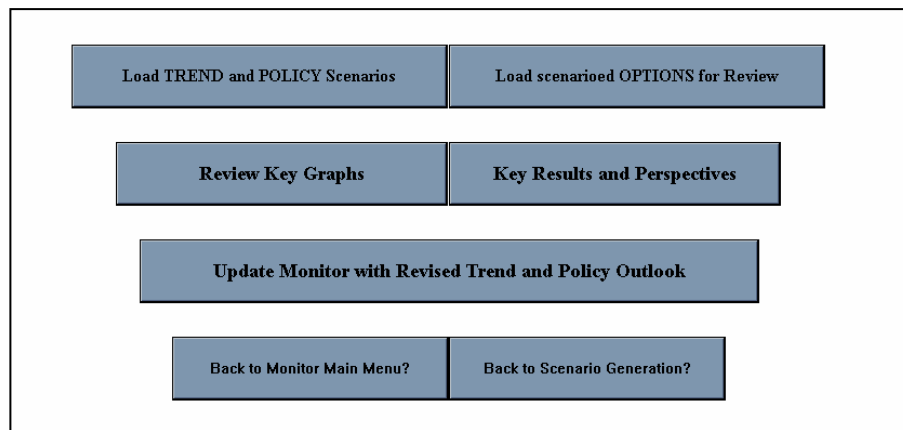
**MONITOR 2: Controlling Menu of Component Monitors**

with the exception of,

which has an extra button *"Review Equilibrium and Intertemporal Consistency"*. This has been added for reasons of clarity to enable the user to verify the equilibrium balance for each account. In function, however, it is similar to the "*Key Results and Perspectives*" button

The first row of buttons allows the user to select the scenarios for review. *Trend* is the business-as-usual case, whereas the *policy* scenario would correspond to *trend plus selected*

policy instruments such that desired/plan outcomes are achieved. Typically, the user would be loading these two scenarios for review. This is done by using the button *"Load Trend and Policy Scenarios"*. Since the monitor is also used to analyse any scenario that may be generated – in particular those which are generated while mapping the feasible policy space corresponding to various setting of policy instruments – the button "*Load Scenarioed Options for Review"* has been added. Its function is analogous to the button *"Load Trend and Policy Scenarios",* use of which successively open two windows
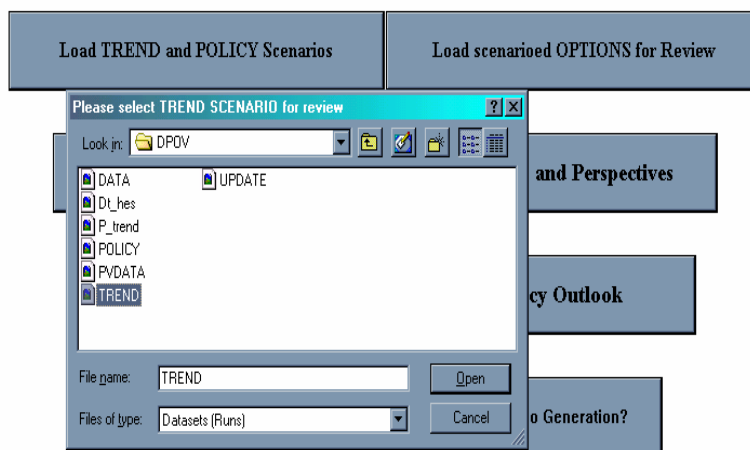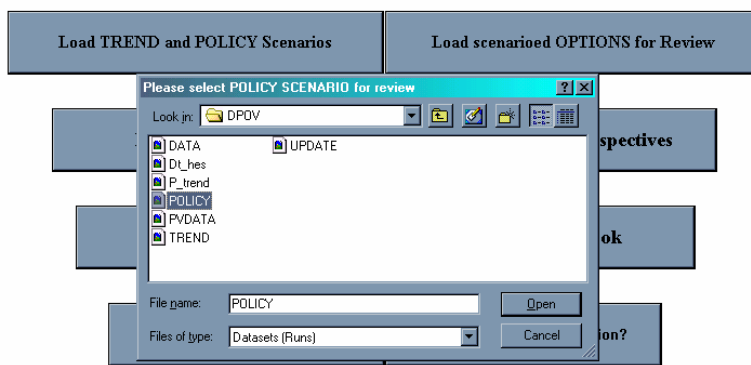
MONITOR 3: Button *"Load TREND and POLICY Scenario"*

which prompt the user to select the required scenarios, and pauses at the menu below.
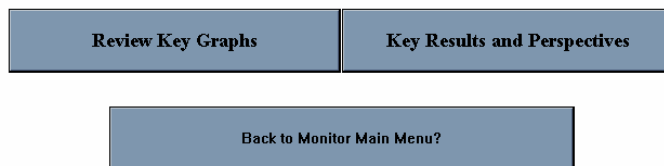
Using "*Key Results and Perspectives*" Button

The use off this button, or the *"Review Equilibrium and Intertemporal Consistency"* button, in the Economic Monitor leads to a screen like the next, *MONITOR 4,* which displays:

  i. A sketch depicting a *key model concept*, in this case the layout and dimensions of the SAM for Bangladesh since this is the economic monitor

  ii. A set of buttons at the bottom of the sketch which allow the user to
- *Return* to the controlling menu for the component monitor
- *Load, unload and reorder scenarios*
- Review *differences between first two scenarios* which are loaded. These differences refer to policy /parameter changes which can vary during the course of a simulation but not data changes which are typically specified at the beginning of a simulation.
- *Review related concepts* about the SHD model. The concept sketches are the basic flow charts of the model and provide a visualization of model specification. They complement the equations of the model.
- *Review classification* used in the component model, such as the set of activities, household categories, etc.

  iii. A set of buttons on the right which are used to analyze the results for the loaded scenarios. There may be more than one set of such buttons. The analyzer which is invoked by these buttons – in some cases after an intermediate concept sketch - functions in two modes depending on whether a <u>single variable</u> or a <u>set of variables</u> is to be analyzed. The perspective in mode 1 is dynamic - causal and over time. In mode two it is comparative static – cross sectional for a selected time reference.

    Mode 1: Single variable. Dynamic-causal. This mode enables the user to:
- a. Review the causes of the variable graphically and in tabular form
- b. Review the equation for the variable as it is implemented in the program and also variable names.
- c. *Change the variable analyzed* by selecting another element in the classification sets.
- d. *Change perspective* for the variable being analyzed by using the three buttons
  - Button *"Full size graph?"*
  - Button *"Tabulate?"*
  - Button *"Analysis?"*
- e. Switch between the two modes

    Mode 2: Vector of variables. Comparative static. This mode permits the user to:
- a. Compare across a vector of variables for a given year.
- b. Change the reference year for comparison
- c. Review the equation and variable names.
- d. *Change the set of variable analyzed* by redefining subsets .
- e. *Change perspective* for the vector being analyzed by using the four buttons
  - Button *"Full size graph?"*
  - Button *"Tabulate?"*
  - Button *"Analysis?"*
  - Button *"Component Graphs"*
- f. Switch between the two modes

To fix ideas we comment on the screens a user will encounter while using the above features. We will not try to interpret the results at this moment, that is reserved for another opportunity. We continue with illustrations from the Economic Monitor.

C:\SUS_DEV\PP...\DSAM.vmf Workbench Variable is: growth

Review Equilibrium Conditions and Intertemporal Consistency

SOCIAL ACCOUNTING MATRIX FOR BANGLADESH

DIMENSIONS

Institutions

	Activity	Factors K, L	Basic needs BN	Households HH	Government GOV	Corporation COR	Rest of World ROW	Consolidated Capital Account	DEMAND
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Households		income from factors 9x2		transfer 9x9	transfer 9x1	dividend 9x1	remittance 9x1		income HH
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INCOMING

OUTGOING

INSTRUMENTS

164 GOVERNMENT Taxes -Tarrifs -- Expenditures-Transfers

81 HOUSEHOLD Transfers

MULTISECTOR-MULTIPROCESS FRAMEWORK FOR CONSISTENT DATA STRUCTURES & MODELS

Equilibrium

- 45 activities
- 9 households
- 9 basic needs

Factor market

- factor capital
- factor labour

Macro balances

- household
- government
- corporation
- rest of world
- capital A/C

Results?..

Review Concepts

- SHD Ver 1
- Dimensions
- Economy

Scenario Control

- Load,Unload and Reorder Scenarios
- Differences between first two scenarios

Return to SAM Menu

Review Classifications

| Activities	Households
Basic needs	Institutions
Invest. by sector of origin	

MONITOR 4: Button *"Key Results and Perspective"*
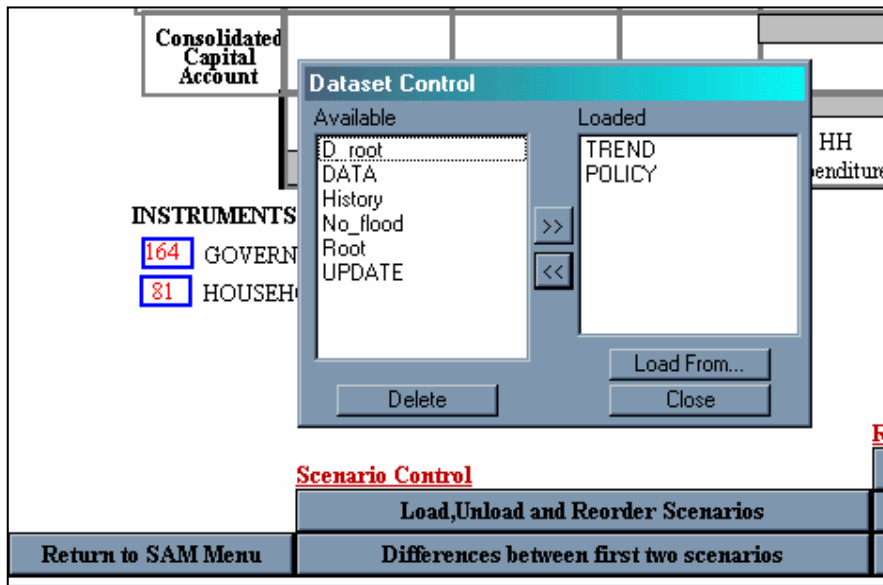
MONITOR 5: Button *"Load Unload and Reorder Scenarios"*

Activating button *"Load Unload and Reorder Scenarios"* opens a window entitled *"Dataset Control"* which gives access to scenarios available in the current directory. By using the buttons now available in this window it is possible to change the selection(s) and to reorder them. This reordering affects the ordering of variables from the selected scenarios in graphical and tabular outputs.
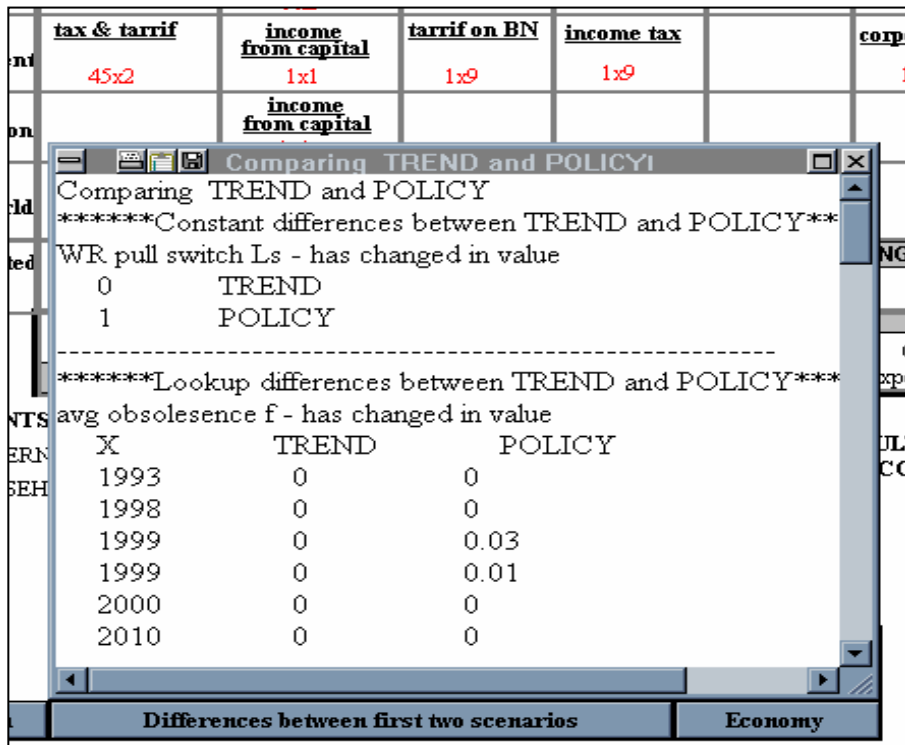

MONITOR 6: Button *'Differences between first two scenarios"*

Activating the button *"Differences between first two scenarios"* opens a window which lists the changes in parameters which are either, constants, functions of time or switches which activate alternate model behaviour, such as, alternate closure rules for markets. Interpreting these setting requires familiarity with the model.

The use of the buttons under the group *"Review Concepts"* is straightforward. They provide quick access to the principal flow charts of the model.

