

The Melbourne Institute Tax and Transfer Simulator (MITTS)¹

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Melbourne Institute Working Paper No. 16/01

ISSN 1328-4991

ISBN 0 7340 1520 8

November 2001

¹Version 3.00 (August 2001).

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Abstract

This publication is a manual for the use of the Melbourne Institute Tax and Transfer Simulator (MITTS). MITTS provides a tool for analysing policy changes. It allows us to examine the effect of a variety of policy changes on labour supply and income distribution for the Australian population.

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1 Introduction

The **M**elbourne **I**nstitute **T**ax and **T**ransfer **S**imulator – MITTS – is designed to examine the effects on individuals and households in Australia of policy changes to any component of the income tax and transfer payments system. This document provides a brief guide to the installation and use of MITTS, which actually consists of two closely integrated simulation models.

First, an arithmetic model, MITTS-A, examines the effects of a specified change in the direct tax and transfer system, assuming that the labour supply, and hence pre-tax and transfer income, of each individual remains fixed.

Secondly, a behavioural model, MITTS-B, allows for the effects of labour supply variations in response to changes in the tax and transfer system. MITTS-B produces simulations based on the use of a user-specified discrete range of hours, rather than allowing continuous hours variations.

In designing MITTS, ease of use has been a primary objective. MITTS is operated by moving between a series of menus. Choices are available for selecting alternative tax systems, data sets and types of analysis.

A brief description of the functions performed by MITTS is given in section 2. Its structure is described in section 3. Instructions for installing MITTS are in section 4. A broad description of the general sequence of operations and the way in which MITTS may be used is given in section 5, which also provides an introduction to the subsequent sections which concentrate on particular features. The choice of alternative tax systems and modification of tax structures is described in section 6. The procedures involved in running MITTS-A and producing summary results of tax reforms are described in section 7. MITTS-B is described in section 8. The selection of individuals and households from the data file, or the examination of hypothetical households, is described in section 9. Further comments on handling

the output from MITTS are made in section 10. Finally, section 11 provides details of the MITTS file structure.

When using MITTS, it should be borne in mind that it is a supply-side partial equilibrium model. In particular, the behavioural component, MITTS-B, concentrates on examining the effects of tax structure changes on variations in the hours of work that individuals wish to supply. No allowance is made for the demand for labour. Hence, in interpreting the output from MITTS, it should be recognised that, depending on what happens to the demand for labour, individuals may not in reality be able to work their desired number of hours; they may be constrained. Large changes in the tax structure, designed for example to increase the labour force participation of benefit recipients, may also have effects on the demand for labour. In addition, changes in the tax and transfer system are assumed to have no effect on individuals' gross wage rates, so that general equilibrium considerations are ignored.

2 The Main Features of MITTS

The main features of MITTS can be listed as follows.

1. MITTS is operated via a user-friendly 'front end' which provides a series of menus. Choices are available for selecting alternative tax systems, data sets, and analyses.
2. Tax reforms can be examined using a choice of Australian Bureau of Statistics Confidential Unit Record Files (CURFs). MITTS contains the Income Distribution Surveys for 1994, 1995, 1996 and 1997. The interview period for the IDS is the twelve months running from July to the following June. Hence, reference to IDS survey, IDS_t , means that weekly incomes are based on financial year t to $t + 1$. However, annual incomes are for the financial year $t - 1$ to t .

3. MITTS has the ability to select two tax and transfer systems for analysis, namely pre-reform and post-reform systems.
 - (a) These can be selected from a range of previously stored systems, or:
 - (b) It is possible to modify an existing tax and transfer system interactively using a set of menus (rather than altering the basic programming code). Considerable flexibility in altering the tax system is allowed.
4. For each tax system, MITTS calculates the gross and net incomes of each individual, household and tax unit in the data base. Two options are available. First, MITTS-A produces an arithmetic calculation of changes in net incomes on the assumption that all gross earnings are fixed. Second, MITTS-B can allow for the probable variations in labour supply of each individual, using the econometric estimates of preference functions.
5. Expenditure costs and revenues can be updated to specified years.
6. For individuals who are not working during the sample period, and for whom a wage rate is therefore not observed, MITTS assigns a wage rate, based on econometric estimates of wage functions. Individuals are assumed to work in a single job, at which they are paid a fixed wage rate (irrespective of the number of hours worked).
7. MITTS-B uses econometric estimates of utility functions defined in terms of consumption (net income) and leisure.
8. MITTS provides details of the effects of changing the tax system on the benefit levels and net incomes of individuals.

9. MITTS produces, for each individual, the precise nature of the budget constraint in terms of the choice of hours worked and net income (consumption). That is, given the individual's wage rate, it provides details of the variation in net income as the number of hours of work increases, under each specified tax system.
10. Details are provided of the reasons for each discontinuity and kink in each individual's budget constraint.
11. MITTS allows individual budget constraints to be printed. Breakdowns of budget constraints are also provided in bar charts.
12. It is possible to examine, for each tax system, the relationship between gross income and net income for particular hypothetical types of household, according to specified demographic characteristics and wage rates.
13. MITTS contains a user-friendly 'back end' which allows, via a set of menus, the calculation of summary measures of distributional changes, such as Lorenz curves and changes in a variety of inequality and poverty measures.
14. MITTS produces, via a set of menus, a wide variety of summary tables showing the characteristics of gainers and losers from the specified tax structure change.
15. It is possible to move directly from a cell of each summary table (for example, of gainers and losers from a tax reform) to an examination of those individuals and households who appear in the cell. The characteristics of these individuals and households can be changed interactively to study the effect of a change on the net income and benefit payments.
16. MITTS calculates the overall tax revenue and expenditure effects of a tax policy change.

17. Figures and tables can be printed or pasted into documents. MITTS enables the tables to be written to other files for further analysis using other software, such as spreadsheets.

3 The Structure of MITTS

This section describes the broad structure of MITTS and the relationships among its components.

3.1 Data Input Files

1. MITTS is based on the (Australian) Income Distribution Survey (IDS). The surveys for the four years 1994, 1995, 1996 and 1997 are available in MITTS. The IDS is the only Australian cross-sectional survey containing hours of work in a continuous form, which is required for the labour supply estimation of the model.
2. The IDS surveys have been transformed so that they can be read by MITTS along with all the variable names.
3. Most of the variables have been re-coded so that they have names instead of code numbers. This makes it possible to present the output in a form that is more easily read.

3.2 Data Transformations

The data contained in the Data Input File undergo a series of transformations in preparation for modelling. The data transformations use several inputs, as follows:

1. Population weights provide information about the number of each type of household in the population. This means that, for example, the aggregate revenue and expenditure values reflect national aggregates

and the distributional analysis represents the population rather than the sample characteristics.

2. Uprating factors make it possible to examine values corresponding to the current calendar year, although the basic Data Input File inevitably contains information relating to an earlier year (1994, 1995, 1996 or 1997).
3. Other data imputations are required. The most important of these concerns the wages of non-workers; see the discussion in the next subsection.

3.3 Wage Equations

It is necessary to assign an appropriate wage rate to those individuals in the sample who did not work during the sample period. This is because no observed wage rate is directly available. The required rates are obtained by estimating wage equations using the observed wages of workers. For those who do work, wage rates can be obtained directly from information about gross earnings and hours worked in the IDS. However, allowance is made for selectivity bias arising from the use of a sample consisting only of workers.

The demographic information about each non-working individual is used in order to produce an appropriate imputed wage. The imputed wages provide an input into the behavioural model, the estimation of labour supply behaviour, and are required in the production of the budget constraints for non-workers.

Estimation of wages of non-workers includes:

1. Division of the IDS population into five demographic groups. These are single parents; single males; single females; married males; married females.

2. Estimation, for each demographic group, of probit equations whereby employment status is determined as a function of individual characteristics, such as education, location, and age.
3. Estimation of wage functions for each demographic group. The wage rate for each individual is expressed as a function of a number of characteristics. These wage functions allow for any bias arising from the use of a sample containing only those who work, and whose wage rate is known. This is achieved by the addition of a variable for each individual, the inverse Mills ratio, calculated from the probit equations.
4. In imputing the wages of non-workers, extraneous information about the industry and occupation characteristics of non-workers are used. These are, on average, different from those of workers.

3.4 The Tax System

The Tax System component contains the required procedures for applying each type of tax and benefit. Each tax structure has a data file containing the required tax and benefit rates, benefit levels, and income thresholds used in means testing. In view of the data limitations of the IDS, it is not possible to include within MITTS all the complexity of the tax and transfer system.

Changes to the tax and benefit structure, including the introduction of additional taxes, can be modelled by editing this component. MITTS stores several previous Australian tax and transfer systems which can be used as bases for the analysis of policy changes.

It is possible to generate a new tax system by introducing various types of policy change interactively when using MITTS. This enables new tax structures to be generated without the need for re-programming.

3.5 Take-up Rates

Ideally, it would be useful to model take-up rates for each of the types of benefit at the same time as labour supply behaviour is modelled. Take-up rates may, however, depend on the level of the benefit to which the individual is eligible, the income level and demographic structure of the household. This is considerably complicated by the fact that take-up rates are in general expected to depend on the levels and conditions applying to benefits. Further work will be carried out on this aspect of MITTS in future.

3.6 Budget Constraints

A crucial ingredient of the labour supply analysis, in addition to the information on preferences from the behavioural model component, consists of the budget constraints for each individual. These constraints in turn require output generated by the arithmetic component, MITTS-A. MITTS contains:

1. An algorithm for constructing the exact form of the budget constraint in an efficient manner. The algorithm used is superior to an alternative approach consisting of numerically evaluating the relationship between gross and net income for a specified range of hours worked. Such an approach would be more cumbersome and may not identify the precise location of kinks in the budget constraint.
2. The ability to produce a detailed description of each individual's budget constraint, providing graphs of net income against hours worked under alternative tax structures.
3. A description of the reason for each kink or discontinuity in the budget constraint.

3.7 MITTS-A

MITTS-A is the arithmetic tax and benefit modelling component of the analysis of the effects of a specified tax reform. It assumes that labour supplies are fixed. This component also provides, using the wage rate of each individual, the information needed for the construction of the budget constraints that are crucial for the analysis of behavioural responses to tax changes.

The Tax System component is directly linked to MITTS-A, and *vice versa*. MITTS assembles the various components of the tax and benefit structure in the required way in order to work out the transformation between gross and net income for each individual under each tax system. For example, some benefits are taxable while others are not, so the order in which taxes and transfers are evaluated is important.

MITTS-A contains:

1. The facility to examine each household, income unit and individual in the selected IDS in turn, and to display major relevant demographic characteristics along with taxes and benefits received. This component of MITTS also allows comparisons to be made with results obtained from other Australian non-behavioural tax-benefit models.
2. The production of net incomes for each individual in the IDS, at the given hourly wage rate, for variations in the number of hours worked
3. The facility to examine budget constraints and net incomes for hypothetical households.

3.8 MITTS-B

MITTS-B is the behavioural component of MITTS. It examines the effects of a specified tax reform, allowing individuals to adjust their labour supply behaviour where appropriate. Behavioural analyses can be obtained in the same way as for the arithmetic analyses. Given the estimated preference

functions, it will in future be possible to obtain a measure of each individual's welfare change, such as the equivalent variation.

The simulation is essentially probabilistic. That is, it does not identify a particular level of hours worked for each individual after the policy change, but generates a probability distribution over the discrete hours levels used. For this reason the present version of MITTS-B does not produce distributional analyses of the effects of tax reforms on net incomes. Some individuals, such as the self employed, the disabled, students and those over 65 have their labour supply fixed at their observed hours.

The behavioural simulations begin by taking the discrete hours level for each individual that is closest to the observed hours level. Then, given the parameter estimates of the quadratic preference function (which vary according to a range of characteristics), a random draw is taken from the distribution of the 'error' term. This draw is rejected if it results in an optimal hours level that differs from the discretised value observed. The accepted drawings are then used in the determination of the optimal hours level after the policy change. A user-specified total number of 'successful draws' (that is, drawings which generate the observed hours as the optimal value under the base system for the individual) are produced. This gives rise to a probability distribution over the set of discrete hours for each individual under the new tax and transfer structure. In computing the transition matrices showing probabilities of movement between hours levels, the labour supply of each individual before the policy change is fixed at the discretised value, and a number of transitions are produced for each individual, equal to the number of successful draws specified.

When examining average hours in MITTS-B, the labour supply after the change for each individual is based on the average value over the successful draws, for which the error term leads to the correct predicted hours before the change. This is equivalent to calculating the expected hours of labour supply after the change, conditional on starting from the observed hours before the

change. In computing the tax and revenue levels, an expected value is also obtained after the policy change. That is, the tax and revenue for each of the accepted draws are computed for each individual, and the average of these is taken.

In some cases, the specified number of successful random draws producing observed hours as the optimal hours cannot be generated from the model within a reasonable number of total drawings. In simulations, a maximum number of draws from the error term distribution is set: if the model fails to predict the observed labour supply the required number of times within this maximum number of draws, the individual is dropped from the simulation. The use of such a probabilistic approach means that the run-time of MITTS-B is substantially longer than that of MITTS-A.

