# 1. PREPARING INPUT

## ABOUT THE INPUT TEMPLATE

The Input Template (named as I_Prost14_template.xlsx) is an Excel workbook designed to enter data and assumptions necessary for running PROST14[1]. This template contains the following eight worksheets[2]:

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|---|---|
| General | General (not-age-specific) information |
| Population | Age-specific demographic data/assumptions |
| Labor | Age-specific labor market data/assumptions |
| Pension | Age-specific pension system data/assumptions |
| Profiles | Profile data for six different individuals |
| ReformGeneral | General (not-age-specific) parameters for systemic reform |
| ReformPension | Age-specific parameters for systemic reform |
| Factors | Actuarial tables |

To use this template, load the file I_Prost14_template.xlsx using PROST as it is described in the manual. It is important to notice that the file name has three parts. The first part "I_" indicates that this is an input workbook. The second part is reserved for country or case names. The third part (.xlsx) is the file identifier for an Excel workbook. It is necessary to follow the naming convention described here. The user can specify the file name in any way without changing the first and last parts of the file name.

Data Entry:  Enter data as per the instructions given here. It is not necessary to enter the data in one session. You can stop data entry at any stage and start again at a later point if so desired. Remember to save the input file periodically.

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[1] Pension Reform Option Simulation Toolkit, copyright IBRD, 2012.

[2] Users can add more worksheets for rough/background calculations if necessary though it is not necessary to do so.

Saving Input Files:  The user is advised to save the input file often during data entry to prevent data loss. Click *FILE* and then *Save As.* Change the file name into what makes sense to the user, such as **I_CHN_A.xlsx** for case A of China or **I_UKR_C.xlsx** for case C of Ukraine.  Do not change the first part ("I_") or the file extension (".xlsx") otherwise PROST will not be able to read it. Note that the 'I" prefix is used to denote an input file. After running PROST, an Excel file with the same name but prefixed with an "o" will be created. This new file would contain the output tables from PROST runs.

The amount of time it takes to assimilate and enter the data required for these simulations should not be underestimated.  It is suggested that the user maintains careful notes about the sources of input data and assumptions used for the data for future reference. Note that all areas of the input files are protected and the user may enter comments/notes only in the space allocated for such annotated comments.

## SIMULATION HORIZON, BLANK CELLS, DATA INTERPOLATION, INSERTING AND DELETING DATA

The program can handle simulations up to 100 years or more. The exact capabilities would depend largely on the computer being used.  The number of years in the simulation is determined by the user, usually ranging from 50 to 75 years for pension reforms.  A 75 year horizon is suggested since it covers the remaining lifetime of those people beginning work today. Users select a base-year (e.g., 2010) and an ending-year (e.g., 2075), and enter these two dates in worksheet "General".

Any cell that is left blank is assumed to have a value of zero. The user is encouraged to check, if there are no "unintentional" zeros of this kind in the input file. For example, if you specify a positive number of 40 year old retirees, make sure, that length of service and replacement rates for that particular cohort are also positive. Otherwise, PROST will interpret the data as some people retiring with zero pensions, which will bring down the average pension in the economy. Similarly, if you have positive number of 60 year old contributors, you should also have a positive earnings profile for that cohort. Otherwise PROST assumes that these contributors are working for free and therefore collected revenues will be reported lower than actual. It is safest to fill as many cells as you can. For example, if you specify a positive replacement rate for 20 year old it will not have any impact, unless you also specify a positive number of retirees. However, not specifying a replacement rate for the cohorts that have positive number of retirees will have a major impact on the results.

All data and assumptions are put in defined rectangle range blocks sandwiched by a first column containing information for the base year (e.g., 2010), and, a last column containing information for the ending year (e.g., 2075).  In most instances, the end year data are usually derived from a reasonable hypothesis or assumption about the way the base year data are expected to behave over time. The program linearly interpolates between the two values to determine values for each year of the simulation.  Sometimes it may be necessary to assume that the end year data and the base year data are the same if the variable is not expected to change over time.  On the other hand, there may be instances when it becomes necessary to specify a hypothetical time path for some of the

input file variables. For example, maybe GDP growth is expected to be high for the next 10 years and then to slow down thereafter. In such cases, data for additional years between the base year and the end year could be entered by inserting cells between the base year and the end year. If the user wishes to insert or delete data for intervening years in any of the spreadsheets, he/she can use the buttons for inserting(**I**) and deleting(**D**) columns of data. By clicking on the "I" icon, a column is inserted for data entry with the year field as well as other data fields linearly interpolated according to values in neighboring cells. The user can over-write these values if necessary. As the user adds intermediate years, interpolated values for these intermediate years appear in the data cells. These can be overwritten by the user. Conversely, by clicking on the "D" button, data are deleted for any year. Numerical data fields between two specified years (e.g., 2010 and 2015) are interpolated linearly.

> **Note:** You will not be able to insert data before the base year or after the end year, and you will not be able to overwrite the base year or end year values by manually typing over them. They can be changed only in the lines 14 (labeled "Base Year") and 15 (labeled "Ending Year") of spreadsheet "General".