Under the *Review Classification* group are buttons which display the elements of the set of activities, households, basic needs, institutions and investment by sector of origin. For instance, using the button *"Basic Needs"* displays the nine basic needs considered in the model and so on for the other buttons in this group.
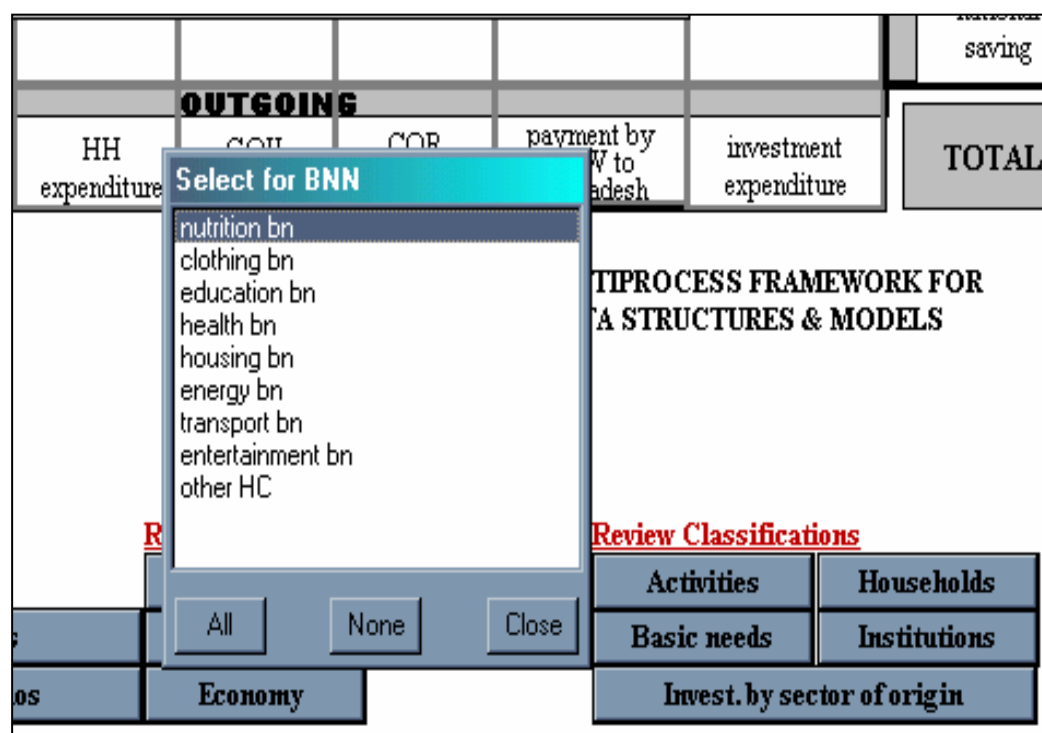
MONITOR 7: Button "*Basic Needs*"

All the variables which are entry points for analysis in the *Economic Monitor* are listed below. Analysis is initiated by pressing the required button positioned on the right edge of the controlling screen. This selection may point to a single variable, or a vector of variables. Corresponding to these two cases the analyzer activates in the *dynamic-causal mode 1,* or *comparative static mode 2*. The features of both these modes are explained and illustrated using buttons *"45 activities"* and *"investment by sector"*, respectively.
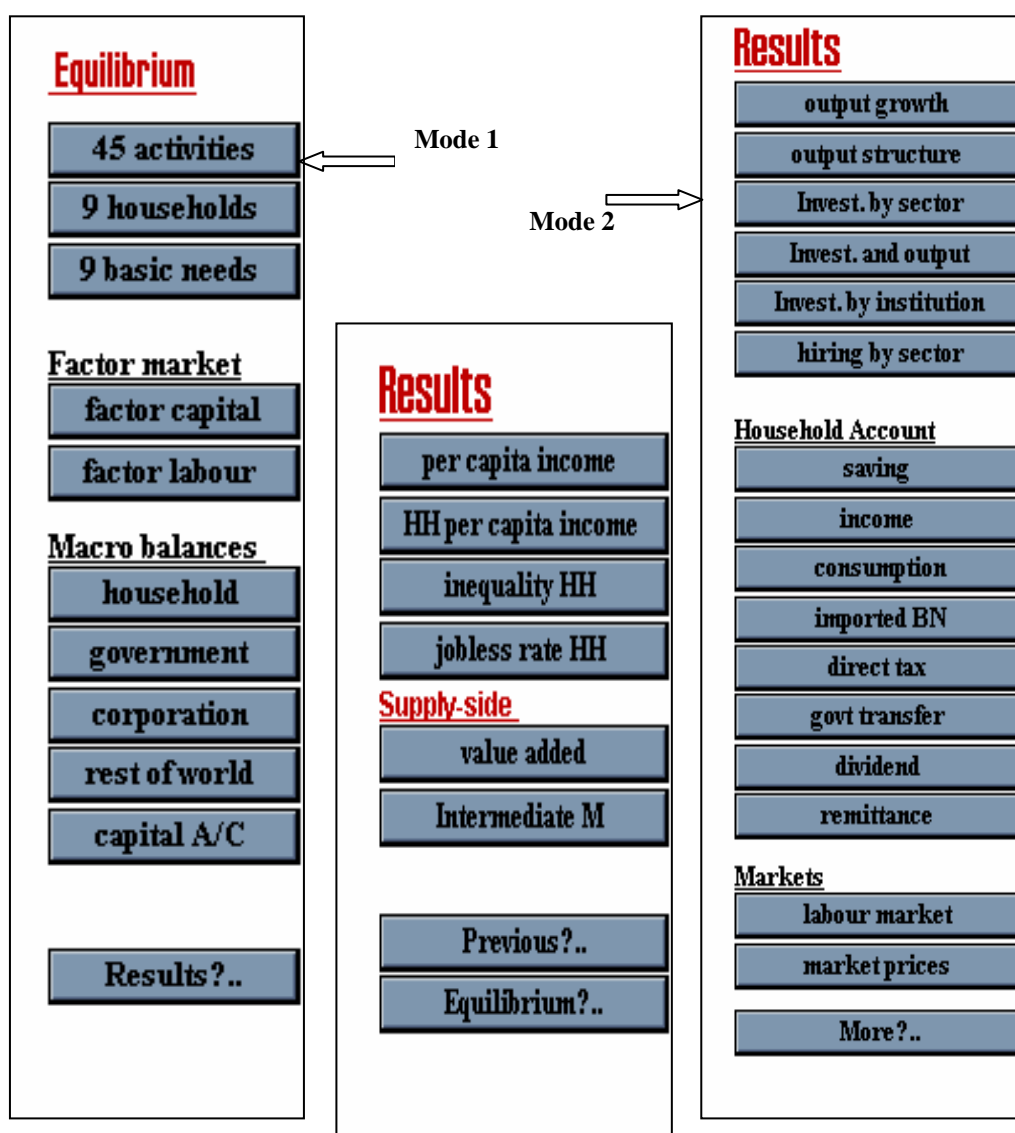
MONITOR 8: *"Equilibrium and Result Variables"* **in the Economic Monitor**

Mode 1: dynamic-causal, one variable

The perspective of the analyzer in *mode-1* is *dynamic-causal.* Button *"45 activities"* activates this mode and opens the following screen. Here for the selected variable[4], it is possible to:

✡ view a basic screen which reports the variable and its immediate causes via tree diagrams and graphs, including the equation of the variable and definition of arguments;

✡ compare across scenarios

✡ perform a causal tracing of the variable via tree diagrams and graphs

✡ allow user control over sub-vector definitions, that is, to change the loaded vector element, to load more elements and /or redefine the loaded sub-vector in the workbench[5]

✡ access other report generating screens[6]

✡ return to the controlling screen[7] .
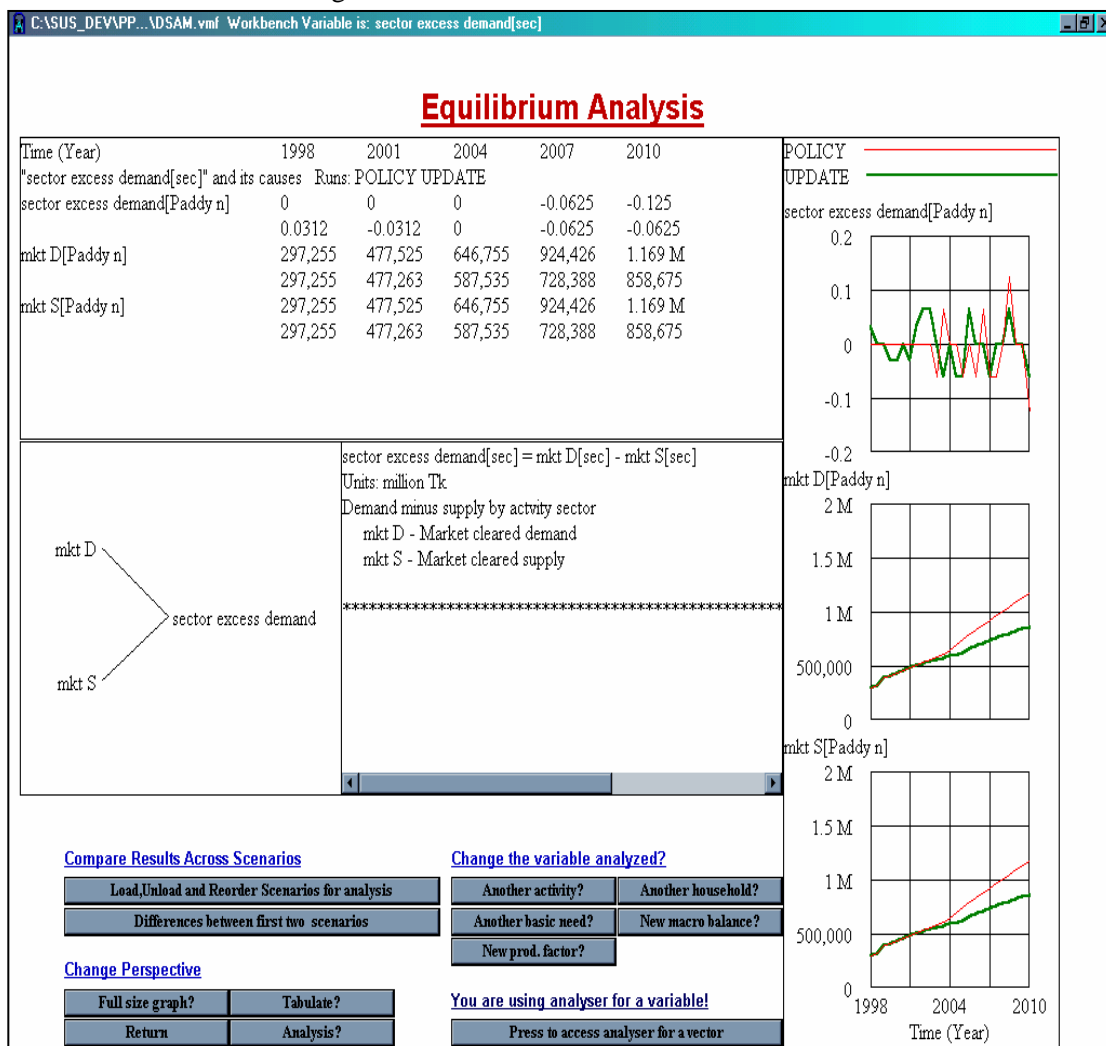
MONITOR 9: Mode-1, Basic Screen

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[4] Please note the selected variable is a element of the activity vector.

[5] Done by buttons *"Another activity, Another household, Another basic need".*

[6] Accessed by buttons *"Full size graph, Tabulate, Analysis"* and the mode-2 switch *"Press to access analyzer for a vector".*

[7] Please note the "controlling screen" would mean that where the analyzer was invoked.

Basic Screen. This screen has four panels and four groups of buttons. The title bar on top displays the variable being analyzed, namely, *sector excess demand[sec=Grains n].* Two scenarios are being reported – *Policy* and *Update*. The table reports the values of the variable and its causes, which are the arguments of the equation for the variable. The equation panel gives the specification of the equation, an elaboration of variable names and the units of measure. The panel to the left depicts the variable and its causes as a *"tree diagram",* while the panel to the right of the equation panel shows the corresponding graphs of the variable and its arguments.

Causal tracing. The variables on the branches of the tree are active[8]. Practically, this means by double clicking on say, *mkt S,* it is possible to analyze that variable and its causes. The tree now depicts both backward and forward linkages of the variable, please see *MONITOR 10*. To continue analyzing these linkages, equivalently exploring the causal chains associated with a variable, it is simply required to double click the variable. A word of caution, given the large number of variables in the model, it helps to have a well defined purpose while using the analyzer.

Causal Analysis of Variable: mkt S[sec]

Time (Year)	1998	2001	2004	2007	2010
"mkt S[sec]" and its causes	Runs: UPDATE				
mkt S[Grains n]	13,951	18,349	28,303	35,776	44,696
Ind tax[Grains n]	0	0	0	0	0
Int M[Grains n]	0	0	0	0	0
Int Use[Grains n]	7,380	9,708	14,974	18,927	23,647
IntM duty[Grains n]	0	0	0	0	0
VA[Grains n]	6,570	8,641	13,329	16,848	21,049

mkt S[secC] = Int Use[secC] + Int M[secC] + IntM duty[sec] + In VA[secC]

Units: million Tk

Market cleared supply
   Ind tax - Indirect tax by activity
   Int M - Intermediate imports
   Int Use - Intermediate use
   IntM duty - Duty on intermediate imports
   VA - Value added by sector

MONITOR 10: Mode-1, Basic Screen, Example (ii)

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[8] Indeed this is true for all variable definitions in this screen except for descriptive variable names.