4 Installation of MITTS

Installation of MITTS involves preparation of the basic IDS data files and the program itself. In most cases Windows software, such as Windows Explorer and WinZip can be used. However, appropriate DOS commands are also given.

In this document, computer keys to be hit are indicated using italics. Commands which need to be typed, following the DOS command prompt, after which the *enter* key must be hit, are indicated within rectangular boxes.

4.1 Gauss For DOS

MITTS is written in GAUSS and requires the DOS version 3.2.14, or later, of GAUSS. In the following description it is assumed that GAUSS is placed in a directory called `c:\gauss`.

First it is necessary to edit (using an ASCII editor) the file GAUSS.CFG to ensure that there is sufficient memory allocated. Change the appropriate line so that it reads: `max_workspace = 50`. In addition, set `dat_fmt_version`

= v89.

4.2 Data Installation

Analyses using MITTS can be based on one of four Australian Income Distribution Surveys (IDS). The present version of MITTS allows for the use of surveys for 1994, 1995, 1996 and 1997. The following instructions are for the 1995 survey. In order to install the other IDSs, simply replace 95 with the appropriate date at each stage.

1. From the root directory, make a directory called IDS95. This can be achieved using the DOS command `mkdir ids95`. Then move to this directory, using the DOS command `cd\ids95`.
2. Insert the disk marked IDS95 into the floppy disk drive and copy the file IDS95.ZIP into the IDS95 directory, using the command `copy a:ids95.zip`.
3. Unzip the file. This can be done using either WINZIP or the DOS version, PKUNZIP, using the command `pkunzip ids95.zip`. This produces the three files:
 - (a) IDS95URT.DAT
 - (b) IDS_VARS.TXT
 - (c) READ_IDS.E.
4. The first file contains the basic IDS data for 1995; the second file contains a list of variable names for use by MITTS; the third file contains a program to carry out the required data transformation.

4.3 Data Preparation

1. Start GAUSS, and go to the directory IDS95. To change the directory in GAUSS, enter the command `dos cd\ids95`. The current directory in GAUSS is indicated in the bottom right hand corner of the screen.

2. Run the program READ_IDS.E by entering the command `run read_ids.e`. This program takes several minutes to run. It creates four files, as follows:
 - (a) IDS95_IN.DAT
 - (b) IDS95_IN.DHT
 - (c) IDS95_PR.DAT
 - (d) IDS95_PR.DHT.
3. Files with the extension .DHT are GAUSS data files of the corresponding ASCII files, with a .DAT extension.

4.4 Installing MITTS

1. Create a sub-directory of the C:\GAUSS directory, called MITTS. If using DOS, from the c:\gauss directory enter the command `mkdir mitts`. Move to this directory, using the DOS command `cd mitts`.
2. Insert the disk marked MITTS into the floppy disk drive and copy the file MITTS.ZIP into the MITTS directory. The DOS command is `copy a:mitts.zip`
3. Unzip the MITTS.ZIP file. If WinZip is being used, ensure that the option 'retain folders' is selected. Alternatively, use the DOS command `pkunzip -d mitts.zip`. The option to retain folders is necessary because a number of separate folders are created, containing different groups of files. These are described as follows (further details are given in section 11).
 - (a) The c:\gauss\mitts directory contains the main file needed to run MITTS.

- (b) The `c:\gauss\mitts\benefits` directory contains the gauss procedures used to compute benefits.
- (c) The `c:\gauss\mitts\data` directory contains the various data files, containing, for example, labour supply parameters, used by MITTS.
- (d) The `c:\gauss\mitts\netinc` directory contains the gauss procedure used to compute net incomes.
- (e) The `c:\gauss\mitts\programs` directory contains a range of gauss procedures used when running MITTS.
- (f) The `c:\gauss\mitts\rebates` directory contains the gauss procedures used to compute rebates.
- (g) The `c:\gauss\mitts\results` directory contains output files saved during the running of MITTS.
- (h) The `c:\gauss\mitts\tax&ml` directory contains the gauss procedures used to compute income taxation and the Medicare Levy.

5 Running MITTS

5.1 Starting MITTS

1. Start GAUSS, and go to the directory `C:\GAUSS\MITTS`, using the command `dos cd mitts`.
2. Start the main program MITTS.E by entering the GAUSS command `run mitts.e`.

After a few seconds the main menu appears. This is shown in Figure 1. MITTS should now be ready for use.

When running GAUSS, it may be shown within a separate window or occupy the full screen: simultaneously hitting the keys *Alt* and *enter* toggles

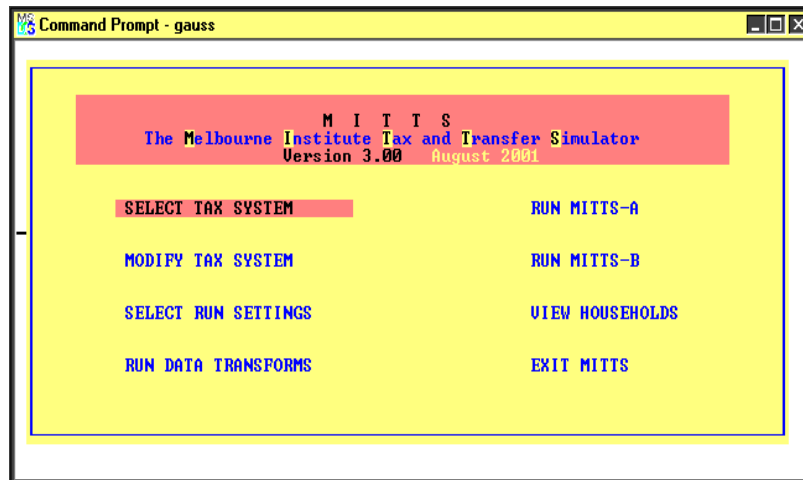


Figure 1: The Main Menu

between a window and full screen.¹

If MITTS crashes for any reason, simultaneously pressing the *ctrl* and *home* keys returns control to the GAUSS command prompt, allowing MITTS to be run again. Then enter the command `mainmenu` to use the set-up when the crash took place, or restart entirely.

Movement between menu items is achieved using the standard direction keys. Operating the highlighted menu choice is achieved by hitting the *enter* key.

5.1.1 Data Transforms

After first installing MITTS it is necessary to prepare each of the IDS datasets for further analysis. For each of the IDS surveys in turn, use the ‘Select run settings’ option to select the required year and then select the ‘Run data transforms’ option from the main menu. This takes several minutes to cycle through the data. After the transforms have been run for each year of data, it is not necessary to use this option again, unless new wage equations have

¹The size of the window can be adjusted as required: click on the right mouse button and use the options available under ‘properties’.

been estimated.

5.2 The General Procedure

The first thing to do when using MITTS is to select two tax and transfer systems for analysis, as described in the following section. These are referred to as the ‘first system’ (pre-reform) and ‘second system’ (post-reform). If an attempt is made to run MITTS-A or MITTS-B or to examine households before the tax structures are specified, MITTS requests details.

After selecting the two tax systems, the cost and distributional implications of the alternative systems, along with various effects of the reform, can be examined. It is possible to examine, first, the aggregate revenue and distributional effects of a policy change using either MITTS-A or MITTS-B and, second, the effects on particular individuals and households (including specific households contained in the IDS and hypothetical households). These facilities are described in turn below.

6 Alternative Tax Systems

6.1 Selecting Tax Systems

The option ‘Select Tax System’ from the main menu gives the choices shown in Figure 2. On highlighting ‘select first system’ and hitting *enter*, a choice of several Australian tax systems is displayed. After selecting one of these, the second tax system must then be chosen. It is possible to select one of the systems that are already programmed or to copy the first system. A tax reform can then be examined by suitably modifying the second tax system, using the options described in the following subsection.

The tax systems from which selections can be made include the following: March 1998, July 1998 (Youth Allowance introduced), March 1999, January 2000, ANTS (A New Tax System, July 2000).

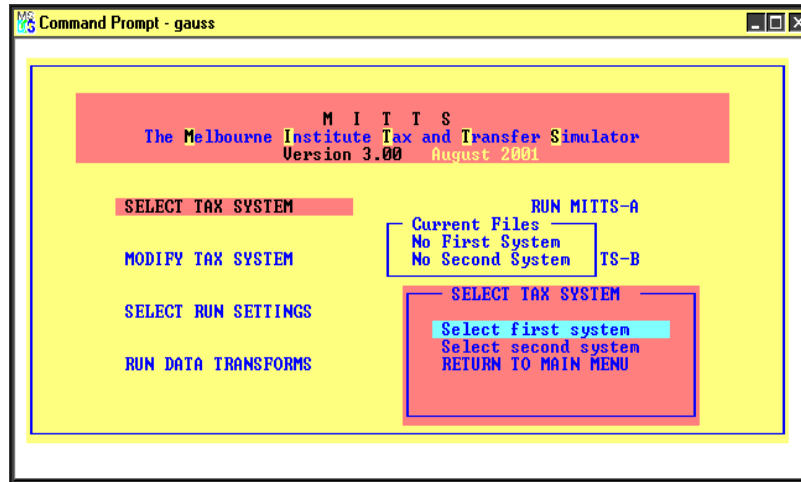


Figure 2: Selecting Tax Systems

6.2 Modifying Tax Systems

It is possible to make a large number of modifications to the selected tax and transfer systems using the choices available under the ‘Modify Tax System’ option in the main menu. Selecting this option gives rise to the menu shown in Figure 3.

For example, selection of the option, income taxes and rebates, gives the window shown in 4. To make alterations, use the direction keys to move to the different features. Then hit *enter*, and a box will appear round the items that can be modified. Moving to each item in turn, using the direction keys, gives rise to a description of that item in the bottom left hand corner of the screen. To make a change, highlight the item, hit *enter*, and then type the new value. Press *esc* and then respond to the invitation to save the change, which appears in the bottom left hand corner of the window. After responding (y/n), press *esc* to return to the ‘modify first system’ window. Further changes can then be made as required.

If it is required to delete a row of rates and thresholds, move to the relevant row and press *del*. In order to add a row, move to the required

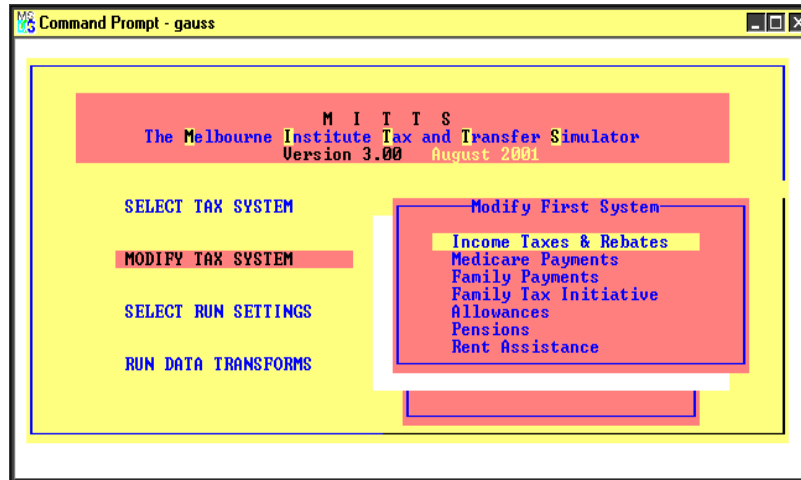


Figure 3: Modifying Tax Systems

position, hit *insert* and then enter the values as required. Again, after making the changes, press *esc* and follow the invitation to save the changes.

A large variety of changes to a tax and benefit system can be carried out, involving a large number of features of the tax system, by repeatedly carrying out the procedures outlined in the previous subsection. The changes may be made to either the first or second tax system chosen.

6.3 Saving New Systems

For some purposes it is desired to save the generated tax system for future analysis. This is done as follows. Suppose the first tax system has been changed. After returning to the ‘modify first system’ window, pressing *esc* displays a window with the invitation to ‘save first system’. If it is not required to save the system for future use, press *esc* again, and a message ‘system not saved’ is displayed.

By responding positively, an invitation is given to name the new system. Simply type in a name without a file extension, and press *enter*. MITTS automatically adds the required extension (.TBP) and places the file in the

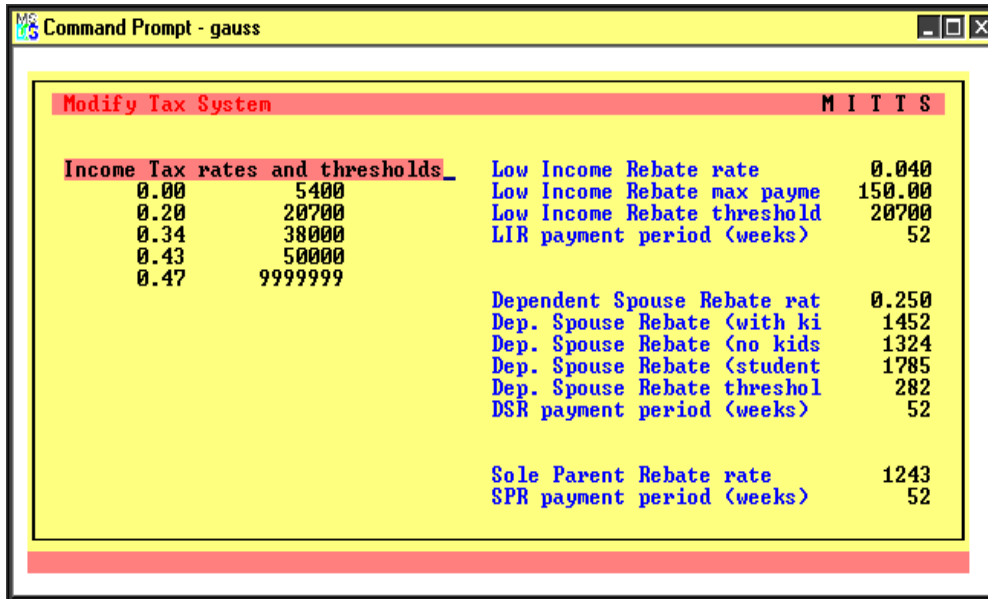


Figure 4: Modifying Income Taxation

c:\gauss\mitts\system subdirectory. Then, enter a brief description of the new system. This description appears at the head of the new .tbp file as a reminder.