To reduce clutter the scenario *Update* which was included in the previous screen has been deselected using the button *"Load, Unload and Reorder Scenarios for analysis"* .

Change the variable analyzed? If the variable being analyzed is a member of the activity sectors, as in the current example, it is possible to select another activity from the set of 45 activities by using the button *"another activity?"*. Similarly, if the workbench[9] variable is an element of the set of households or basic needs.

Button "Full size graph". The use of this button generates a larger graph for the workbench variable with option to choose alternative scenarios for analysis.
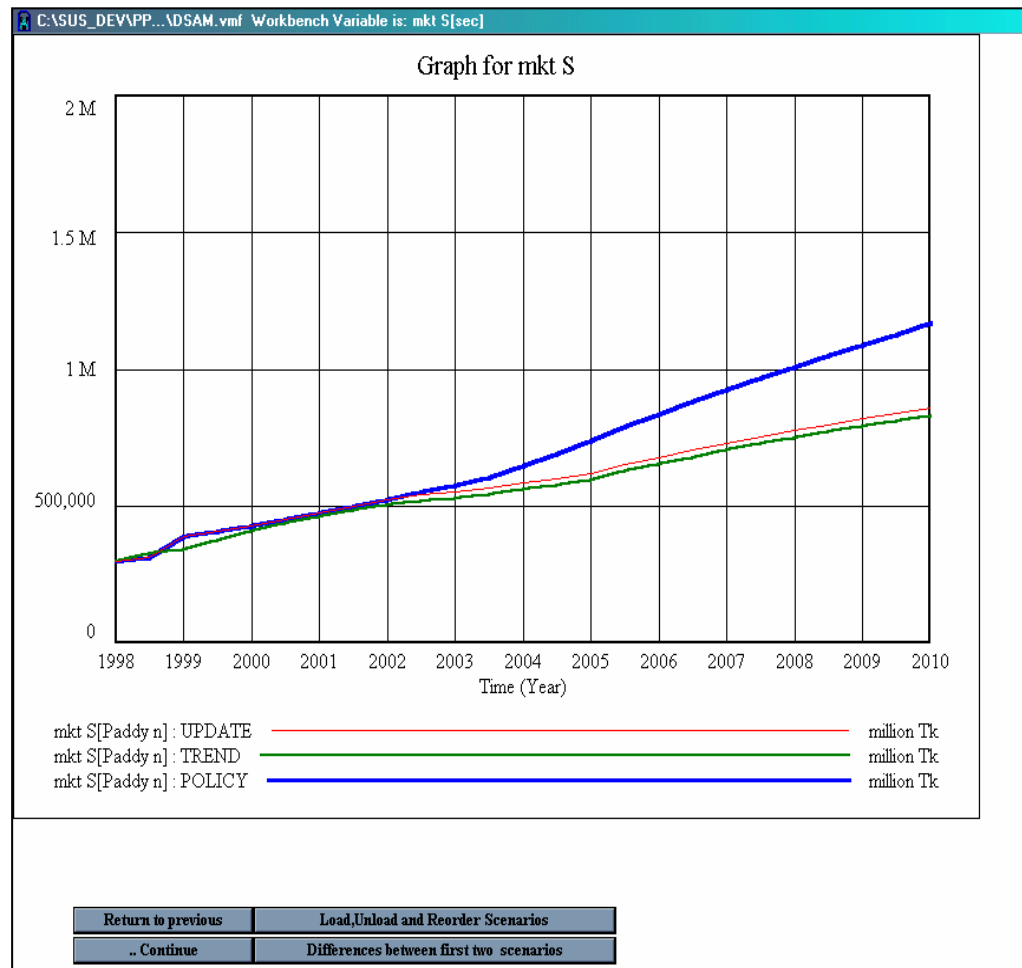
MONITOR 11: Button *"Full size graph"*

No new operations are involved.

Button "Tabulate"

This button allows user greater control over output display, that is, causal trees, equations, tables and graphs. We now describe the novel aspects of this feature of the analyzer and pass over those it shares in common with the earlier screens. Continuing the example, if the analyst were to use this button while in *MONITOR 10* this would result in the next screen, namely, *MONITOR 12 Button "Tabulate",* Screen-1. The following observation may be made:

---
[9] "Variable being analyzed" and "work-bench variable" are synonymous.

Panels
- ✿ A new panel with a *time selector* for bar graphs has been included. This allows redrawing the bar graph for any selected year. Selection is made by using the slide control and pressing the indicated button to accept the time change.
- ✿ A *depth-2* causal tree has been included along with the *cause-use* tree.
- ✿ Two *table* panels are available, one for reporting the values of the work-bench variable and the other for reporting the variable and its causes.

MONITOR 12 Button *"Tabulate",* **Screen-1**

Basic operations

✿ Display in each panel is generated <u>first</u>, by double clicking and highlighting the variable in the tree panel and <u>second</u>, pressing the required panel button which may be "*Build Table, Build Table of causes, Cause-Use links on highlight, Equation on highlight*".[10]

✿ Additional output displays are available using the button, "*Full Graph, Component Graph, Bar Graphs* and *Graph of Causes*". Each of them opens a new window with the required output.

✿ Button "*Refresh Screen*" clears all output and reverts to initial settings for the work-bench variable.

Following two screens are the outcome of using the above basic operations. They provide user examples to verify familiarity with these operations.

MONITOR 13: Button *"Tabulate"* **Screen-2**

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[10] Debug "Another household", "Another basic need"

Hint: Double click on *VA*. Verify that it is highlighted. Click on each of the buttons – *Depth 2 causal links on highlight, Equation on highlight* and *"Build Table of causes"*. Resize and drag the output window to below the button as shown above.
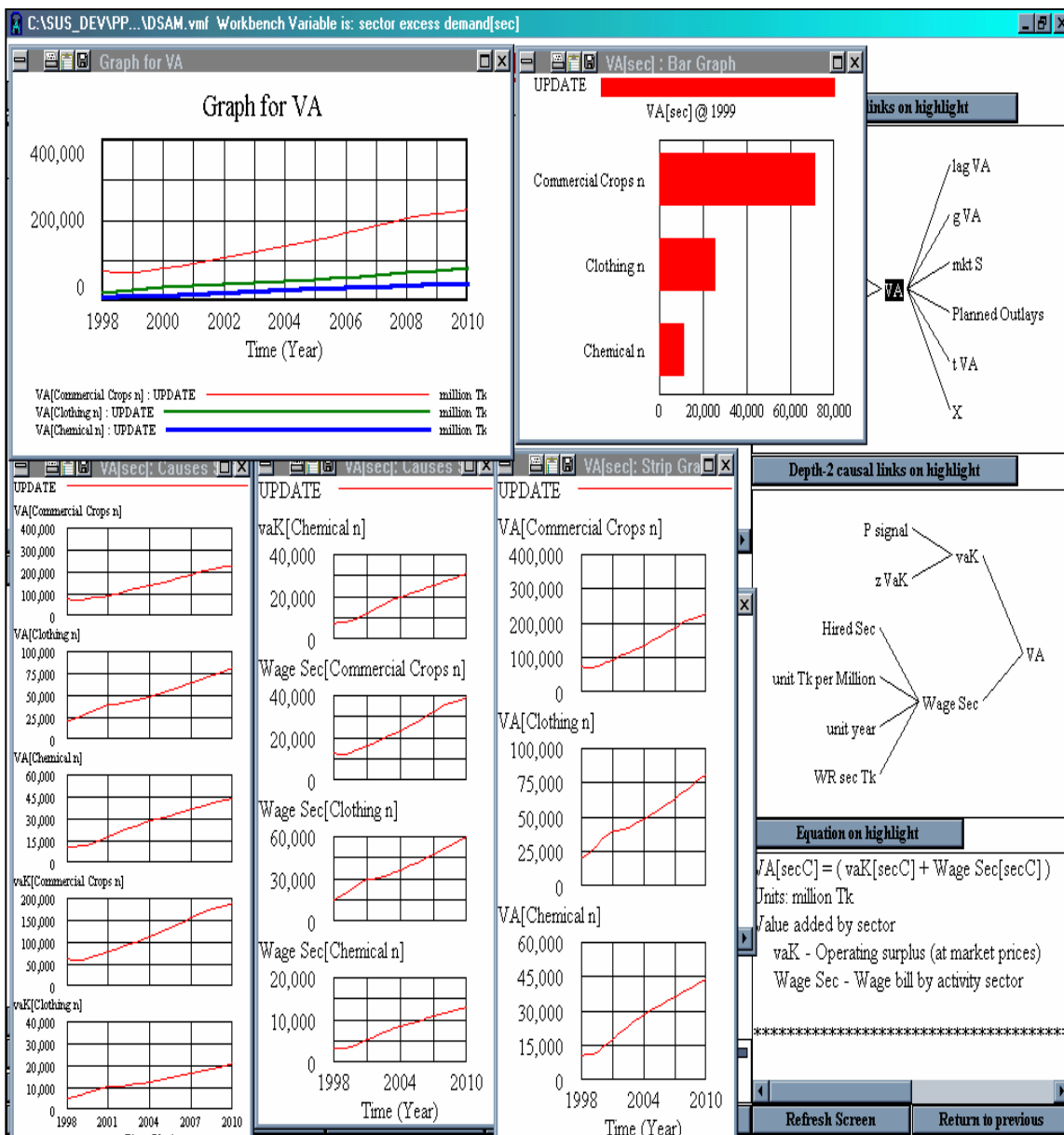
MONITOR 14: Button "*Tabulate",* Screen -3

Hint: Load activity sectors *commercial crops n, clothing and chemicals* in the workbench using button *"Another activity set?"*. Set time for bar graph at 1999 and "accept/commit" the change. Use *Full Graph* button and position the result window as shown above. Do the same using button *Bar Graphs, Component Graphs* and *Graph of causes.*

Button "Analysis"

MONITOR 15: Button *"Analysis"*, Screen-1

The above screen is almost identical to that generated using button *Tabulate.* The difference is now the table output generated with *Build Table?* button is not directed to a pre-defined panel. It behaves like the output of button *Build Table of Causes?* which gives the user more degrees of freedom in composing a screen with different types of outputs.

As an example consider the screen below generated using the *Analysis* button


MONITOR 16: Button *"Analysis"*, Screen-2

This feature is exceedingly useful for an analyst to focus attention on aspects of model behaviour from varying perspectives. It provides the user with a powerful instrument to customize output screens for maximum insight and easy communication

Mode 2: comparative-static, set of variables

The perspective of the analyzer in *mode-2* is *comparative-static.* Button *"Investment by sector",* among others, activates this mode and opens the following screen. Here for the selected vector variable *(cf. MONITOR 8)* [11], it is possible to:

✡ View a basic screen which reports the variable in a multiple bar diagram along with the equation of the variable and definition of arguments.

✡ Allow user control over the selection of year.
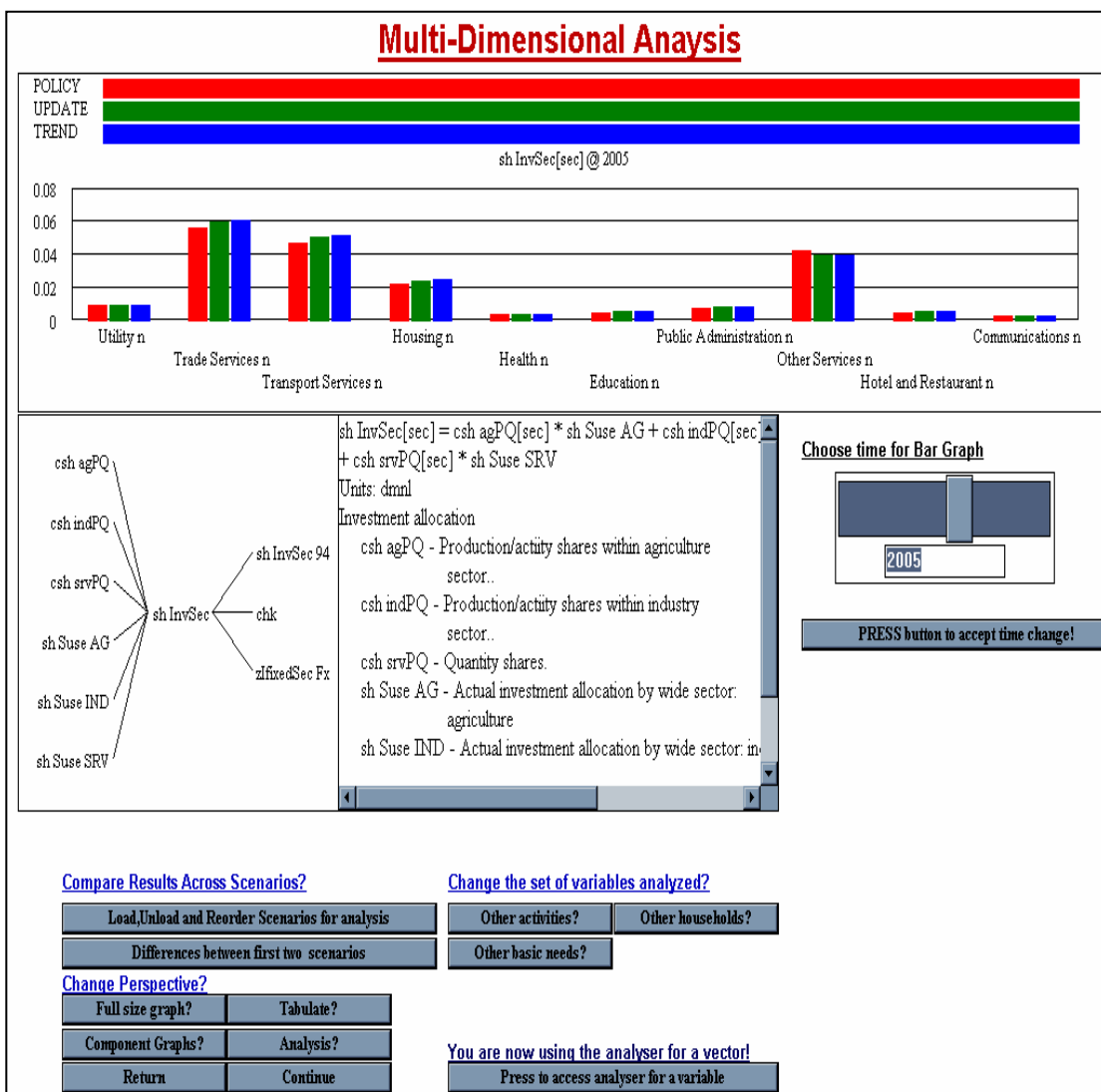
MONITOR 17: Mode-2, Basic Screen

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[11] Please note the selected variable is a sub-vector element of the activity vector.