7 Running MITTS-A

7.1 Run Settings

Before actually running MITTS-A it is necessary to specify a range of run settings, using the ‘Run Settings’ option in the main menu. The selections are as follows:

1. Choice of IDS
2. Upratings setting
3. Equivalence scales

Select the required item and press *enter* for further options. The first item allows for choice of the required IDS survey (1994, 1995, 1996 or 1997).

When ‘uprating settings’ is chosen, the menu shown in Figure 5 is displayed. The choice is given to uprate the data: select yes or no by pressing the space bar. The answer ‘yes’ means that the data are adjusted to the same year as the tax and transfer system selected. The final costs can then be adjusted to a specified year and quarter. These adjustments use the retail price index. The choice of an index for uprating wage rates can also be made.

The equivalence scales option gives a choice of Whiteford or OECD scales, as shown in Table 1. Alternatively, an option is available to specify user-defined equivalence scales.

Table 1: Equivalence Scales

Scale	Head	Spouse	Other Adult	Child
Whiteford	1	0.52	0.52	0.32
OECD	1	0.70	0.5	0.5

These scales are used in the distributional analyses.

7.2 Run MITTS-A

Selection of the menu option Run MITTS-A produces a further set of menu choices shown in Figure 6. When the Run MITTS-A option is selected, a box is displayed indicating the simulation file. This file is given the default name of ‘mitts’, and is placed in the subdirectory `c:\gauss\mitts\results`. It contains the results relating to the costs of a simulation run. If desired, a user-specified output filename can be given by selecting the option ‘Simulation file name’. Follow the instruction to type a file name (limited to a maximum of eight characters). This named file is placed in the subdirectory `c:\gauss\mitts\results`.

The ‘simulation settings’ option produces the choice shown in Figure 7. This allows for the choice of a range of households to examine from the

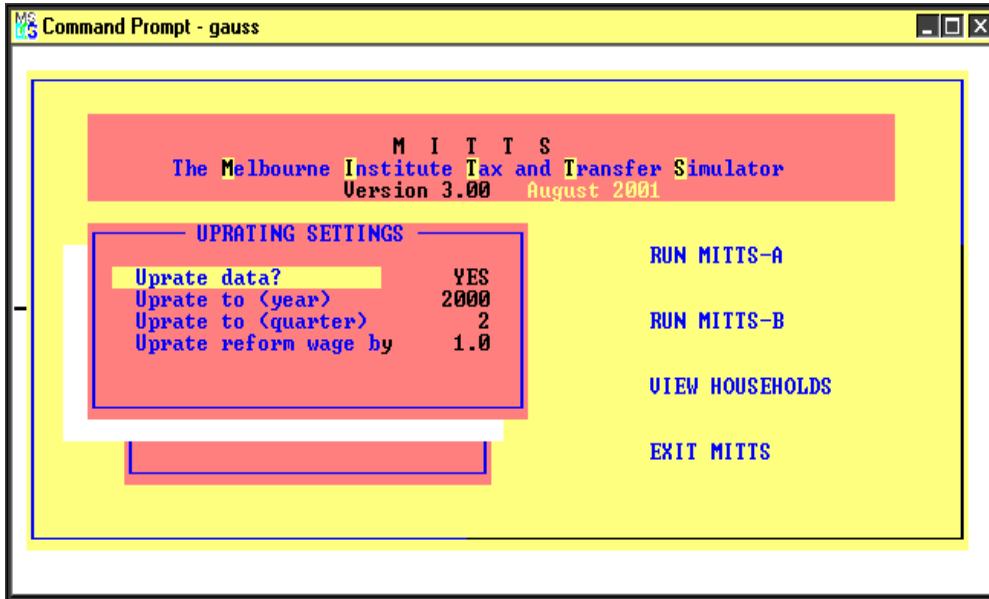


Figure 5: Upratings Settings

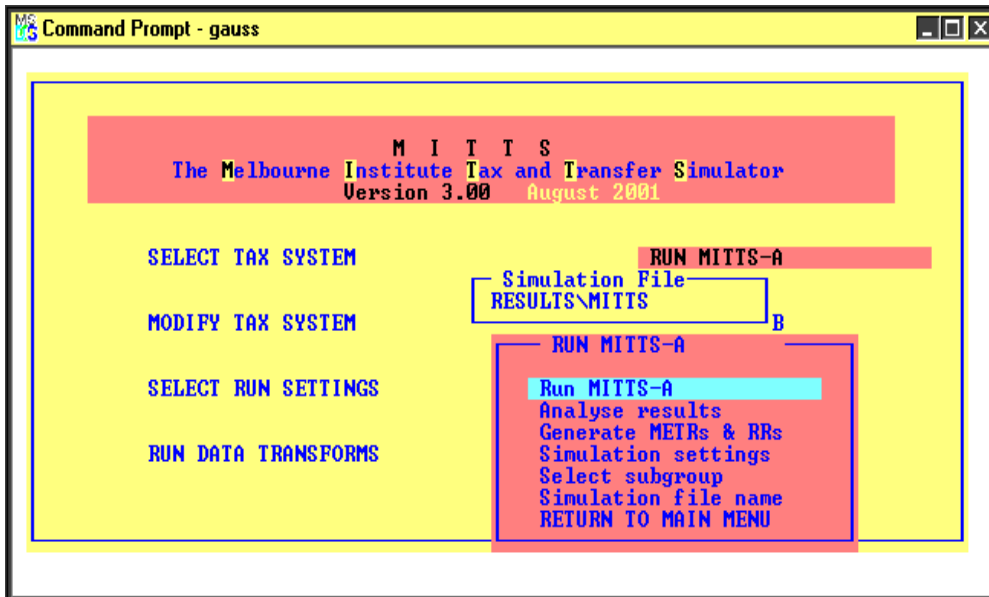


Figure 6: MITTS-A Menu

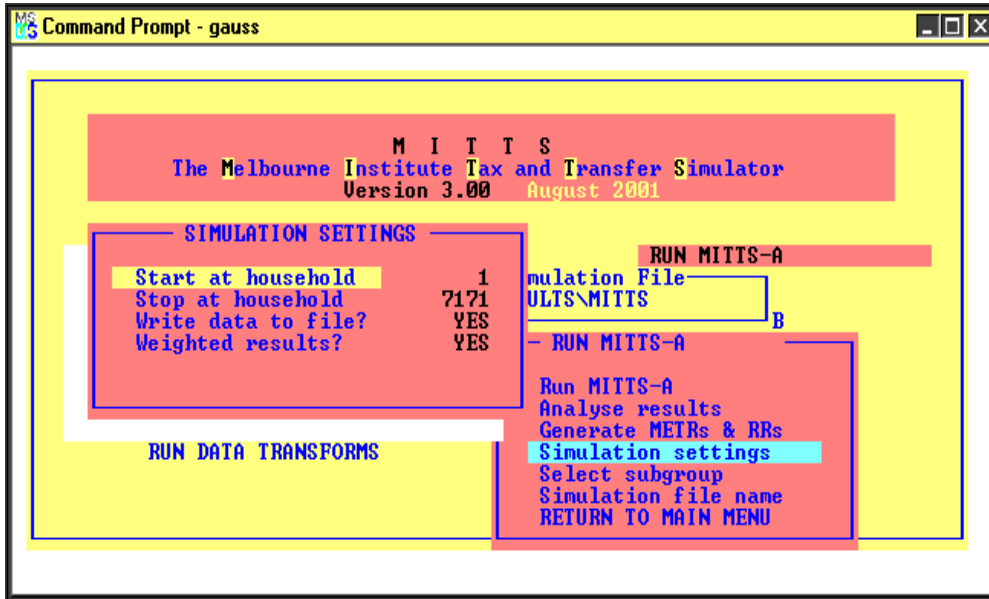


Figure 7: Simulation Settings

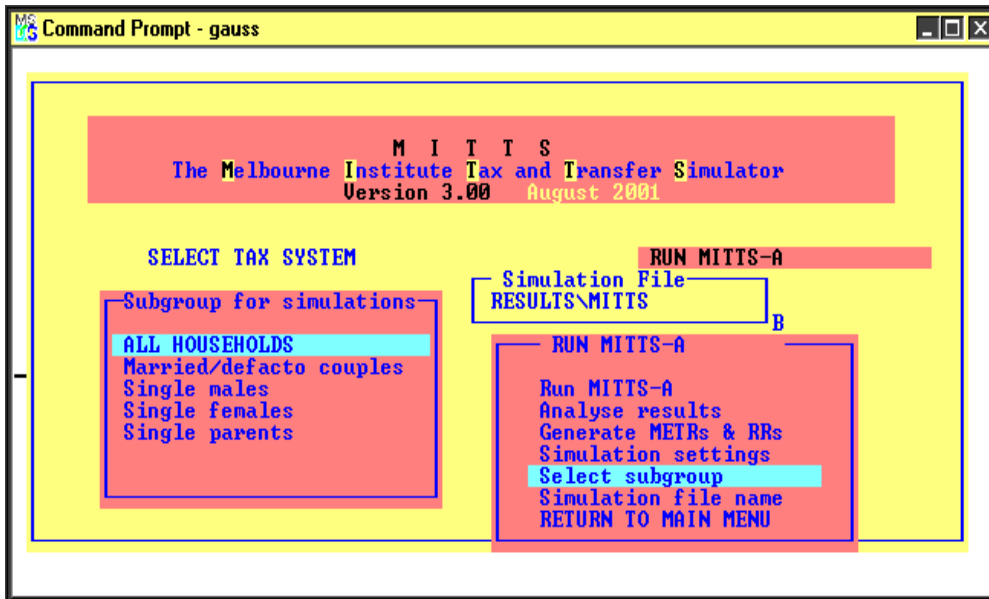


Figure 8: Selection of Simulation Group

IDS. The default values cover all households in the survey. A further choice involves the decision to weight the cost and revenue information using the IDS weights, so that they represent population values rather than sample values.

It is possible to run MITTS-A for a specified population group. Selection of the option ‘select subgroup’ gives the options shown in Figure 8.

The ‘Generate METRs and RRs’ option generates information about marginal effective tax rates and replacement rates. This option must be selected if it is later required to examine various distributions of these rates under the ‘analysis of results’ option. Generating the rates is a lengthy procedure.

The ‘analysis of results’ option is described in the following subsection below and can be selected only after running MITTS-A.

To begin the analysis of the specified tax reform, select the ‘Run MITTS-A’ option. This provides the basic aggregate effects of the tax reform examined. This takes several minutes, depending on the speed of the computer being used. An indication is given of the estimated running time and costs, as shown in the screen illustrated in Figure 9.

The costs are given in \$millions, and are aggregates based on weights given in the IDS. During the running time, it is possible to view details of Allowances, Pensions, and Rebates by hitting the *a*, *p* and *r* keys respectively. To return to the Main Costings, hit the *m* key.

The run can be stopped at any time by pressing *esc*. This causes the run to stop: it does not cause MITTS-A simply to pause.

When the run is complete, hit any key to return to the menu. After pressing *esc* or when the run is complete, tables are automatically written to the simulation file (either the default or the named file).

Tax and Transfer Reform Simulation M I T T S

Elapsed Time 59 secs HH Fam IU
 Estimated Time 2 mins 14 secs 3149 1 2

Tax or Transfer	Cost (\$m)		Numbers		Estimated Cost	
	Sys1	Sys2	Sys1	Sys2	Sys1	Sys2
Income Tax (-)	32744.0	0.0	5605	0	75719.8	0.0
Medicare Levy (-)	2033.9	0.0	3618	0	4703.3	0.0
Tax Rebates	1801.6	0.0	4131	0	4166.1	0.0
Family Payment	2719.4	0.0	1403	0	6288.6	0.0
FIP/FIB	281.3	0.0	713	0	650.5	0.0
Allowances	7320.2	0.0	1787	0	16927.8	0.0
Pensions	9723.3	0.0	1298	0	22484.9	0.0
Pharm Allow	149.7	0.0	1441	0	346.2	0.0
Rent Allowance	773.3	0.0	695	0	1788.3	0.0
Net Expenditure	-12009.0	0.0			-27770.7	0.0

Main:<M> Allowances:<A> Pensions:<P> Rebates:<R> Exit:<ESC>

Figure 9: A MITTS-A Run

7.3 Analysis of Results

Selection of the ‘Analyse Results’ option from the Run MITTS-A sub-menu displays the further choices shown in Figure 10. The items indicated along the bottom of the screen include the choice of

1. Winners and losers
2. Income changes
3. Inequality
4. METRs and Rep Rates

In each case the analyses can be carried out for a range of characteristics. When selecting one of these options, a range of income unit categories and individual characteristics of the income unit head is listed, as also shown in Figure 10.