And, as in mode 1, discussed earlier (*cf.* page *28*):

✿ Allow user control over sub-vector definitions, that is, to change the loaded vector element, to load more elements and /or redefine the loaded sub-vector in the workbench[12]
✿ Change variable selection using the *cause-use* tree.
✿ Access other report generating screens[13]
✿ Return to the controlling screen[14] .

Basic Screen. This screen has four panels and four groups of buttons. The title bar displays the variable being analyzed. Three scenarios are being reported, namely, *policy, update and trend.* The bar diagram panel may be redrawn for another year using the *time selector.* Selection is made by using the slide control and pressing the indicated button to accept the time change. The other panels and buttons are similar to those discussed above for mode-1.

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[12] Done by buttons *"Another activity, Another household, Another basic need".*

[13] Accessed by buttons *"Full size graph, Tabulate, Analysis, Component graphs"* and the mode-2 switch *"Press to access analyzer for a variable".*

[14] Please note the "controlling screen" would mean that where the analyzer was invoked.
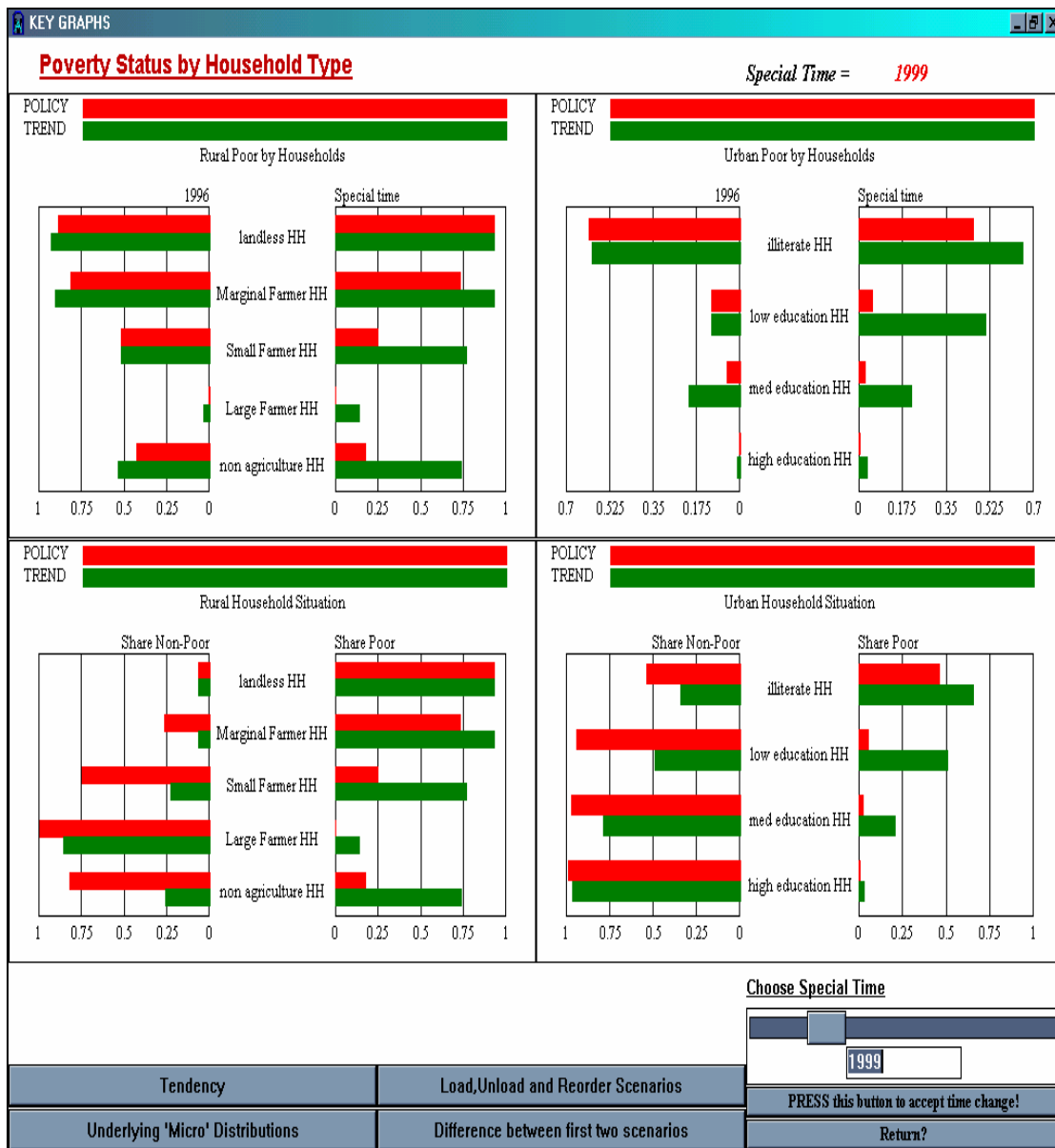
Using "Key Graphs" Button

Essentially it enables a graphic review of key results pertaining to the component monitor. The selection of graphs is controlled by buttons which typically offer user a "pick list" of graphs from which to choose and displays them in the associated panels. The graphs are time charts, standard bar charts, population pyramids and analogues. For standard bar-graphs and those of the population pyramid type, a time selector has been included. The use of multiple panels facilitates rapid imaging of various perspectives which renders the model transparent, thereby, making it possible to understand easily and communicate effectively, to a wide audience, the evolution of interdependent processes with policy intervention. The following illustrations are from the poverty monitor.
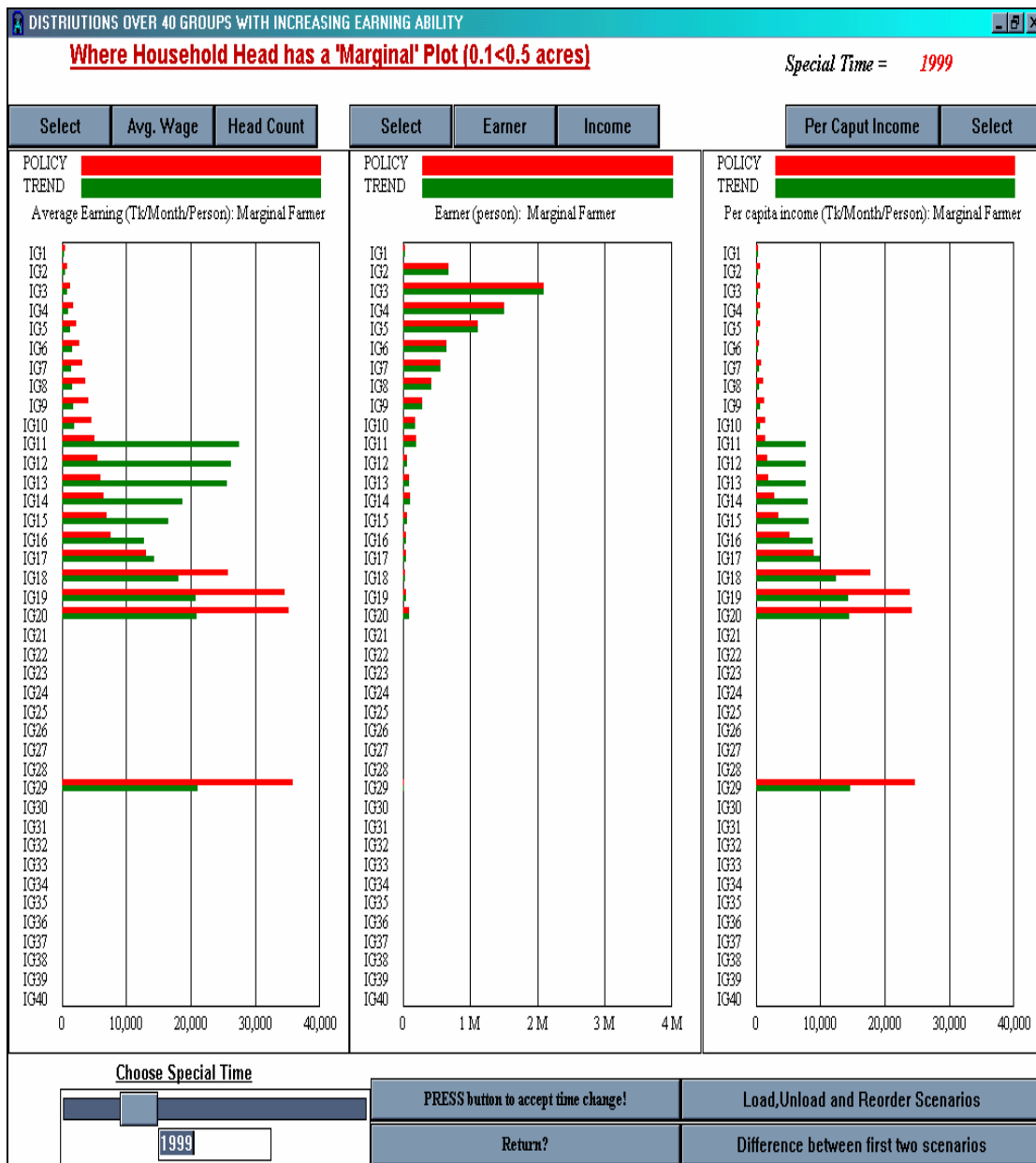

MONITOR 18: Button "*Key Graphs*", Time Charts
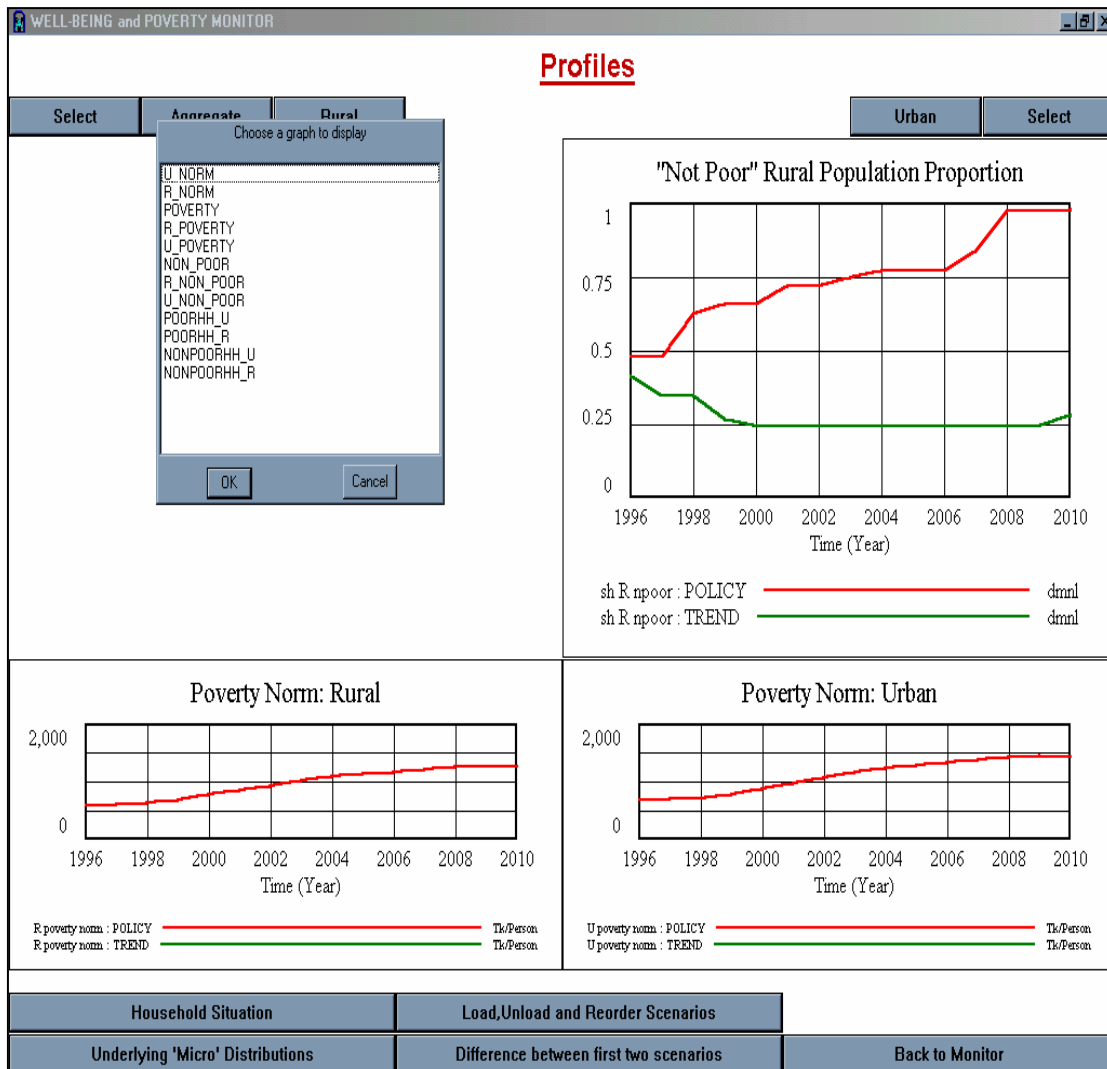
MONITOR 19: Button "*Key Graph*", Pick List

**MONITOR 20: Button "*Key Graph*", Pyramids**

MONITOR 21: Button "*Key Graphs",* Bar Charts

Using "Update" Button

It is maintained that having a set of consistent development accounts, historical and prospective, available to all development agents, will improve development practice by creating a shared quantitative appreciation of development efforts and providing a consistent-coherent numerical basis for designing, costing and monitoring interventions. The SHD-Unit has a role to play in this process. It is expected to periodically share results with

✿ line ministries
✿ development partners
✿ data producers.
✿ who in turn are expected to use it design their sectoral programs and interventions

and, in time, establish a data feedback loop from the sector-program level to the SHD-Unit. For data producers' the link works as a cross-check to their national account estimation and other re-surveys of primary data and back to the SHD-Unit where the model is housed. To enable the SHD-Unit to discharge this function the *"Update"* button has been included in the *Monitor Module.* Pressing the *Update* button activates the next screen.
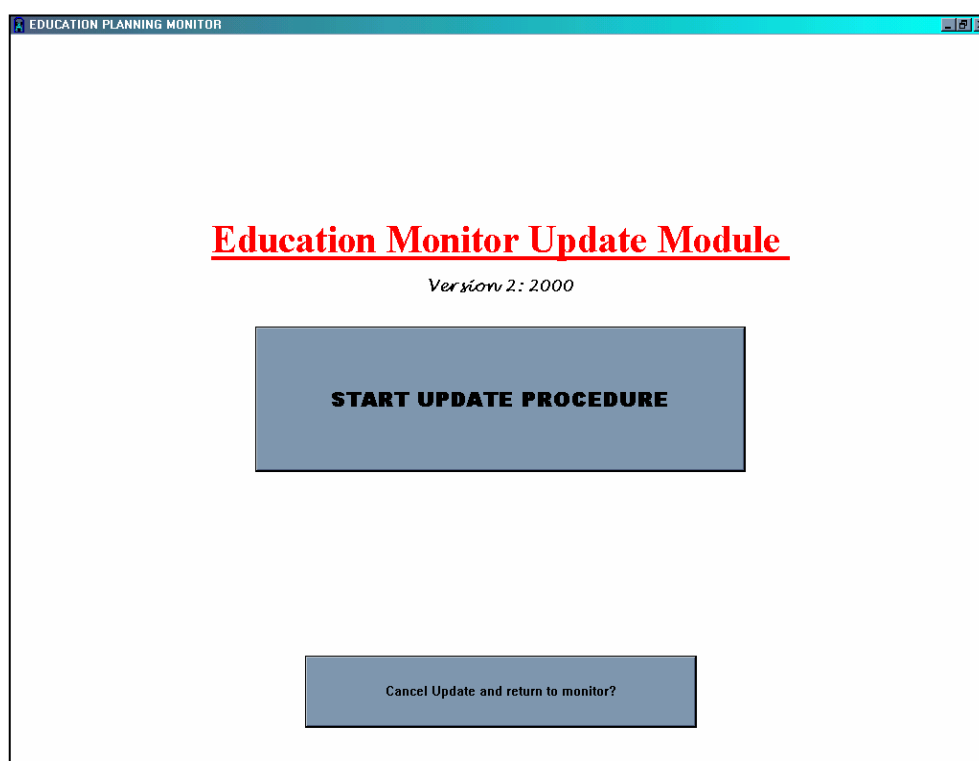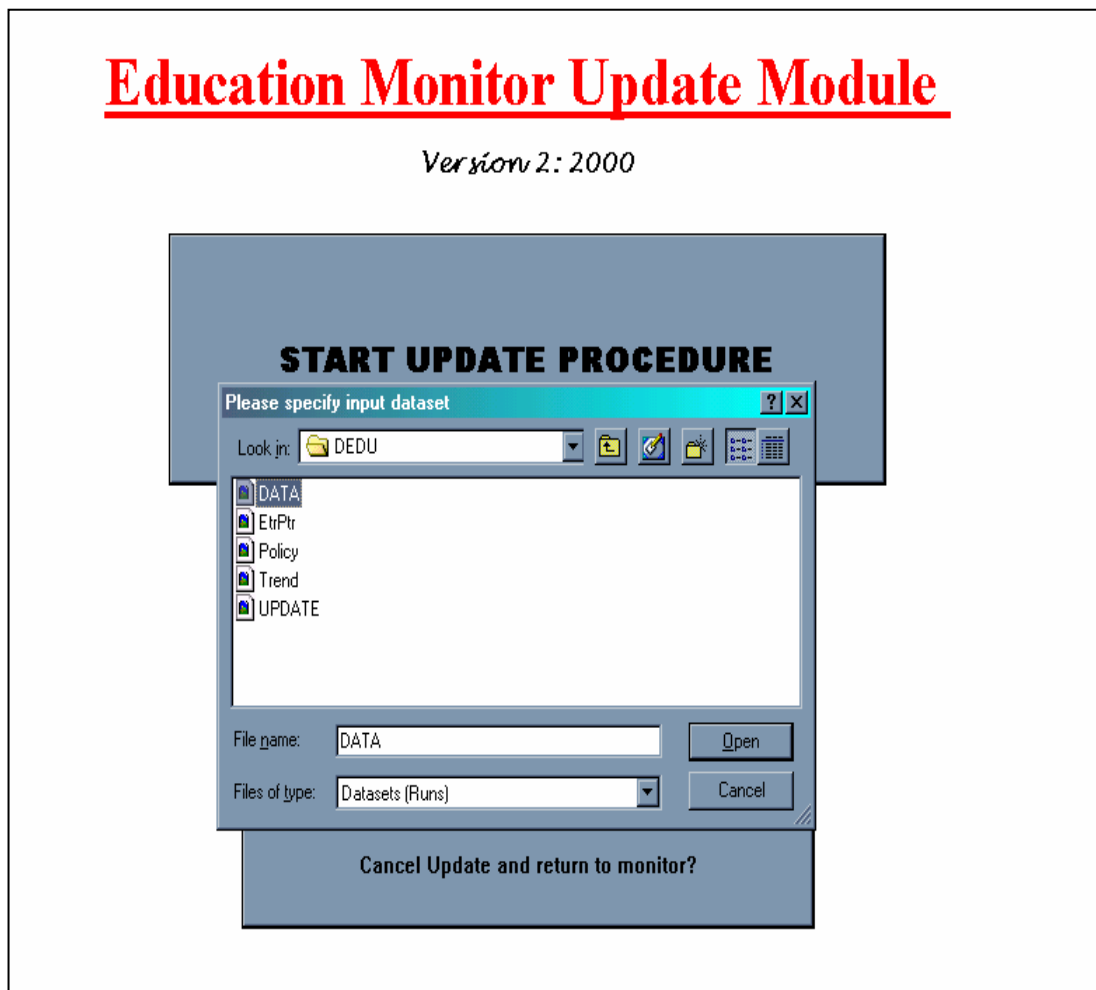

MONITOR 22: Button "Update". Screen-1

This module allows the user to:

✿ Update the *trend* scenario as new data becomes available;
✿ Update the *policy* scenario as the *trend* is updated, as development goals are reset, norms are revised, strategic choices are reviewed and interventions are modulated or re-designed;

- ✿ Maintain a log of updates;
- ✿ Access[15] and use all historical data bases;
- ✿ Access[16] and use all data bases of consistent and coherent model-based projections[17].

Basic operations involved in using the *"Update"* feature are illustrated with the *"Education Planning Monitor"*. On starting the *Update procedure* the user encounters three prompts. *First,* to specify the data[18] set.

**MONITOR 23: Button "Update" Selecting a Dataset**

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[15] Assumes prior training

[16] Assumes prior training

[17] Based on the then available data and prevalent policy regimes

[18] Currently there is only one data set in this directory. As new data comes on line, it will be formatted so that the model can read it. A time stamp will indicate when this was done.

Second, to specify the policy settings which are coded in the *"changes"* file. For instance, file *E5P.cin* was prepared to correspond to the 5th-Plan targets for education.
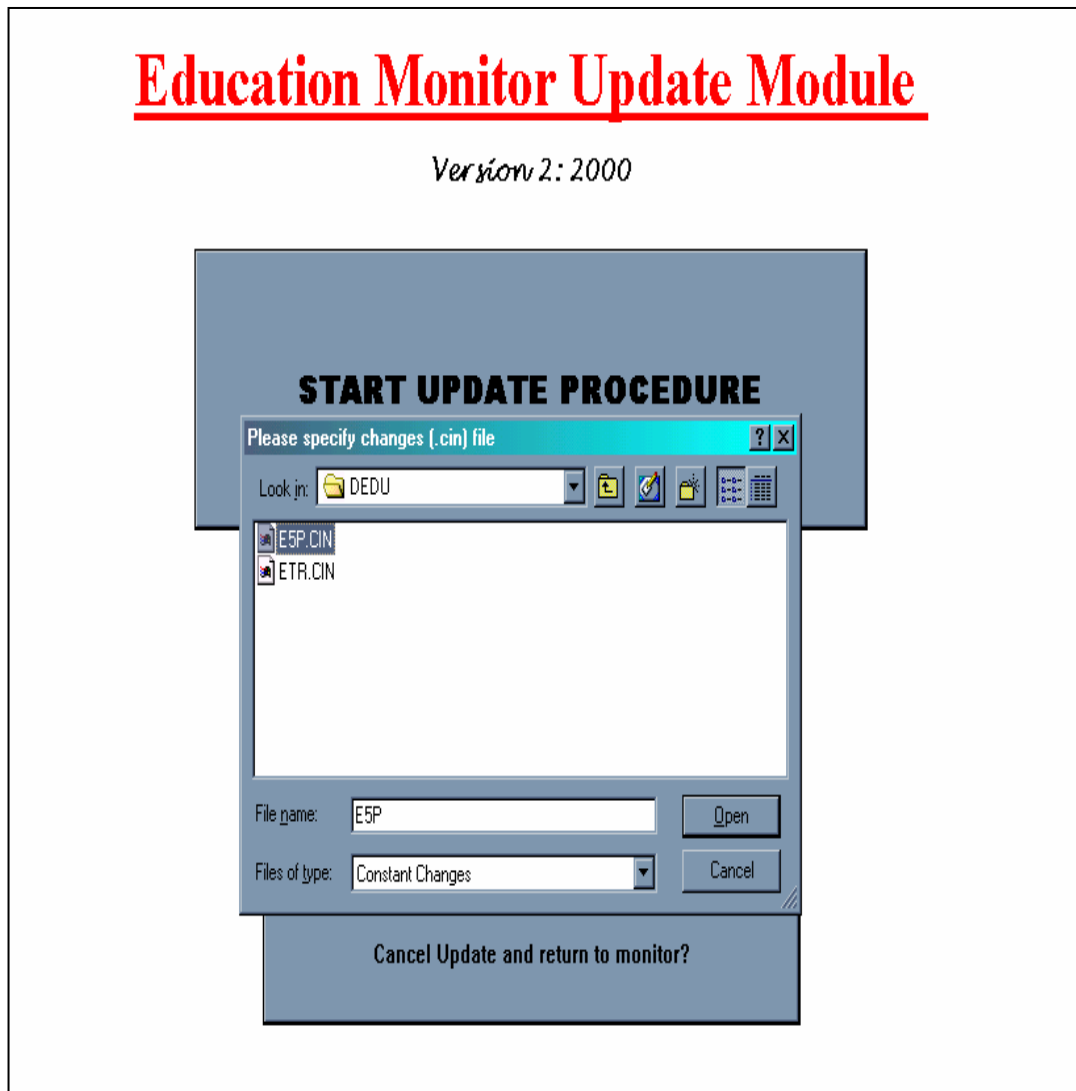
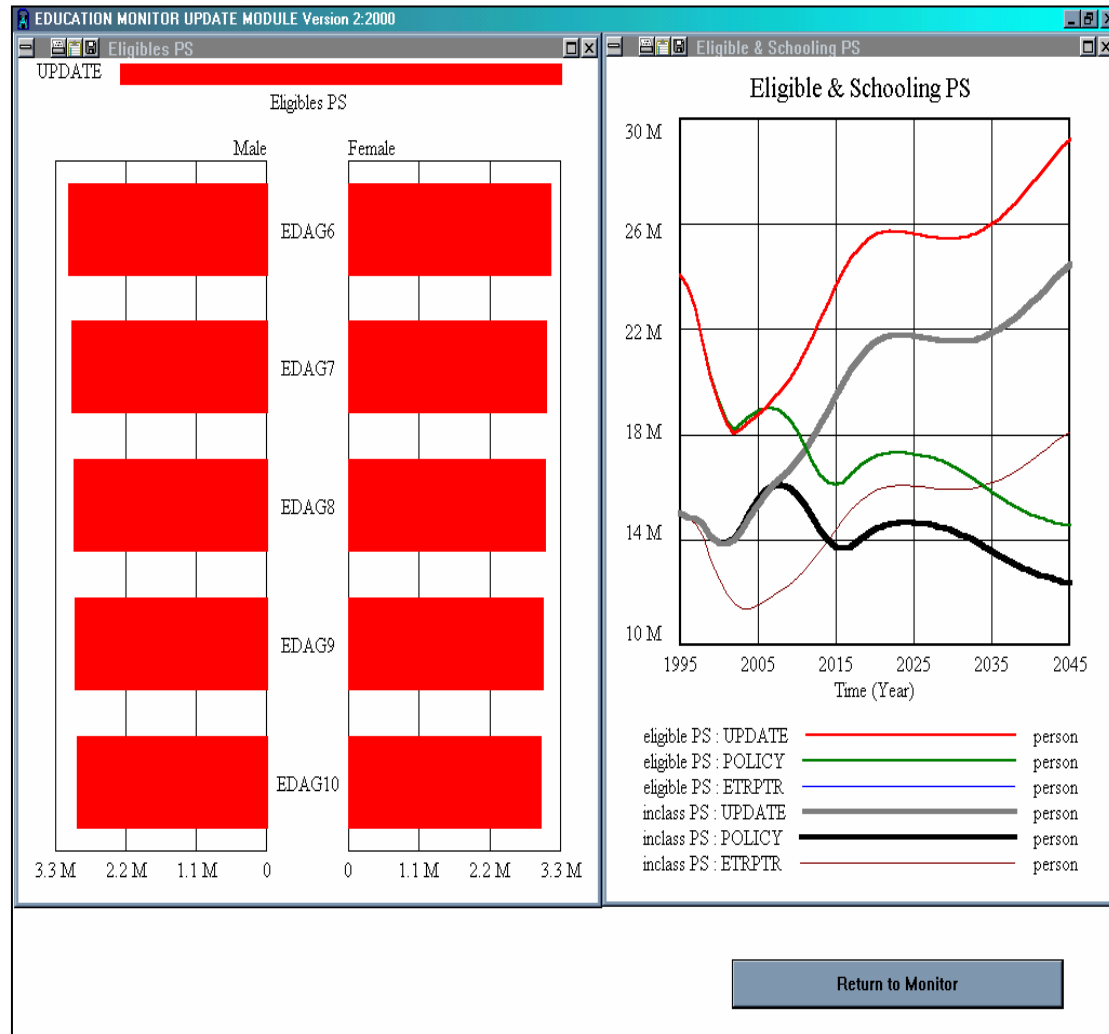**MONITOR 24: Button "Update" Policy Setting**