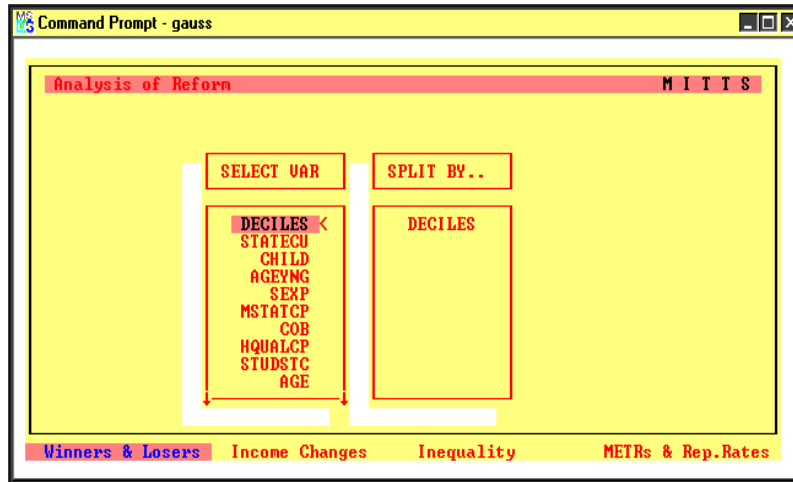


Figure 10: Selection of Categories for Analysis

The choice of categories to be examined is achieved by moving through the list of options displayed in the left-hand window shown in Figure 10, using the direction keys, and then making the selection of the highlighted option by pressing the *space bar*. The categories are listed using the abbreviations provided by the IDS. These are defined in Table 2 and, where relevant, refer to the characteristics of the head of the income unit.

The selected categories move into the right-hand window. After selecting the required categories, press *enter*. The results for the first category selected are then displayed. To move to the next table on the list, press *esc*.

When selecting ‘income differences’, charts such as that in Figure 11, for deciles, are given.

Figure 12 gives an example of a table of Gainers and Losers.

This type of table can be saved using the Alt-S option given on the bottom of the window, as shown in Figure 12. After this option is selected, follow the instruction to name the file. This file is automatically placed in the `c:\gauss\mitts\results` subdirectory with other output files. Then follow the instruction to provide a file description: this is placed at the head of the

Table 2: Categories

No.	Item	Description
1	DECILES	Household income decile
2	IUTYPEP	Income unit type
3	HHTYPEC	Household type
4	FAMTYPE	Family type
5	STATECU	State of residence
6	CHILD	No. of dep children in unit
7	AGEYNG	Age of youngest child
8	SEXP	Gender
9	TENURECU	Tenure type
10	MSTATCP	Marital status
11	COB	Country of birth
12	HQUALCP	Highest educational qualification
13	STUDSTC	Study status
14	AGE	Age
15	EMPSTAT	Employment status
16	AREAU	
17	OCCCP	Occupation in major job
18	INDCP	Industry of major job
19	DWELLCU	Dwelling type

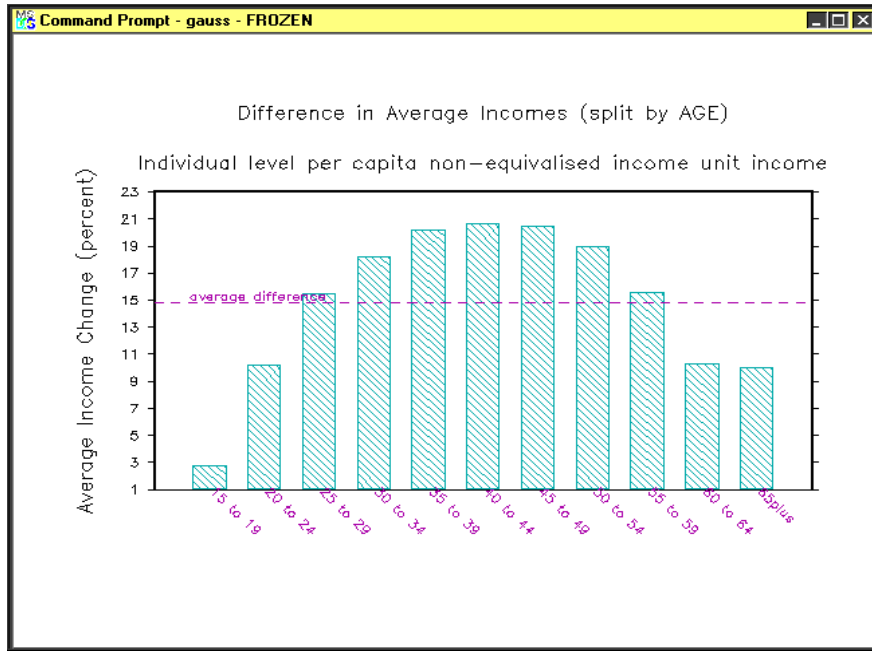


Figure 11: Income Changes

file as a convenient reminder. The file automatically adds information about which tax systems are used.

7.3.1 From Cells to Households

It is possible to examine specific households falling into each of the cells of the table. For example, in the case of the table shown in Figure 12, pressing the *F7* key produces a screen in which the selected cell is indicated along the bottom of the screen. In order to select the desired row (in this case the age, that is, whichever household characteristic is relevant), use the up and down direction keys. In order to select the column of the table, use the left and right direction keys.

After selecting the cell, hit the *enter* key. The screen will then display the details for one of the households in that cell. To view other households, press the *n* or *p* keys, for ‘next’ and ‘previous’ respectively; up to 20 households

Analysis of Reform MITTS

MITTS Version 3.00, August 2001

Income Gainers/Losers by AGE (row percentages)
Individual level per capita non-equivalised income unit income

	Decrease in \$				Increase in \$			avg	Total
	<10	5-10	1-5	none	1-5	5-10	>10		
15 to 19	0.1	0.4	6.2	24.7	46.1	15.9	6.5	2.78	100.0
20 to 24	0.2	-	1.5	5.0	23.7	23.9	45.8	10.17	100.0
25 to 29	0.0	0.1	-	-	10.9	14.9	74.0	15.47	100.0
30 to 34	0.2	0.1	0.2	0.3	7.7	11.2	80.3	18.22	100.0
35 to 39	0.1	-	-	0.1	5.1	8.4	86.2	20.22	100.0
40 to 44	0.1	-	-	0.1	5.0	10.8	84.1	20.64	100.0
45 to 49	0.1	0.1	-	0.1	5.6	13.2	80.9	20.51	100.0

Navigate: Up/Down/PgUp/PgDn Example: <F?> Save: <Alt-S> Exit: <ESC>

Figure 12: Gainers and Losers

from each cell may be viewed in this way. Further analysis of each specific household is described in more detail in section 9 below. To return to the original table, hit *esc*.

7.3.2 Marginal Tax Rates and Replacement Rates

If the ‘generate METRs and RRs’ option has previously been selected from the ‘Run MITTS-A’ submenu, it is possible to obtain a large variety of distributions of marginal effective tax and replacement rates. Selecting the ‘METRs and Rep Rates’ option from the ‘Analyse Results’ submenu gives the choice of the following:

1. METRs (system 1)
2. METRs (system 2)
3. RRs (system 1)
4. RRs (system 2)

Command Prompt - gauss

Analysis of Reform MITTS

MITTS Version 3.00, August 2001

Distribution of METRs under system 1, by AGE (row percentages)

	0	10	20	30	40	50	60	70	80	90	100	110	avg Tot
15to19	60	0	17	7	7	0	3	1	3	0	2	-	14.92 100
20to24	28	-	4	9	38	6	3	1	4	3	3	1	33.25 100
25to29	25	-	0	4	41	21	0	1	2	3	3	0	32.80 100
30to34	28	-	0	3	27	30	-	1	3	4	2	2	34.43 100
35to39	26	-	1	2	25	34	0	2	3	5	2	1	35.85 100
40to44	25	-	1	3	24	35	1	2	2	3	3	2	40.58 100
45to49	26	-	0	4	24	34	1	3	3	3	3	0	37.62 100
50to54	34	-	1	6	23	31	0	0	2	1	2	0	29.03 100
55to59	46	-	1	3	20	22	1	0	3	1	3	0	25.02 100
60to64	66	0	1	1	10	8	1	1	3	2	8	0	20.33 100
65plus	96	-	0	0	0	1	1	1	1	0	0	-	2.34 100

Navigate: Up/Down/PgUp/PgDn Save: <Alt-S> Exit: <ESC>

Figure 13: An Example of METRs

5. METRs (diffs)
6. RRs (diffs)

For each of these choices, tables can be obtained for the categories listed in Table 2 above. Selection is carried out as before, using the direction keys to highlight a category and then pressing the space bar. Hitting *enter* produces the required tables. An example of a table of distributions of effective marginal tax rates for each age group is shown in Table 13. Similarly, an example of distributions of replacement rates for each age group are shown in Table 14. The term ‘diffs’ in the last two options refers to distributions of changes in the rates as a result of a policy change.

7.3.3 Inequality Measures

If ‘inequality’ is selected the options are displayed as in Figure 15. Before selecting measures, the ‘poverty settings’ should be specified. The choices

Command Prompt - gauss

Analysis of Reform M I T T S

MITTS Version 3.00, August 2001

Distribution of RRs under system 1, by AGE (percent)

	0	10	20	30	40	50	60	70	80	90	100	110	avg	Tot
15to19	-	-	6	24	36	12	11	8	2	1	-	-	38.35	100
20to24	-	-	6	8	15	8	10	25	24	3	0	-	54.83	100
25to29	-	-	0	4	8	7	13	30	28	9	0	-	62.46	100
30to34	-	-	1	4	7	6	10	22	32	17	1	-	65.35	100
35to39	-	-	0	4	5	6	8	22	30	23	2	-	68.04	100
40to44	-	-	1	2	5	8	10	22	30	20	2	-	66.90	100
45to49	-	-	0	3	6	9	13	22	29	15	2	-	64.77	100
50to54	-	-	0	4	6	7	15	29	30	8	1	-	63.84	100
55to59	-	-	0	2	6	8	18	25	32	7	1	-	63.44	100
60to64	-	-	0	9	5	17	13	27	24	5	0	-	58.73	100
65plus	-	-	0	8	8	16	26	39	3	0	0	-	54.00	100

Navigate: Up/Down/PgUp/PgDn Save: <Alt-S> Exit: <ESC>

Figure 14: Replacement Rates

Command Prompt - gauss

Analysis of Reform M I T T S

Gini coefficients
 Atkinson indices
 90-10 ratios
 Foster indices
 Lorenz curves
 TIP curves
POVERTY SETTINGS

Winners & Losers Income Changes METRs & Rep.Rates

Figure 15: Inequality Measures

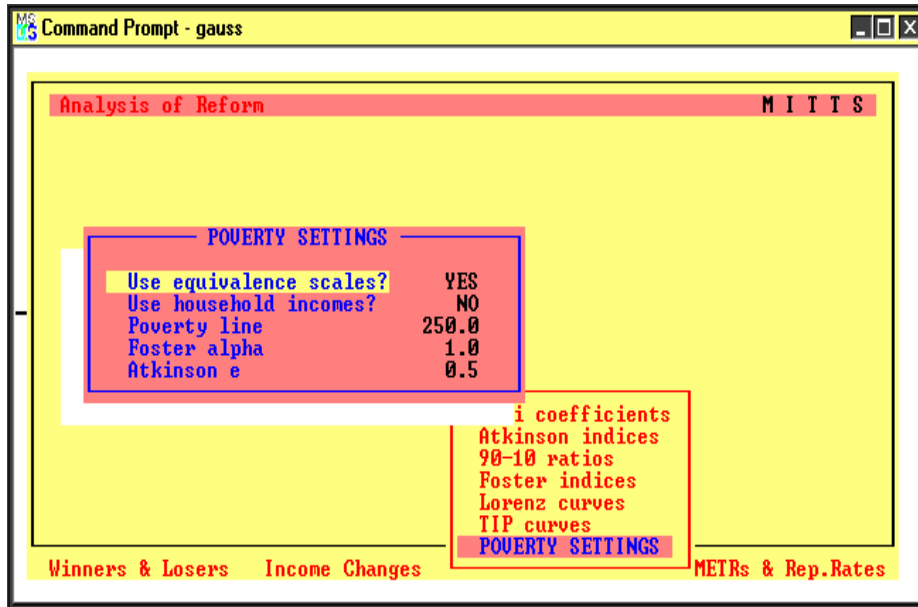


Figure 16: Settings for Inequality Measures

are shown in Figure 16. The space bar is used for selecting yes/no and values of the required parameters are set in the usual way. Selection of equivalence scales and individual incomes gives individual level analyses with each individual given the household income per equivalent adult. Selection of equivalence scales and household incomes produces analyses using one observation per household, having the household income per equivalent adult. Selecting no equivalence scales and individual incomes produces analyses at the individual level, with each individual receiving an equal share of the household income.