Third, to assign a name[19] to the *Update.*
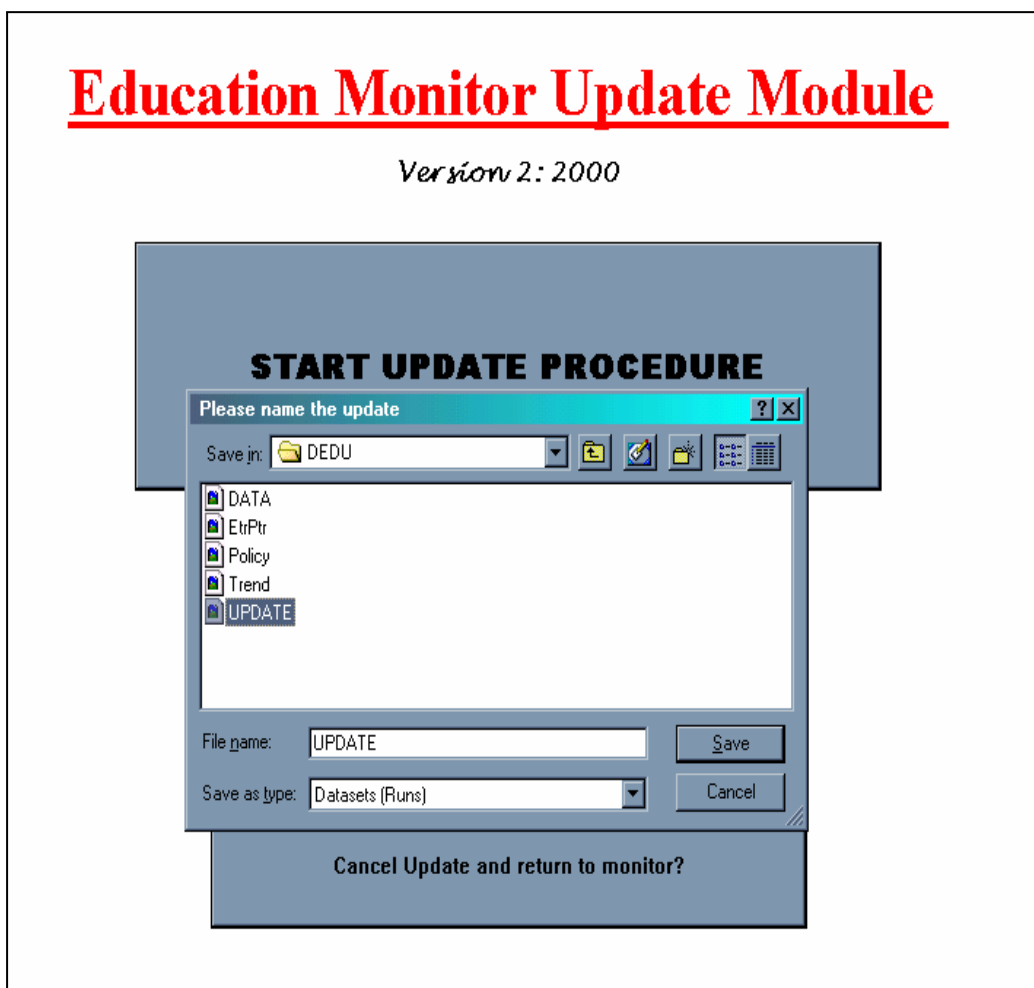
MONITOR 25: Button "Update", Labeling the Update

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[19] As for instance, Update00, Update01, …., keeping the length to 8 characters.

On saving the response to the third prompt the component model is solved to generate the update.


MONITOR 26: Generating Update

At this juncture *"work-in-progress"* graphs, as above, may be displayed. Or, a counter is displayed indicating the time interval for the update. In either event, the user returns back to the monitor menu where the *Update* may be reviewed.

II.1.2. Options Menu

Design

The *Option* Button in the main menu of the user interface (*cf. page 17*) opens the following screen. This is the *main* screen of the *options simulator* from which the user may access any of the listed component simulators by pressing the corresponding button.
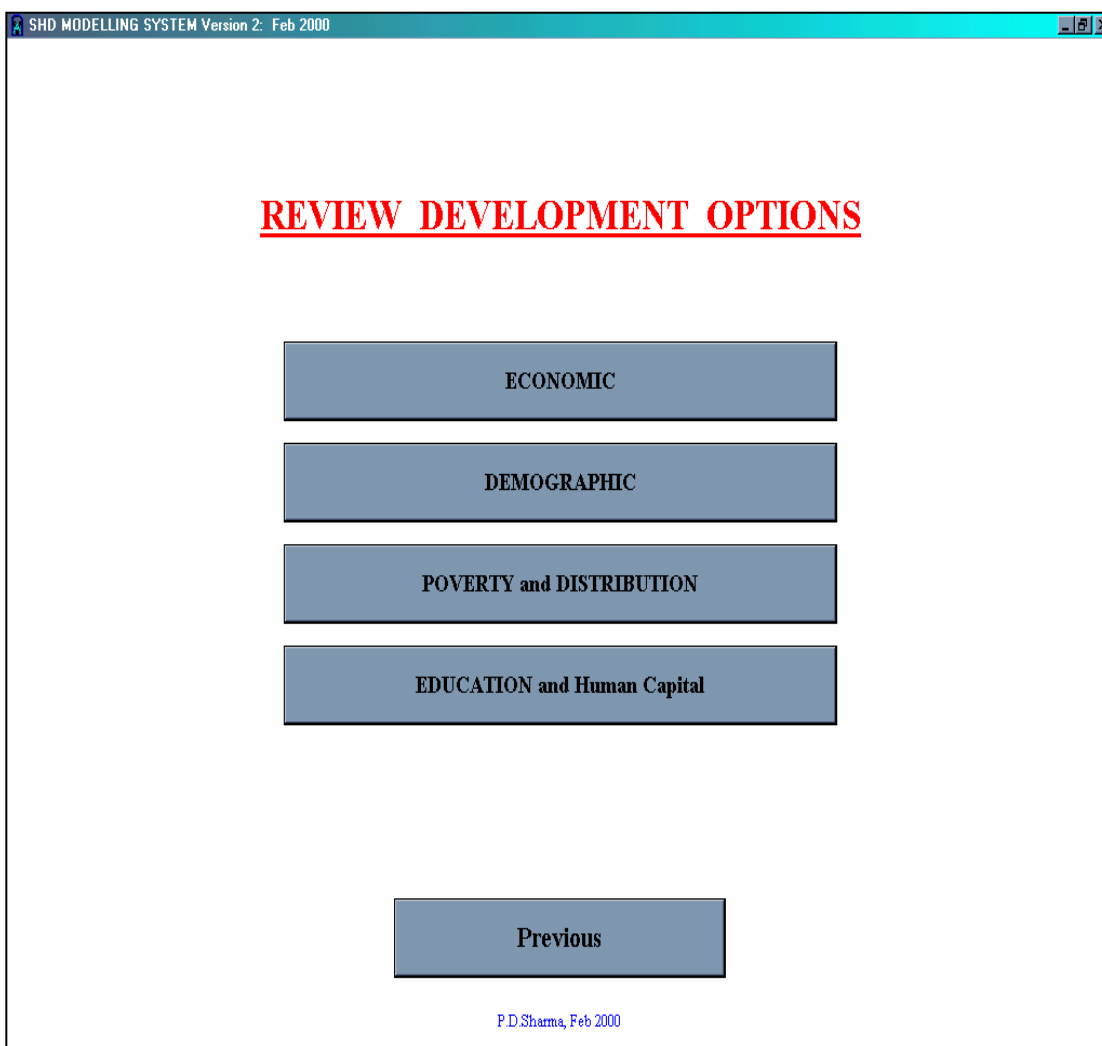
OPTIONS 1: Simulator Main Screen

Each of the above buttons opens a screen from which the user may, for the selected model component, either continue to *generate scenarios* using the simulator or use the monitor to *review results*. This screen is the *component simulator main screen.*

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GENERATE SCENARIOS

REVIEW RESULTS

Back to SHD Modelling System?
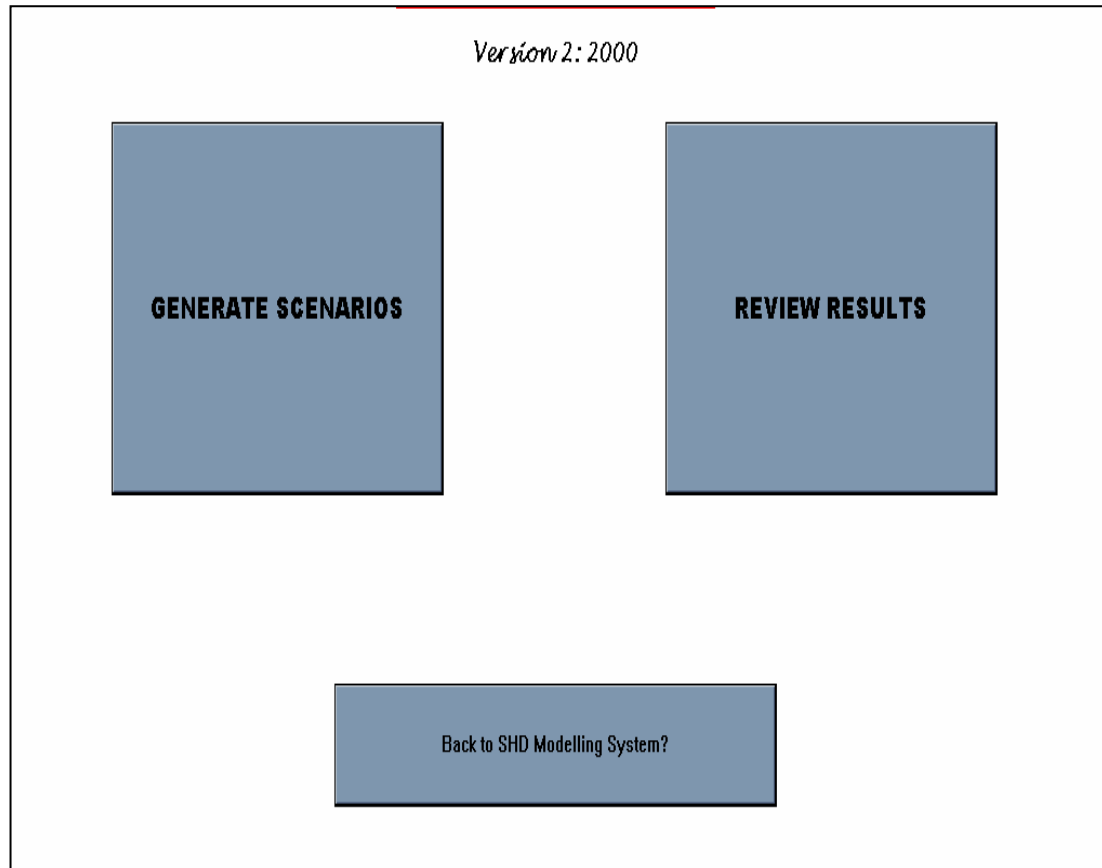
OPTIONS 2: Component Simulator Main Screen

Basically there are *four* steps in using the simulator to generate a scenario:

Step I.   *Setup the scenario.* This requires specifying the data sets to be used, the basic policy parameter setting, if any, and specifying a name for the new scenario. For some *setup* designs the program jumps directly to step III and for others it proceeds sequentially.