Definitions of these measures are as follows. This discussion refers to the unit of analysis as the individual, but MITTS allows for households or individuals. For the Lorenz curve, individuals are first ranked in ascending order according to their incomes, y_i , for individuals $i = 1, \dots, N$, so that $y_i > y_j$ for $i > j$. As i is increased from 1 to N , the Lorenz curve is defined as the relationship between the proportion of people with income less than or

equal to y_i , and the associated proportion of total income obtained by those individuals.

The Gini inequality measure is twice the area contained by the Lorenz curve and the line of equality. The area is doubled simply to ensure that the maximum value that the Gini measure can take is 1. For the distribution of y , where incomes are arranged in ascending order and \bar{y} is the arithmetic mean, the Gini measure, G_y , can be calculated directly using:

$$G_y = 1 + \frac{1}{N} - \frac{2}{N^2} \sum_{i=1}^N (N + 1 - i) \left(\frac{y_i}{\bar{y}} \right) \quad (1)$$

Suppose y_p is the poverty level and let $g(y_i | y_p)$ take the value of 1 if $y_i \leq y_p$, and 0 otherwise. The headcount poverty measure, H , is:

$$H = \frac{1}{N} \sum_{i=1}^N g(y_i | y_p) \quad (2)$$

and is the proportion of the population found on or below the poverty line. The TIP curve refers to three characteristics of poverty (the ‘Three ‘T’s of Poverty’) - its incidence, intensity and inequality. In defining the TIP curve, redefine $g(y_i | y_p)$, so that it indicates not only whether an individual is below the poverty line, y_p , but also the absolute poverty gap, or the extent to which y_i falls below y_p . Thus let:

$$\begin{aligned} g(y_i | y_p) &= y_p - y_i && \text{for } y_i \leq y_p \\ &= 0 && \text{for } y_i > y_p \end{aligned} \quad (3)$$

Suppose, as before, that individuals are ranked in ascending order. The TIP curve is obtained by plotting the total poverty gap per capita against the corresponding proportion of people. In other words:

$$\text{plot } \frac{1}{N} \sum_{i=1}^k g(y_i | y_p) \quad \text{against } \frac{k}{N} \quad \text{for } k = 1, \dots, N \quad (4)$$

The slope of the non-horizontal section of the curve at any point is the poverty gap at that point. The extent to which the poverty gap falls as

income rises is therefore reflected in the flattening of the TIP curve, so the extent of inequality among the poor is shown by the concavity of the TIP curve.

The Foster poverty measures are the set, P_α :

$$P_\alpha = \frac{1}{N} \sum_{y_i \leq y_p} \left(\frac{y_p - y_i}{y_p} \right)^\alpha \quad (5)$$

where α is a parameter to be set by the user. When $\alpha = 0$, the poverty measure, P_0 , is equal to the headcount measure. When $\alpha = 1$, the corresponding poverty measure is equal to the headcount measure multiplied by $G = 1 - \mu_p/y_p$, where μ_p is the arithmetic mean income of those in poverty. Hence $P_1 = P_0G$ depends on both the proportion of people in poverty and the extent to which, on average, those people fall below the poverty line. When $\alpha = 2$, the poverty measure depends also on the inequality of those in poverty, as measured by the coefficient of variation, η_p^2 . It can be shown that $P_2 = P_0 \{G^2 + (1 - G)^2 \eta_p^2\}$.

Atkinson's inequality measure is linked to a social welfare function, W , defined as:

$$W = \sum H(y_i) = NH(y_e) \quad (6)$$

The function, $H(y)$, is given by:

$$\begin{aligned} H(y) &= \frac{y^{1-\varepsilon}}{1-\varepsilon} & \text{for } \varepsilon \neq 1 \\ H(y) &= \log y & \text{for } \varepsilon = 1 \end{aligned} \quad (7)$$

where ε is a measure of relative inequality aversion. Combining (6) and (7) gives:

$$y_e = \left\{ \frac{1}{N} \sum_{i=1}^N y_i^{1-\varepsilon} \right\}^{1/(1-\varepsilon)} \quad (8)$$

The term y_e is the equally distributed equivalent income and is that level which, if obtained by everyone, produces the same social welfare as the actual

distribution. The Atkinson inequality measure, A , is the proportional difference between arithmetic mean income and the equally distributed equivalent level. Hence:

$$A = \frac{\bar{y} - y_e}{\bar{y}} \quad (9)$$

The inequality aversion parameter required can be selected as described above.

7.3.4 Saving Simulations Runs

It may be required to run MITTS-A for a specified policy change and then to return to MITTS at a later date in order to carry out further analyses of the results. This can be achieved without having to re-run the simulation, as follows.

After carrying out the simulation, go to the `c:\gauss\mitts\results` directory. Copy the file `MITTS.DAT` to another file where you wish to store the results for future use. For example, to copy to a file named `MRUN1.SAV`, use the DOS command `copy mitts.dat mrun1.sav`). When it is required to return to these results to obtain further distributional and summary analyses, simply copy the stored file back to `MITTS.DAT`, using the DOS command `copy mrun1.sav mitts.dat`.

Similarly, the details of marginal effective tax rates and replacement rates under the two tax systems may be stored by copying the files `METR1.DAT` and `METR2.DAT` to other files.

8 Running MITTS-B

A behavioural microsimulation analysis of a tax reform can be carried out by selecting the Run MITTS-B option in the main menu. This displays another sub-menu, shown in Figure 17. The simulation settings are chosen as in Figure 18, and the choice of population group to be considered is shown

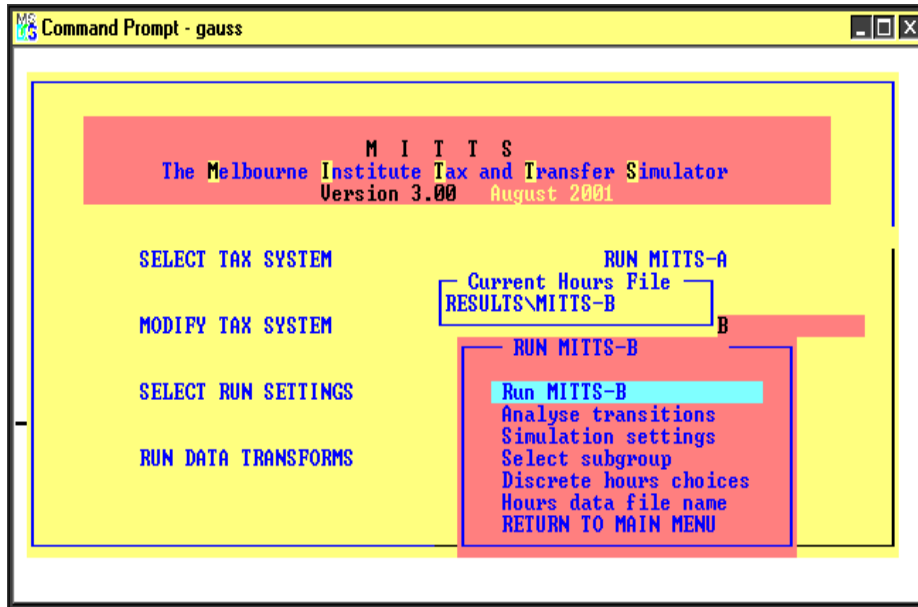


Figure 17: MITTS-B Menu

in Figure 19. The last option regarding hours data is used only for the estimation of preference functions and can be ignored by MITTS users.

MITTS-B is a discrete hours simulation model, in contrast with a continuous hours model. Behavioural responses are based on estimated preference functions for individuals in several demographic groups; these include married (or partnered) men and women, single men and women, and single parents. Hours worked are limited to a set of discrete hours that are chosen under the option ‘simulation settings’ (described below). The simulations are essentially probabilistic, in that they are not based on identification of a particular level of hours for each individual, but on the probability distribution over the discrete hours levels used.

It is first necessary to select the ‘simulation settings’ option. This provides a choice of household number at which to start and end the simulation (the default being all households in the chosen IDS).

In addition, the simulation settings include an option ‘Simulation draws’.

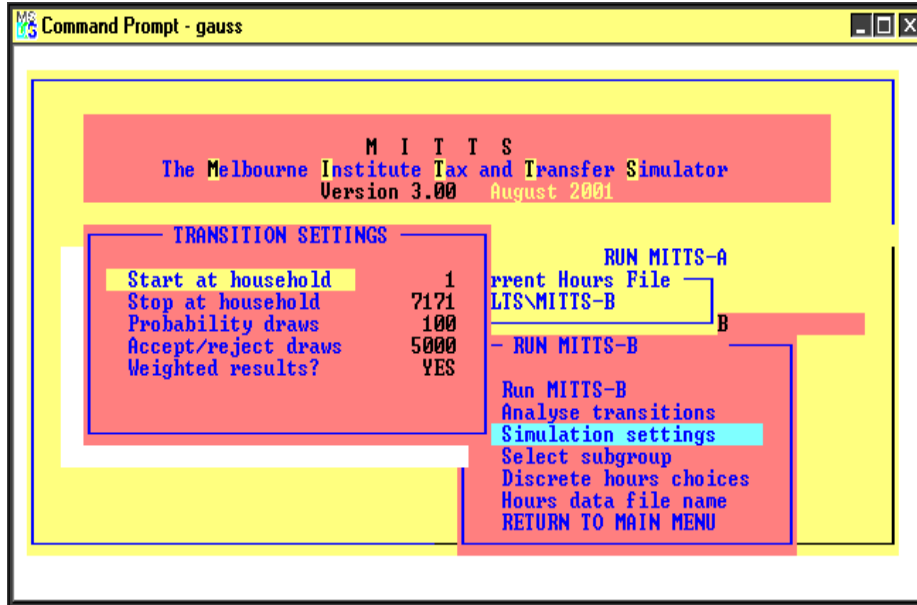


Figure 18: MITTS-B Simulation Settings

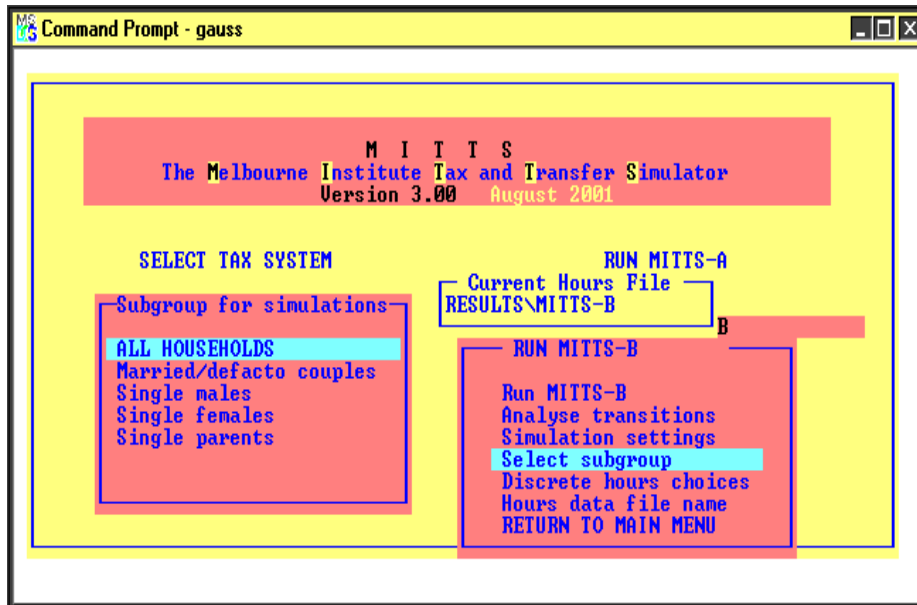


Figure 19: MITTS-B Selection of Groups

This refers to the fact, mentioned above, that simulation results are based on probabilities of working at specified hours levels. These probabilities are obtained by selecting observations at random from the relevant distributions underlying the estimates of preference functions, for each individual. The number chosen under ‘Simulation draws’ refers to the number of random draws required; the default is 100 draws. A higher number of draws increases the required running time.

Before running MITTS-B it is also necessary to set the discrete hours choices. This enables the discrete hours levels to be chosen for each of the five demographic groups distinguished. As MITTS uses discrete simulation, rather than assuming that individuals are able to choose over a continuous range of hours, a decision must be made regarding the particular hours levels that are feasible. Selection of this option gives the screen displayed in Figure 20, with the default values. These settings relate to the discrete hours levels assumed to be available for working.

The default values are the hours levels used when estimating the preference functions. To change the hours levels from the default values, use the up and down direction keys to move between demographic groups. When the desired group is highlighted, hit the *enter* key. Then use the direction keys to highlight a level to be changed. Press *enter* and respond to the invitation to make the change. After typing the new value, press *esc* and respond to the request to save the new level.

To delete an hours level, highlight the selection and press *del*. To insert an additional level of hours, highlight the level before which the new one is to be inserted and hit *ins*. To add higher levels than the existing maximum, highlight it and press both *Ctrl* and *ins*. As many hours levels as required can be used.

Discrete Hours Levels					MITTS
Married Men	Married Women	Single Men	Single Women	Single Parents	
0.00	0.00	0.00	0.00	0.00	0.00
20.00	5.00	20.00	5.00	5.00	5.00
40.00	10.00	40.00	10.00	10.00	10.00
	15.00		15.00	15.00	15.00
	20.00		20.00	20.00	20.00
	25.00		25.00	25.00	25.00
	30.00		30.00	30.00	30.00
	35.00		35.00	35.00	35.00
	40.00		40.00	40.00	40.00
	45.00		45.00	45.00	45.00
	50.00		50.00	50.00	50.00

Figure 20: Hours Selection for MITTS-B

8.1 Run MITTS-B

The desired behavioural simulation can be carried out by selecting the Run MITTS-B option in the sub-menu. This takes substantially longer than the corresponding static simulation of MITTS-A. The time required, and summary information about labour supply responses to the reform, are displayed in a screen similar to Figure 21. The run can be stopped at any time by pressing *esc*. Information about costs can be obtained by pressing *r*. Pressing *h* returns to the window displaying details of changes in hours worked.

The summary information about changes in revenue, shown in Figure 21, are weighted average costings based on the conditional distribution of hours (over the discrete range specified) for each individual. Instead of assigning a single level of hours to each individual, the probability distributions of hours worked for the two tax systems are obtained, along with the costs and revenues at all hours levels, for each individual. These are used to generate the weighted average costs. The non-adjusted change in revenue uses the pre-reform discrete hours for both tax systems. However, the adjusted change in revenue uses the post-reform conditional probability distributions

Behavioural Simulation		MITTS				
Elapsed Time	1 mins 57 secs			HH	Fam	IU
Estimated Time	107 mins 58 secs			131	0	1
Behavioural Response	Couples:		Single	Single	Single	
	Men	Women	Men	Women	Parents	
workers (%base)	63.1	36.1	57.4	42.5	27.0	
workers (%reform)	63.1	37.0	57.3	42.7	30.6	
non-work->work (%)	0.1	0.9	0.0	0.2	3.6	
work->non-work (%)	0.2	0.0	0.0	0.0	0.0	
workers working more	0.0	0.0	0.0	0.1	0.0	
workers working less	0.3	0.2	0.1	0.0	0.3	
average hours change	-0.1	0.2	-0.0	0.1	0.8	
revenue change (%)		10.5	8.0	-3.4	2.5	
revenue change (adj)		10.9	7.7	-5.3	1.0	

repetition # 99 out of 100 Hours:<H> Revenue:<R> To Exit: <ESC>

Figure 21: A MITTS-B Summary Table

of hours resulting from the new tax structure in order to obtain the post-reform revenues. Hence the non-adjusted change in revenue corresponds to a tax change that assumes no changes in the conditional hours distributions and is effectively a non-behavioural simulation. However, this uses the discretised hours rather than the actual hours observed in the data. Hence it gives results that differ from those reported by MITTS-A.

On completion (or termination) of the simulation run, control returns to the Run MITTS-B submenu. The results can be examined by selecting the ‘Analyse transitions’ option. This gives rise to the further choices shown in Figure 22.

Selection of ‘Summary’ gives the summary information regarding the cost and revenue implications of the tax reform, along with aggregate information about hours. These tables, as with all others in MITTS-B, can be saved by using the Alt-S option provided at the bottom of the window.

Selection of ‘Transitions’ produces the transition matrices which show

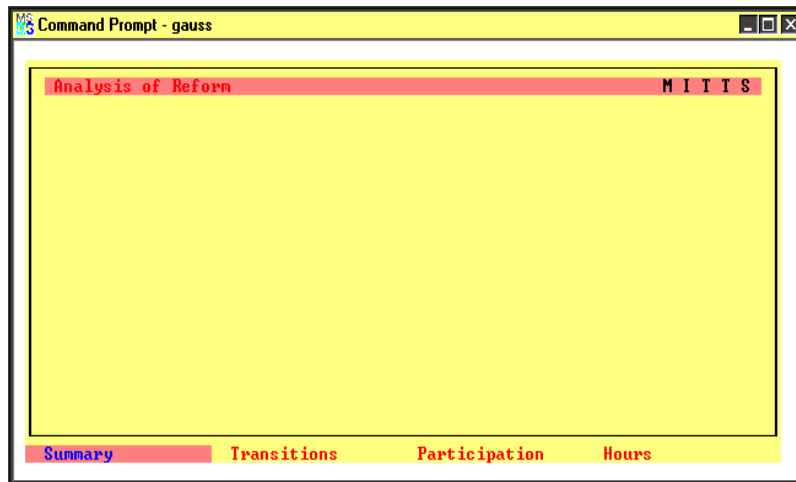


Figure 22: MITTS-B Analysis Options

probabilities of movement between the selected hours levels, for each of the demographic groups in turn. An example of a transition matrix for married men is illustrated in Figure 23.

Selection of the ‘Participation’ option gives results regarding the labour force participation effects of the simulated tax reform, for a range of categories, listed in Table 2 above. An example of changes in the probability of participation in different age groups is given in Figure 24. As with various MITTS-A tables, it is possible to examine specific individuals and households included in any element of the table, using the F7 key.

Distributions of changes in hours, for various categories, are obtained by selecting the ‘Hours’ option. An example is provided in Figures 25. Using the F7 key, it is possible to examine specific individuals from the basic dataset.

9 Selecting Households

MITTS can also be used to produce a variety of analyses for particular individuals and tax units. Furthermore, after running MITTS-A or MITTS-B, it is possible to examine a sample of households who fall into any specified

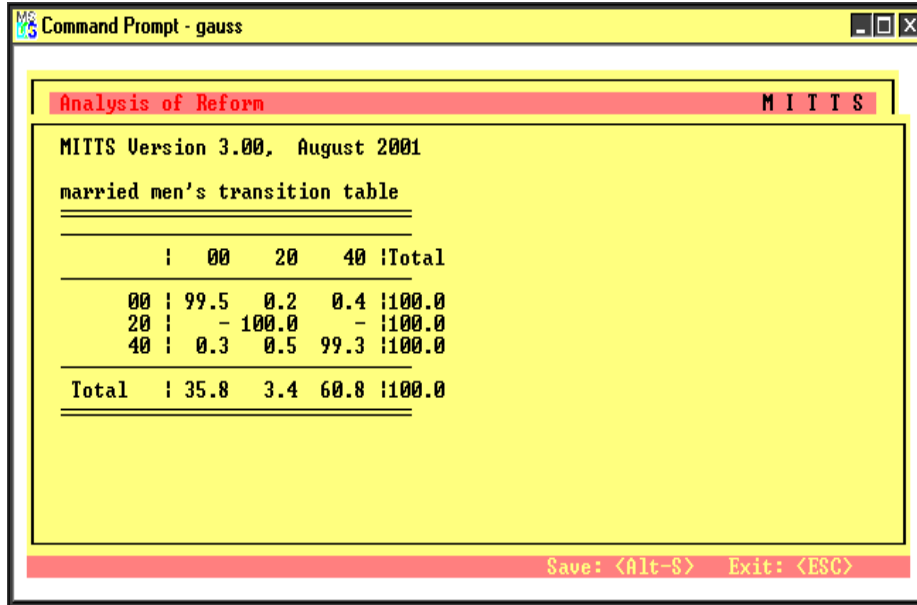


Figure 23: A Transition Table

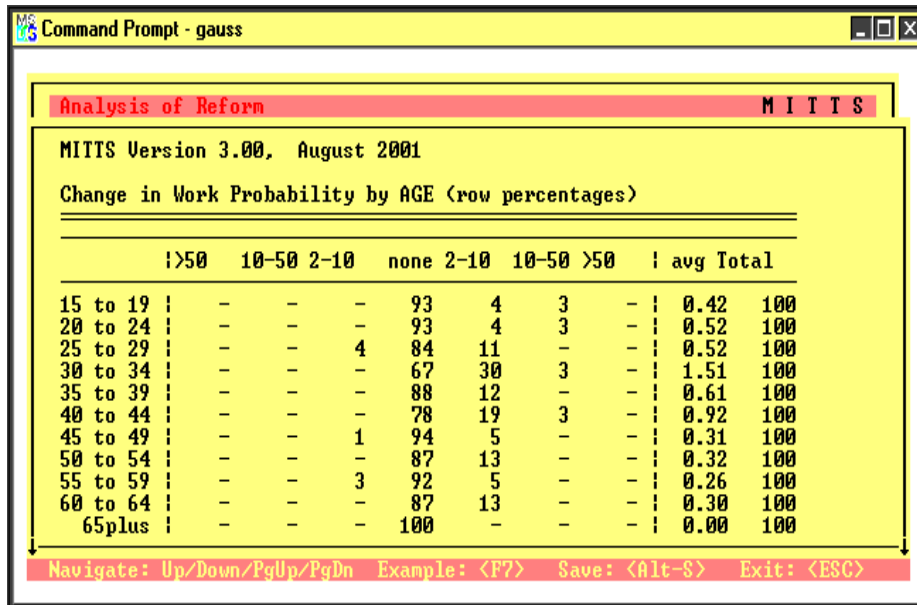


Figure 24: Labour Market Participation

Analysis of Reform MITTS

MITTS Version 3.00, August 2001

Change in Average Predicted Hours by AGE (row percentages)

	>10	5-10	1-5	none	1-5	5-10	>10	avg	Total
15 to 19	-	-	-	97	3	-	-	0.13	100
20 to 24	-	-	-	93	7	-	-	0.18	100
25 to 29	-	-	4	88	8	-	-	0.08	100
30 to 34	-	-	2	81	17	-	-	0.29	100
35 to 39	-	-	4	90	6	-	-	0.09	100
40 to 44	-	-	1	92	7	-	-	0.23	100
45 to 49	-	-	1	95	4	-	-	0.05	100
50 to 54	-	-	-	100	-	-	-	0.04	100
55 to 59	-	-	3	92	5	-	-	0.10	100
60 to 64	-	-	-	99	1	-	-	0.10	100
65plus	-	-	-	100	-	-	-	0.00	100

Navigate: Up/Down/PgUp/PgDn Example: <F7> Save: <Alt-S> Exit: <ESC>

Figure 25: Changes in Hours Worked

cell in a summary table. The available options are described in this section.

For information about particular households in the selected data set, or hypothetical types of household, select the option ‘View Households’ from the Main Menu. Then select the desired choice of ‘households from the dataset’ or ‘hypothetical households’ from the resulting sub-menu. Choice of hypothetical household gives the options shown in Figure 26; the details of the selected type can then be modified.

This component of MITTS can carry out the following analyses.

1. MITTS calculates the gross and net incomes of specified individuals and tax unit in the IDS data base.
2. MITTS provides details of the effects of changing the tax system on all benefit levels and net incomes of specified individuals and income units.
3. MITTS produces, for specified income units, the precise nature of the

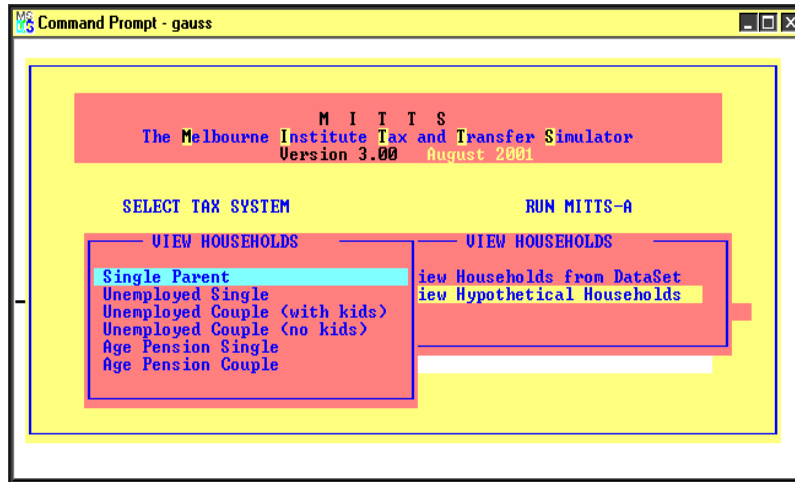


Figure 26: View Hypothetical Household

budget constraint facing the unit, in terms of the choice of hours worked and net income. That is, it provides details of the variation in the income unit's net income as the number of hours worked by a selected individual (either the reference person or the spouse) changes, given the individual's and partner's wage rate, where relevant, under each specified tax system.

4. MITTS provides details of the reasons for each discontinuity and kink in each budget constraint.

After selecting the menu option, 'Households from Dataset', it is necessary to select household number, family number and income unit number in turn, as shown in Figure 27. Hit *enter* after typing each desired number. MITTS then lists the amounts of various taxes and transfers pre- and post-reform, along with the differences. An example is shown in Figure 28. Further information about the income unit can be obtained by selecting from the sub-menu along the bottom of the screen. An example of income unit information is shown in Figure 29.