Step II.   *Select policy.* This means setting, or resetting the elements of the policy package

Step III.   *Run Simulation and Generate Scenario.* Here the user may either
  ✧   *Review Key Graphs* for the component model
  ✧   Go to the monitor for a more comprehensive review
  ✧   Go back to *Step II. Select policy* to continue fine-tuning/analyzing the policy package and/or to save the policy description in a *"see-in"* file.

Step IV.   *Exit* the simulator.

It may be remarked that there is a link between the *update module* of the monitor and the simulator in so far as the former is one of the simulator modes. However, the simulator module is more elaborate. It is like a workshop where different elements of a policy package

may be examined, individually and in combination, to work out what is most effective, subject to a set of decision rules/criteria. The basic operations and functions in using the monitor to review results were discussed in *section II.1.1.* Here the same is done for the component simulators which are entered via the *generate scenario* button. Focus is on the on "how-to-use" aspects while reserving all other issues for Chapter IV.

Step-I: Scenario Setup

The *Generate Scenario* button opens the *Scenario Set-up Menu* where the user is prompted to
✿ Specify the data sets[20] to be used
✿ Specify the basic policy parameter[21] setting, if any
✿ Specify a name for the new scenario
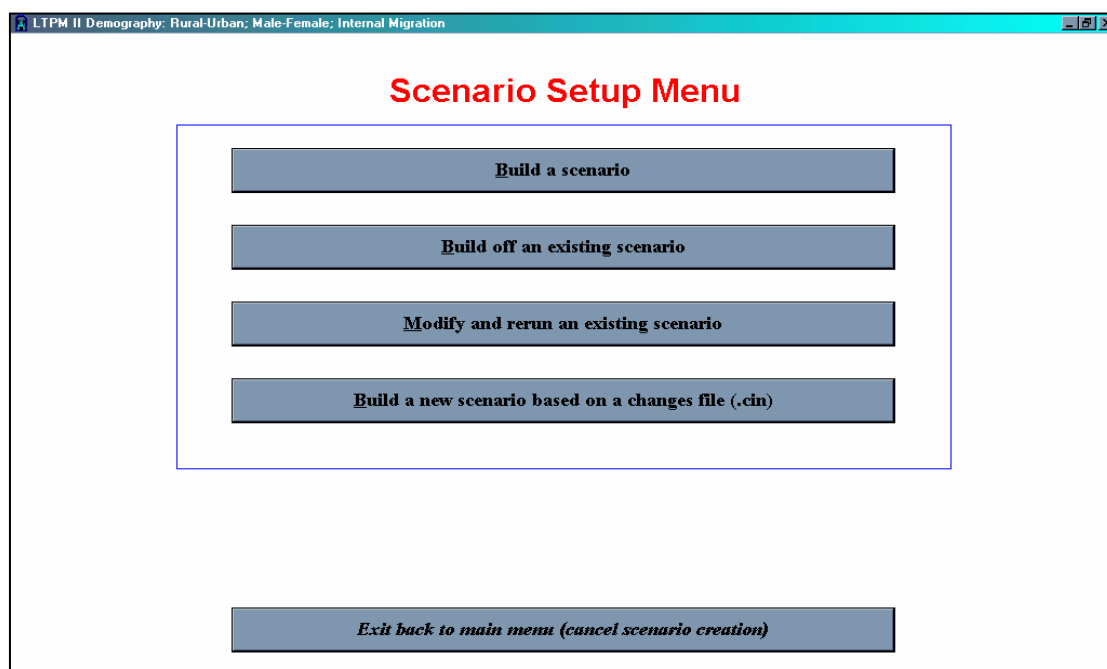
OPTIONS 3: Setup for Example 1

The first button *"Build a scenario"* in the above screen works exactly like the *"Update"* button discussed above. The second button *"Build of an existing scenario"* uses the data and policy parameter settling of a an existing scenario, prompts for a new name and goes to step-II, the *policy selection* step mentioned above. The primary purpose of step-II is to reset the policy elements of a regime and/or the response function[22] associated with development interventions. The third button, *"Modify and rerun an existing scenario"* prompts the user to identify the reference scenario and then goes to step-II. The fourth button, *Build a new scenario based on a changes file,* allows the user to change the policy regime and then goes to step-II. It is useful in the simulation of policy regimes with many elements.

Frequently used combinations of ways in which the selection of *data, parameters* and *labels* is done in practice lead to ways in which the *setup buttons* may be configured. Principally,

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[20] This is a *"vdf"* file type.
[21] This is a synonymously referred to as a *"see-in", "cin", or "changes"* file
[22] Typically this response function is an outcome of effective implementation and operational feasibility.

this is for the convenience of user and /or to lay down guidelines for the SHD-Unit. An example is the scenario set-up screen for the *well-being and poverty* simulator.
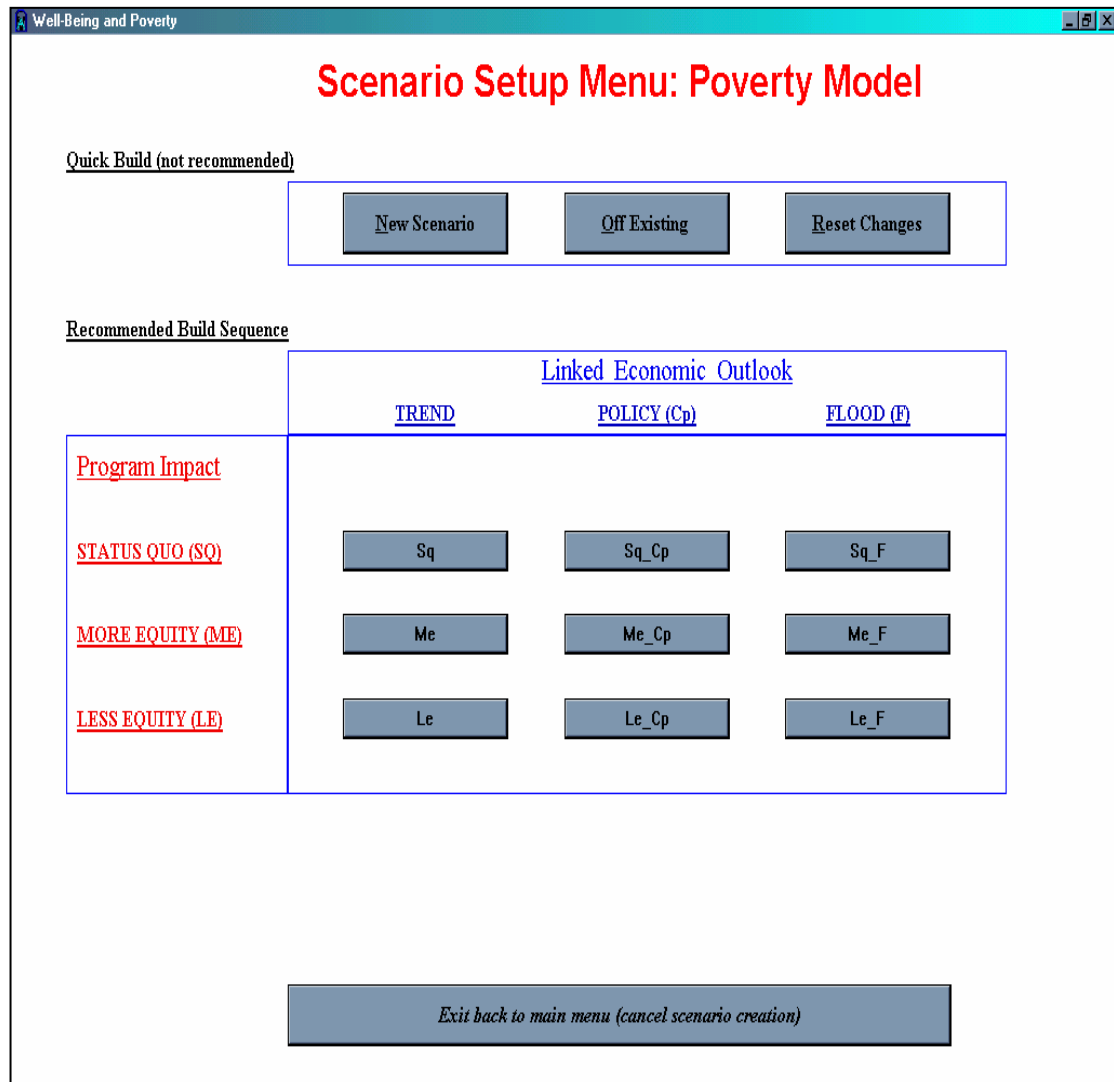


OPTIONS 4: Scenario Setup - Example 2

In the above *set-up* the top row of three buttons are the same as the 1st, 2nd and 4th in the previous example. The set of nine buttons in the box simulate the poverty situation corresponding to 3 categories of expected program impact on the underlying distributions given 3 economic scenarios. Selecting any of these chooses the required data and "see-in" file, simulates the model and allows the user the options associated with Step-III.
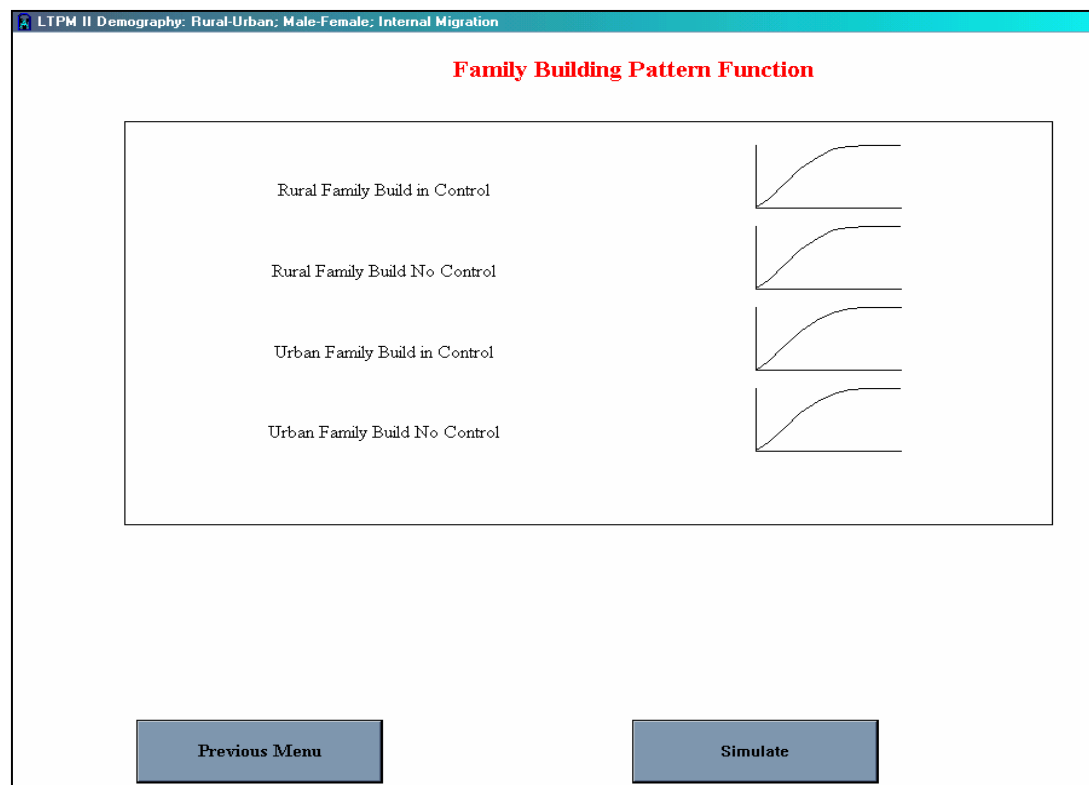
Step-2: Policy Selection