Moving between the reference person and the spouse is achieved using

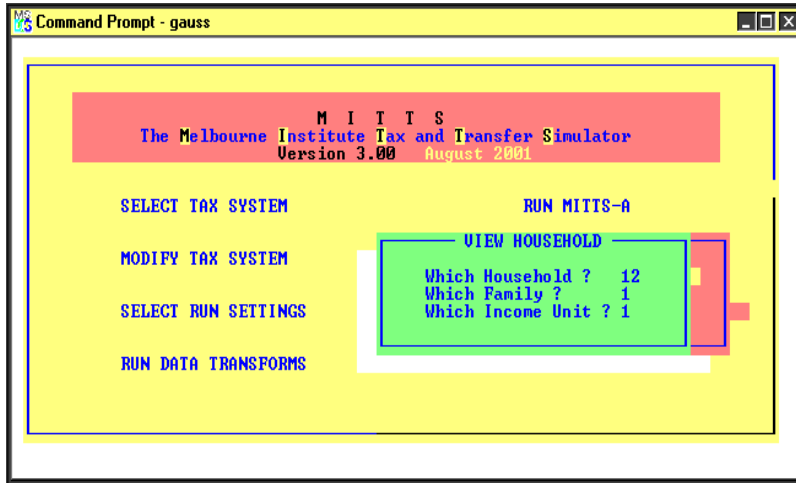


Figure 27: View Households Selection

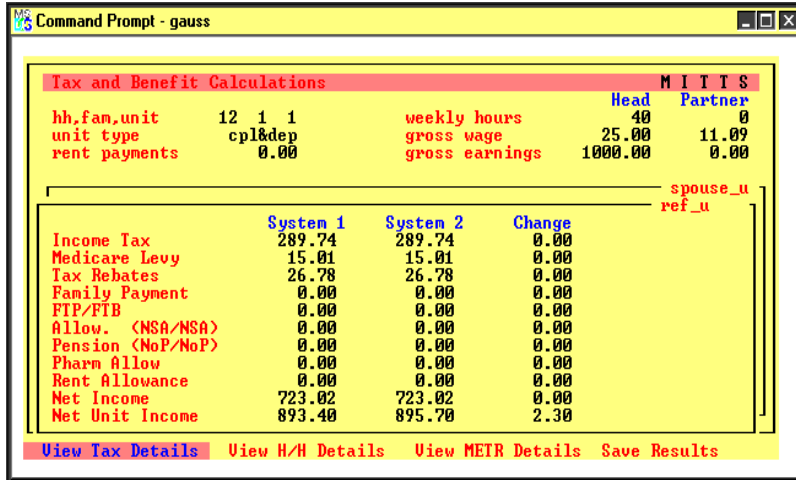


Figure 28: Tax and Benefit Details for Selected Unit

pgup and *pgdn* keys. Moving to the next and previous income unit is achieved using the *n* and *p* keys respectively.

It is possible to examine the effects of variations in some of the characteristics of the income unit, such as the wage rate or hours worked. Hit the *F10* key. Then use the direction keys to highlight the variable to be changed. Pressing *enter* produces a dialogue box, allowing a new value to be entered. The new tax and transfer levels are automatically provided.

The abbreviations used are described in Table 3. Where two values are given using, for example, (DSP/WP), the first term refers to the tax and transfer system 1 while the second term refers to tax system 2.

The sub-menu on the bottom of the screen shown in Figure 28 also provides options to look at household characteristics, and an option ‘View METR Details’. On selecting this option, MITTS then computes the exact budget constraint. This gives the net income of the income unit for variations in hours of work by the individual displayed in the window (for the given actual number of hours worked by the spouse, where relevant). First, details of all the kinks in the constraint, and probable reasons for those kinks and discontinuities, are given in tabular form for the pre-reform system. An example is shown in Figure 30. This table may be saved to a named file by selecting the *Alt-s* option and following the prompts, as before.

Pressing *esc* then provides a further sub-menu for the choice of tax system to be examined, along with ‘graph options’. Selecting ‘graph options’ then allows a choice of either the budget constraint or the profile of marginal effective tax rates. Profiles for both tax systems are placed on a single diagram. In order to return to the menu after viewing the figure, press *esc*. Examples are given in Figures 31 and 32.

Other graph options include the ability to examine replacement rates at different hours levels and average tax rates. These are actually obtained as continuous functions, having derived the exact form of each budget constraint in terms of hours thresholds, net wages and virtual incomes. In addition, a

Table 3: Abbreviations

Allowances	
PPs	Parenting payment (single)
PPp	Parenting payment (couple)
SA	Sickness allowance
WA	Widow's allowance
AUS	Austudy
NSA	Newstart allowance
MAA	Mature age allowance
YA	Youth allowance
SpB	Special benefit
PA	Partner allowance
NoA	No allowance
Pension	
AP	Age pension
DSP	Disability support pension
WP	Wife's pension
WBP	Widow B pension
CP	Carer's payment
VSP	Veteran pension
VDP	Veteran's Disability pension
WWP	War Widow's pension
NoP	No pension
Demographics	
ref_h	Reference person
spouse_h	Spouse of reference person
depkid_h	Dependent child of reference person
ndkid_h	Non-dependent child
non_fam	Non-family member

Command Prompt - gauss

Income Unit Information				M I I T S	
				# children	
hh,fam,unit	12 1 1	tenure type	outright	0-2	1
unit type	cpl&dep	dwelling type	detached	3-4	1
residence state	Victoria	weekly rent	0.00	5-12	2
COB (reference)	Aus	weekly mortgage	0.00	13+	0

age	ref_u	spouse_u
	30	30
sex	male	female
rel in h/h	ref_h	spouse_h
educ status	not stud	not stud
qualifications	no quals	no quals
other income	1.00	10.00
gross salary	1000.00	0.00
hours per wk	40	0
employment	fulltime	non-part
occupation	paraprof	.
industry	elec/gas	.

View Tax Details View H/H Details View MEIR Details Save Results

Figure 29: Income Unit Information

Command Prompt - gauss

Budget Constraint Details: System 1				M I I T S
Hours	Gross	TUNet	MRate	PROBABLE REASON FOR KINK
0.00	0.00	574.72	0.000	constraint starts
0.54	13.42	588.15	0.200	(kink not recognised)
1.16	29.02	600.62	0.700	MR changes for Taxable Allowance
2.76	69.00	612.61	0.900	MR changes for Beneficiary Tax Rebate
3.97	99.29	615.64	0.760	MR changes for Taxable Allowance
9.91	247.64	651.24	0.900	MR changes for Beneficiary Tax Rebate
10.21	255.36	652.02	0.725	Beneficiary Tax Rebate stops
15.88	397.08	690.99	0.905	Taxable Allowance stops
16.34	408.38	692.08	0.380	partner's MR changes for Beneficiary Tax
18.77	469.22	729.80	0.340	Dep Spouse Rebate starts
19.00	475.00	733.61	0.840	MR changes for Low Income Rebate
23.43	585.79	751.34	1.040	Taxable Allowance stops for partner
				MR changes for Dep Spouse Rebate
				Low Income Rebate stops
				partner's MR changes for Family Payment
				Medicare Levy starts

Navigate: Up/Down/PgUp/PgDn Save: <Alt-S> Exit: <ESC>

Figure 30: A Budget Constraint

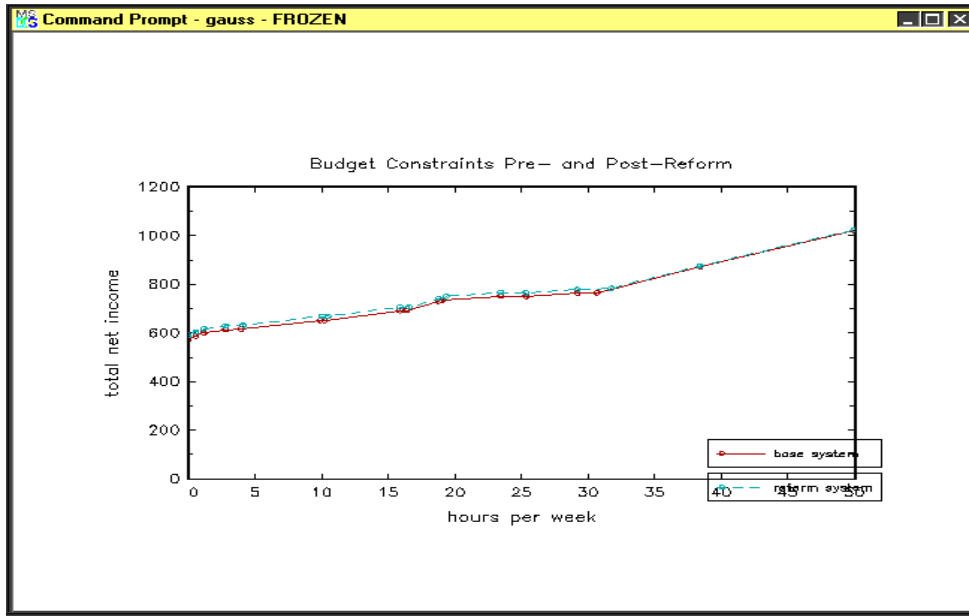


Figure 31: A Budget Constraint

breakdown of the budget constraint, in terms of the source of income, is available in the form of bar charts; an example is shown in Figure 33. The bar charts are actually displayed in colour, and are therefore clearer than the monochrome figures shown here.

The examination of ‘hypothetical households’ proceeds as for households from the dataset, except that it is possible to set wage rates, hours worked and number and ages of dependent children. After making the choice from the main menu, press the *F10* key in order to make changes to the default values displayed. Moving between reference person and spouse is achieved as before by pressing *pgup* and *pgdn*. Again, after selecting ‘view METR details’, press *esc* for graph options. This gives the options discussed above, including plots of net incomes and METRs, along with replacement rates and average marginal effective rates, corresponding to hours worked.

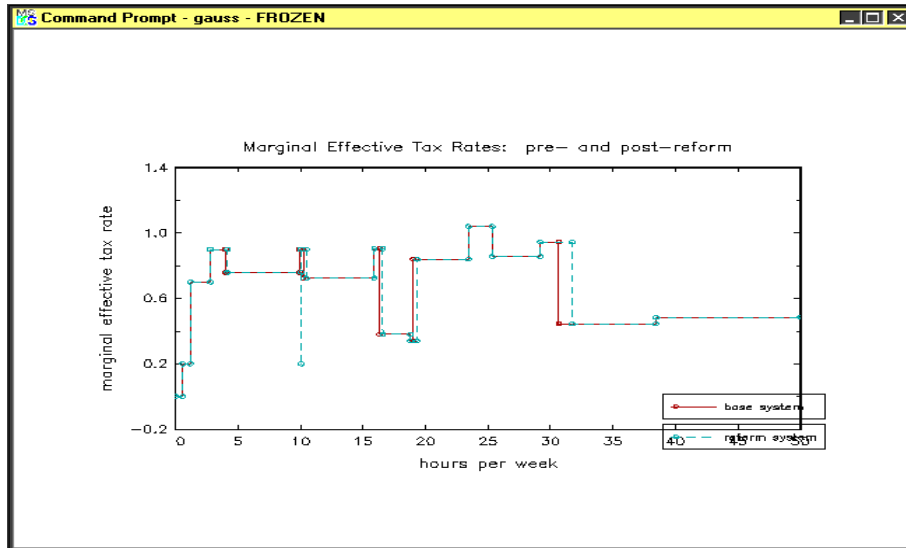


Figure 32: Marginal Effective Tax Rates

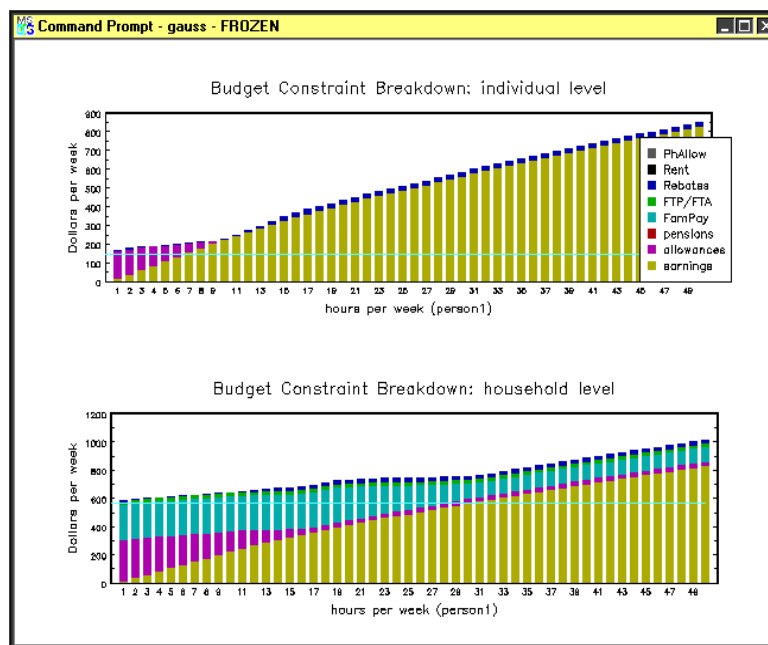


Figure 33: Breakdown of Budget Constraints

10 The Output From MITTS

The generation of files containing tables produced by MITTS has been described at the appropriate points above. These files, placed in the subdirectory `c:\gauss\mitts\results`, are in ASCII form. They can be loaded into other software for further manipulation. In some cases, for example importing into Excel, it is necessary to change the filename so that it has a `.txt` extension. On loading into Excel, the information can be converted into an Excel table, which can then be pasted into MS-Word as a table. Figures can be handled as follows.

10.1 Printing Figures

Several alternative procedures may be used in order to save or print any figures produced by MITTS. First, figures may be pasted into a wordprocessor. With the figure displayed on the screen, simultaneously press the *alt* and *pr scr* keys. Then open a word processor (such as MS-Word, or Scientific Word) and place the cursor where the figure is required. Then simultaneously press the *shift* and *insert* keys. The figure will appear and can be scaled to the required size using the word processor. When using this method, Gauss should be displayed within a window, rather than taking up the full screen, otherwise memory problems arise. This method was used to produce the figures in the present document.

An alternative procedure involves, when viewing the figure, hitting any key; this produces a list of options. The most useful of these options are ‘zoom’ (select this option and then use the direction keys to select the area, and hit *enter*), and ‘Convert File Format’. After making the latter choice by pressing *c*, select *e* for ‘Encapsulated postscript’. This writes the figure to a file in the `c:\gauss\mitts` directory and gives the file an `.out` extension. The name of the file is displayed briefly on the screen. In order to print this

file, change the name so that it has a .ps extension.² Finally, use the DOS command `copy filename.ps LPT1`, or whichever printer is required. This has the effect of printing a full page landscape copy of the figure. Importing the .ps file into a wordprocessor also produces a landscape figure.

10.2 Using PlayW.exe

An alternative, and preferred, method of importing a figure into a wordprocessor makes use of a Gauss utility called PlayW.exe. This software converts files into alternative formats. It can be downloaded from the web site: <http://www.aptech.com/download.html>. After downloading the PlayW.zip file, use Windows Explorer to unzip it and follow the instructions for installation. The installation produces a convenient short cut and icon.

When a figure is being displayed by MITTS, Gauss produces a file called graphic.tkf which is placed in the c:\gauss\mitts subdirectory. With the file displayed, go into PlayW, import the graphic.tkf file and select the convert option from the menu.

Several options are available. One, depending on the machine being used, is to select the postscript option and follow the instruction to name the file.³ Simply type the file name desired (and select the required directory). Use the default values of the various options. The resulting file can then be loaded into the word processor as a picture. Figure 34 was produced in this way.

More flexibility is available if the file is converted into a bitmap. Select bitmap, and leave the options as the default value. Name the file and place it in the desired directory. After this, open Windows Explorer, go to the directory and double click to open the file (in MS Paint). From the Image menu on the toolbar, select Invert Colors in order to change the background colour to white. Then click on the dotted rectangular icon from the tool

²This can be carried out using the DOS command `rename oldname newname`.

³Selection of the wmf (MetaFile) option produces a figure with the same colour scheme as that displayed by MITTS, which is not optimal for documents.

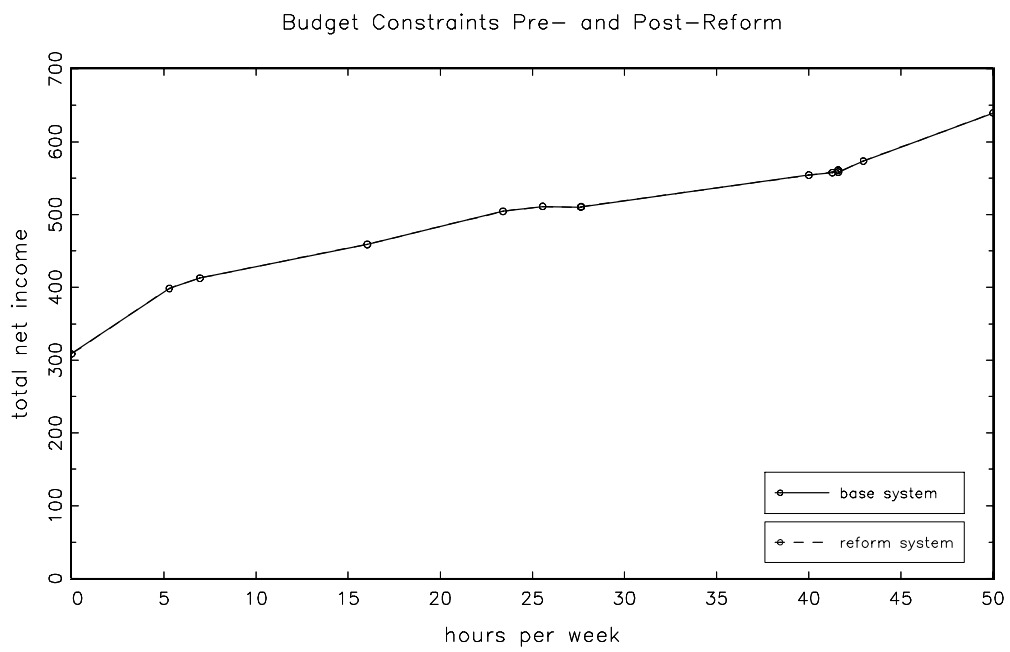


Figure 34: A Figure Obtained using PlayW.exe

bar: it is then possible to drag the cursor in order to frame the required area of the graph that you wish to save (for example, you may wish to omit the title). Other editing of the figure can be carried out using the other facilities provided (such as erasing sections or adding text).

>From the Edit menu, select Copy. It is then possible to paste the figure into a word document. Simply open the word processor, place the cursor at the required point and press Shift+ins. Alternatively, if using MS Word, use Edit and then Paste. If using Scientific Word, the alternative to Shift+ins is to use Edit and Paste Special.

11 The MITTS File Structure

This section provides further details of the MITTS file structure. On installation, the MITTS.ZIP file is placed in the c:\gauss\mitts subdirectory. When MITTS is run, a further set of subdirectories is created, leading from the c:\gauss\mitts directory. These contain groups of data files or procedures and are described as follows.

11.1 Mitts

1. Mitts.e - This is the main file to runs mitts
2. Graphic.tkf - This contains the output of the last diagram produced when running MITTS. It can be loaded into other software that is capable of handling or converting graphics files.

11.2 Benefits

This subdirectory (c:\gauss\mitts\benefits) contains the gauss procedures used to compute benefits.

1. AgePen.prc - Age pension
2. Allow.prc - Allocates individuals to particular allowances. It also calls the particular allowance procedure and determines entitlements.
3. Austudy.prc - Austudy (post July 2000)
4. AusYTA.prc - Austudy (pre July 2000)

5. CarerPay.prc - Carer Payment
6. DSPen.prc - Disability Support Pension
7. DVADis.prc - Department of Veterans Affairs Disability Pension
8. DVAPen.prc - Allocates individuals to particular Department of Veterans Affairs pensions. It also calls the particular DVA pension procedure and determines entitlements.
9. DVAServ.prc - Department of Veterans Affairs Service Pension
10. DVAWWP.prc - Department of Veterans Affairs War Widows Pension and Income Support Supplement
11. Family.prc - Determining whether Family Allowance or Family Tax Benefit is to be called
12. FamPay.prc - Family Allowance/Payment. It also calculates Family Tax Payment/Assistance entitlements
13. FamTBen.prc - Family Tax Benefit Parts (A) and (B)
14. FlatTax.prc - Negative Income Tax
15. MatAge.prc - Mature Age Allowance
16. Newstart.prc - Newstart Allowance
17. ParntPay.prc - Parenting Payment
18. Partner.prc - Partner Allowance
19. Pension.prc - Allocating individuals to particular pensions. It also calls the particular pension procedure and determines entitlements.
20. RentAss.prc - Determines maximum entitlements to Rent Assistance based on family circumstances and rent paid.
21. ResAllow.prc - Allocating individuals to residual allowances, that is, Special Benefit or Partner Allowance. It also calls the particular allowance procedure and determines entitlements.
22. Sickness.prc - Sickness Allowance
23. SpecBen.prc - Special Benefit
24. WidBPen.prc - Widow B Pension

25. Widow.prc - Widow Allowance
26. WifePen.prc - Wife Pension
27. YouthAll.prc - Youth Allowance
28. YthTrain.prc - Youth Training Allowance

11.3 Data

This subdirectory (c:\gauss\mitts\data) contains the various data files used by MITTS.

1. B_hh5.fmt - Labour supply parameters
2. B_sm2.fmt - Labour supply parameters
3. B_sp5.fmt - Labour supply parameters
4. B_sw2.fmt - Labour supply parameters
5. Betas.dat/dht - Wage equation parameters needed for imputing wages for non-workers
6. Deflate.dat/dht - Average weekly earnings wage deflators
7. Femawe.dat/dht - Female average weekly earnings deflators needed for uprating.
8. Gammas.dat/dht - Selection equation parameters needed for imputing wages
9. Maleawe.dat/dht - Male average weekly earnings deflators needed for uprating
10. Mind.dat/dht - Average proportion of employed persons in each industry (needed for imputing wages of non-workers)
11. Mindur.dat/dht - Average proportion of unemployed persons in each industry taken from labour force data (needed for imputing wages of non-workers)
12. Mocc.dat/dht - Average proportion of employed persons in each occupation group (needed for imputing wages of non-workers)

13. Moccu.dat/dht - Average proportion of unemployed persons in each occupation group taken from labour force data (needed for imputing wages of non-workers)
14. Xx_in.fmt - Output file containing all data at household level
15. Xx_pr.fmt - Output file containing all data at person level (one row per person).

11.4 NetInc

This subdirectory (c:\gauss\mitts\netinc) contains the gauss procedure used to compute net incomes. There is just one file.

1. NetInc.prc - Calculates net incomes

11.5 Programs

This subdirectory (c:\gauss\mitts\programs) contains a range of gauss procedures used when running MITTS.

1. Assets.prc - Imputes household assets (currently returns zeros)
2. Back_end.prc - Calculates winners and losers, inequality measures, poverty measure and marginal effective tax rate results.
3. ClearSys - Clears parameters needed for tax systems.
4. Data.prc - Defines openfile procedure, seekhh procedure. Also defines data transformation procedures (datatran performs the transformations and tranfile applies them using seekhh). Data transformations include uprating, imputing certain information such as assets and parental income, recoding numeric variables to string variables, and generating equivalence scale information.
5. DTran.prc - Performs data transformations needed for imputing wages
6. Equiv1.prc - Equivalence scales
7. FindKink.prc - Algorithm to find kinks in individuals budget constraints
8. Frontend.prc - Presents all tax system information to screen enabling user to run simulations interactively

9. Hours.prc - Defines the range of discrete hours over which labour supply behaviour is simulated
10. IneqMenu.prc - Sets up menu for inequality and poverty measure settings.
11. Input.inc - Creates menus to enable interactive use of MITTS.
12. List.prc - Adjusts parameters of the tax system
13. Pickyear.prc - Opens data file depending on year chosen by user
14. Pincome.prc - Imputes parental income for dependent students living away from home, needed for Youth Allowance.
15. PredWage.prc - Calculates imputed wages for non-workers.
16. PrintBC.prc - Plots budget constraints.
17. ReadSys - Reads tax system parameters for simulation RiteMain.prc
18. RunMitts.prc - Runs simulation of MITTS-A. Specifies variables to be written to data file (note that this data file is what is called when generating split groups for results whether it be winners and losers, inequality, marginal effective tax rates or poverty measures.
19. RunSim.prc - Runs simulation of MITTS-B.
20. ShowHH.prc - Generates household information to be written to screen. This includes calculation of net incomes; that is, it calls MittCalc procedure found in NetInc.prc
21. Sysset.prc - Determines tax systems to be used in simulation
22. Tabulate.prc - Defines many procedures used in back_end.prc. Defines tabulate procedure which is called when output needs to be tabulated; Bar_Diff procedure which is called when bar charts average income changes are graphed; GenCount procedure which generates information for tables of winners and losers; MetrTab which is used to generate tables of METR differences and; a range of procedures which generate various inequality and poverty measures which are all used in the Inequal procedure.
23. Uprate.prc - Defines procedure uprating all income data in base file
24. Utility.prc - Household utility specifications for behavioural simulations

25. Virtual.prg - Generates virtual incomes and net marginal effective wage rates
26. WriteSys - Writes tax systems updated interactively to file

11.6 Rebates

This subdirectory (c:\gauss\mitts\rebates) contains the gauss procedures used to compute rebates.

1. BenReb.prc - Beneficiary Rebate
2. DSRReb.prc - Dependent Spouse Rebate
3. LIRebate.prc - Low Income Rebate
4. Prebate.prc - Pension rebate
5. SPPReb.prc - Sole Parent Pensioner rebate
6. SPRebate.prc - Sole Parent Rebate

11.7 Results

This subdirectory (c:\gauss\mitts\results) contains any files saved during the running of MITTS. In particular, it contains:

1. Mitts - This is the default file containing simulation costing results

11.8 Systems

This subdirectory (c:\gauss\mitts\systems) contains the various tax system parameter files.

1. ANTS.tbp - A New Tax System (July 2000)
2. Jan00.tbp - January 2000
3. July98.tbp - July 1998 (Youth Allowance introduced)
4. March98.tbp - March 1998
5. March99.tbp - March 1999

11.9 Tax&ML

This subdirectory (c:\gauss\mitts\tax&ml) contains the gauss procedures used to compute income taxation and the Medicare Levy.

1. AssessI.prc - Calculates assessable income needed to determine eligibility for allowances
2. IncomTax.prc - Income Tax procedure
3. Medicare.prc - Medicare Levy procedure