There is variety in the way this screen appears. For instance, consider the following three examples from the economic, education and demographic simulators, respectively.
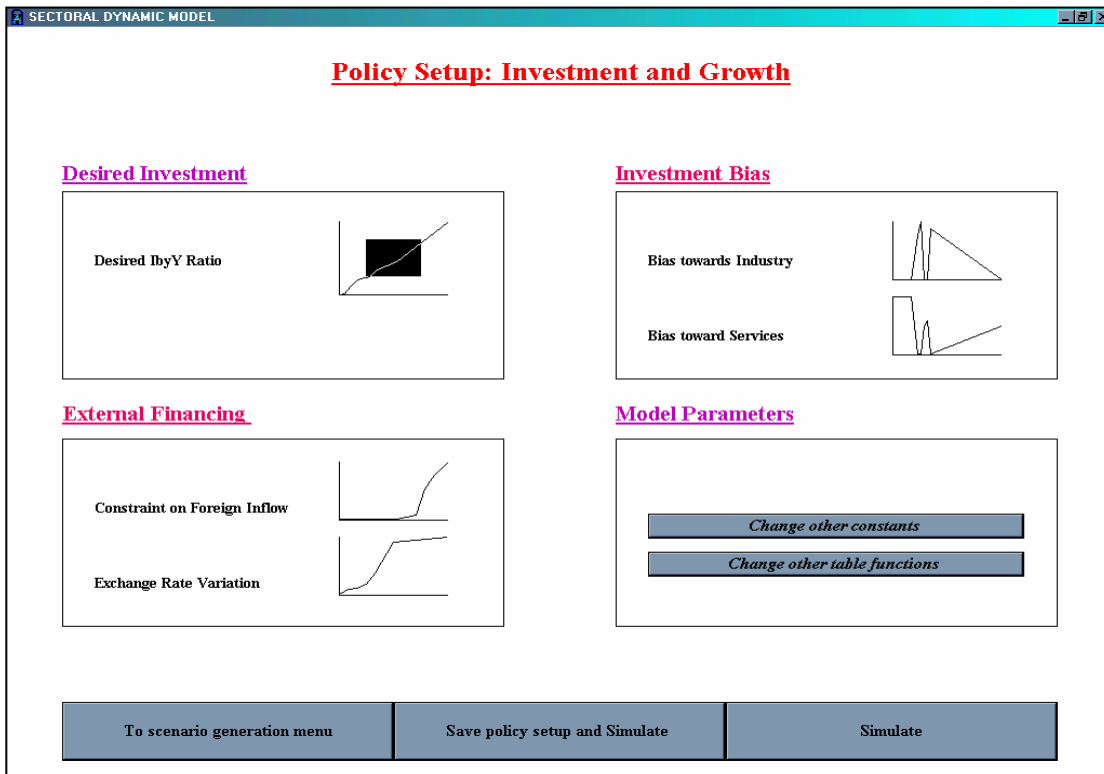
OPTIONS 5: Policy Selection, Example 1
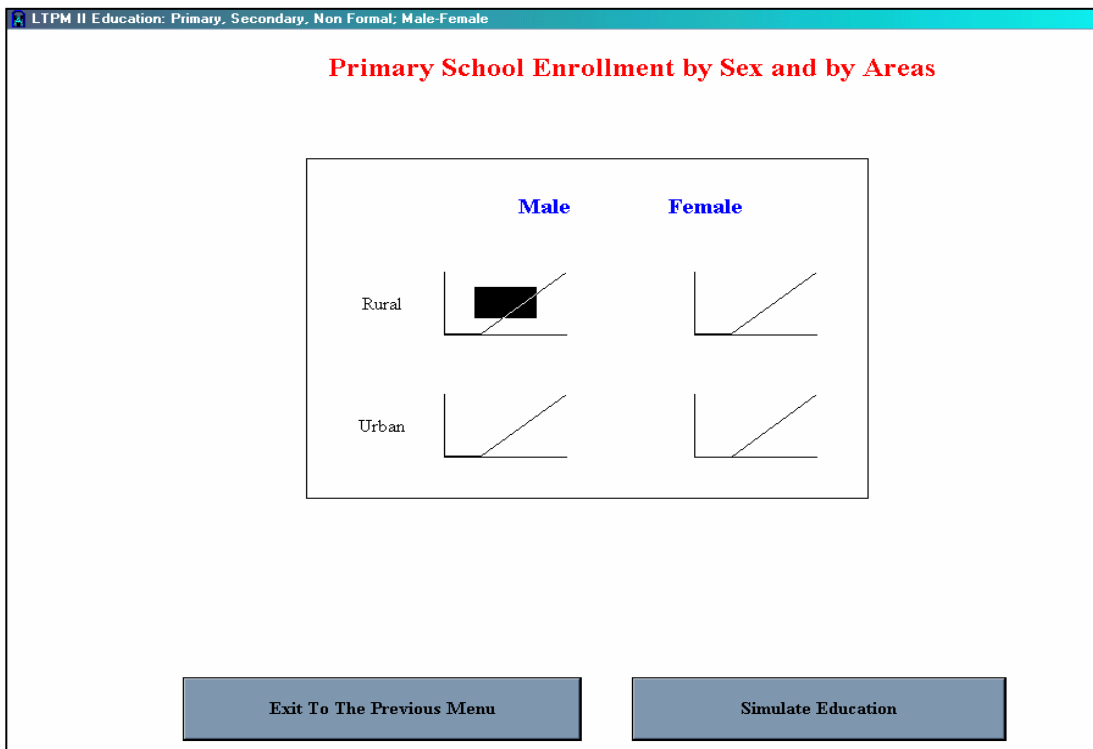
**OPTIONS 6: Policy Selection, Example 2**

**OPTIONS 7: Policy Selection, Example 3**

The preceding examples illustrate that a context sensitive approach is adopted in the design of these screens.

<u>Adjusting Policy Elements</u>

All the small graphs in the above screen are windows to the corresponding parameter definitions over time. These vary as per trend, or, reshape because of interventions. Options may be explored by setting these variations within the expected policy space. For instance, clicking on the small graph *"Rural Family Build No Control"* opens the following window (*see,* OPTIONS 8). This graph depicts the "trend" family building pattern in rural setting without access to reproductive choices. The impact of changes in this pattern – say, where the second child is delayed and the third is spaced – may be simulated by changing the shape of the graph to that in *OPTIONS 9.* This is done by (1) entering the required magnitudes in the in the *input/output* columns, equivalently age/completed family, or (2) by clicking on the response function and dragging to achieve the desired shape. In both cases parameter setting are altered as specified.

Family Building Pattern Function
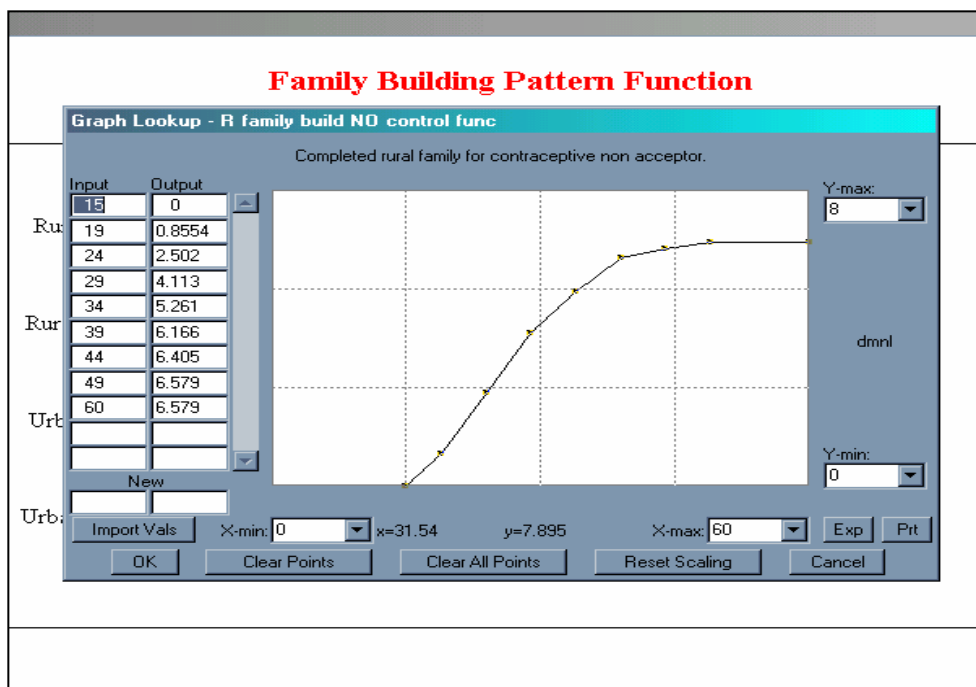
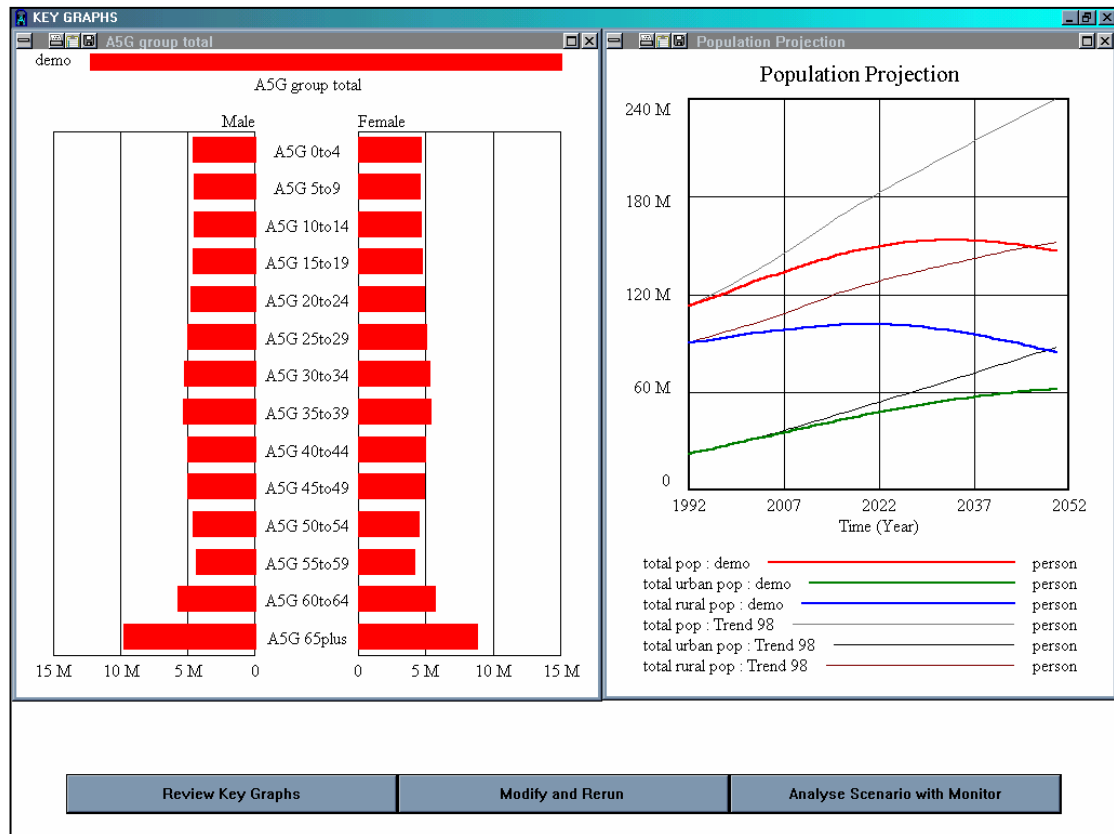**OPTIONS 8: Setting Response Function (a)**
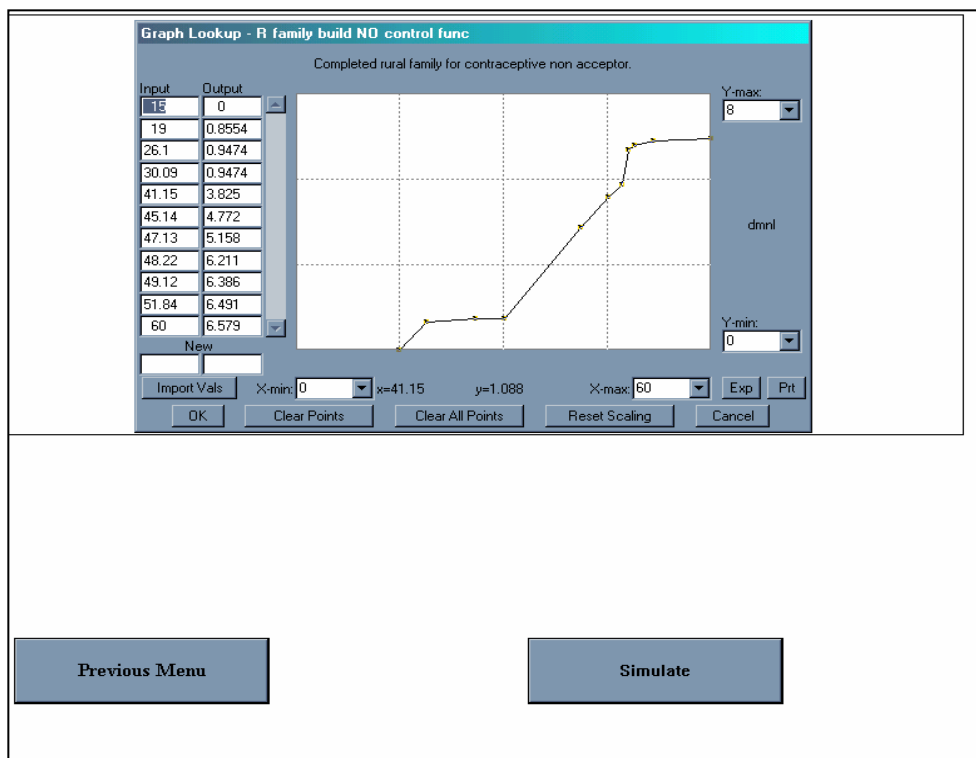
OPTIONS 9: Setting Response Function (b)

It may be observed that the above setting factors in a space after the first child and a delay thereafter.

Step-3: Run Simulation

To run a simulation the user needs to request it by pressing the button. If that is done at this point the following screen is opened.

OPTIONS 10: Run a Simulation

As all the buttons that open up at this point have been already described this completes the description of the "Generate Options" feature of the user interface.