**Please note that line and column numbers refer to the original template. As the user inserts lines or columns, line numbers may no longer match what is written in the manual. Therefore, it is advised to refer to line and column labels rather than to line and column numbers.**

### WORKSHEET I: GENERAL

The spreadsheet "General" contains user options for running PROST, data about general assumptions pertaining to the economy and some parameters of the pension system. The variables need to be entered exactly in the units specified. The following is a list of variables in spreadsheet "General":

> **Beneficiary Categories**: Enter the categories of pensioners being analyzed. PROST allows up to four categories to be selected at a time. The first category will be modeled with the greatest precision by tracking the beneficiaries over time from the assignment of the benefit until the beneficiary dies. The benefit income distribution will also be modeled within each age and gender cohort. This category will be referred as 'old age pensioners' in this document; however, the user can change the name if he wishes. The second category will be called "disabled" throughout the document. The number of beneficiaries will be modeled in the similar way to "old age pensioner" category, but income distribution within the age and gender cohort will not be modeled. I.e. each cohort will be assumed to consist of identical individuals assigned the same average benefit.
>
> The last two categories will be modeled by figuring the total number of beneficiaries every year based on user specified beneficiary rates. In this document these two categories will be referred as 'survivors' and 'orphans'. These last two categories

could also be used for projecting child allowances, unemployment allowances, and other types of social assistance.  The benefit levels will be modeled differently for these two categories. Average "Survivors" will be assumed to track changes in the average old age pension level. Average "Orphan" pension will be linked to average wage instead. This is because most survivor pensions are generated by deaths of old age pensioners, while most orphan pensions are generated by deaths of active contributors.

**Simulation options**:  Enter the simulation options for PROST. PROST contains multiple calculation methodologies to fit varying situations.  Depending on the options selected, PROST will present the user with a customized input file template. Thus, the user may not see all of the ranges specified in this document. The following options should be specified:

Line **Contributors in the "Pension" sheet will be specified as:** Depending on the users' needs and the data available, PROST allows users to specify present and future expected contributors as a) a percentage of population in each age and gender category**, stock of population** b) a percentage of the people employed in each age and gender category, **Stock of employment** c) a finite number which may grow or decrease, but is not linked to changes in population or employment, **Nominal number of positions** (useful for evaluating closed pension systems where individuals enter a pension system  upon being hired and the hiring decision is based on human resource policy as in some civil service systems and corporate pension plans) d) current stock of contributors plus new contributors based on employment in each age and gender category, **Flow of employment** and e) current stock of contributors plus new contributors based on population in each age and gender category, **flow of population.** We generally recommend using **Stock of Population** as it produces the most stable results.  While it might be considered logical to use **Stock of Employment** since the contributors are part of the employed population, if there are errors in the current or projected values of labor force participation or unemployment, these errors will be transferred to the pension system contributors and magnified as the system projects out for 75 years.  If the user wishes to analyze closed pension systems or civil service pension systems, it is recommended that the user select option 'c', the nominal number of contributors. In that case, the population linkages are in effect cut off and PROST will calculate the future flow and stock of contributors according to human resource policy specified in the table **Human Resource Policy** of the spreadsheet "General" when this option is chosen.  **Flow of employment** and **flow of population** are also two other options, but generally not recommended. They both require the user to enter **New Contributors** in the *Pension* sheet as a percentage of either employment or population.  There is more likelihood of abnormal variation in the base year for new contributors than there is for total contributors, and using this methodology will magnify any such abnormalities over the long simulation horizon. However, these are included in case of particular circumstances where this calculation method is more appropriate.

Line **Old age pensioners and disabled will be specified as:** Old age pensioners could be calculated as (a) a percentage of the population in each age and gender

category, **Stock of Population,** or (b) last year's retirees plus a percentage of last year's contributors who are now eligible for retirement, **Flow of contributors previous year.** If you use **Nominal number of positions** in line 6, you must use **Flow of contributors from previous year.** However, for national systems we recommend **Stock of Population**. Frequently, people have accumulated rights to retirement, are no longer contributing, but when they pass the age eligibility requirement, will choose to collect benefits. Therefore, there really isn't a tight link between those who retire this year and those who contributed the previous year.

Line **Survivors and Orphans will be specified as**: Survivors and orphans could be specified as (a) a percentage of the population in each age and gender category, **Stock of Age Specific Population,** or (b) a percentage of the total covered group, contributors, old age pensioners and disabled in a given year, **Stock of Total Contributors and Retirees.** Survivors and orphans are not carried over from year to year. **Survivors** in this context refer primarily to widows and widowers, although other categories such as parents and siblings could be included. **Orphans** refer to children of the contributors. Each year the total number of survivors and orphans is calculated as specified and their benefits are calculated as will be specified below. Generally, for national schemes, you would choose option a, **Stock of Age Specific Population.** In the case of a closed group like civil servants, it is not possible to use the population link. Therefore, it becomes necessary to assume a link between the total number of participants in the system and the number of widows and orphans.

Line **Summary and comparison should reflect finances of**: the user can specify either **Monopillar System** or **Multipillar System**. Depending on the choice summary output and comparison tables will reflect either monopillar or multipillar pension system setup.

Line **User Name**: Type an user name to identify the author of the input file.

Line **Country Name**: Enter the country name.

Line **Case Name**: Enter a name for the case to identify this input file uniquely from others.

Line **Base Year**: The starting year for the simulation horizon. Typically the date entered here is the year for which (i) *all* the other data are available (e.g., 2010) and (ii) the data are *stable* since simulation projections would depend on the initial conditions to a large extent.

Line **Ending Year**: The end point for the simulation horizon. This could be anywhere from twenty five to one hundred years into the future starting from the base year. Note that very long simulation horizons would require sophisticated assumptions about the way macro economic variables are expected to behave in the future. On the other hand, very short simulation horizons are unable to capture the full lifetime of an individual just born during the Base Year.

**Note:** After entering the Base and Final year, these values will automatically appear in the date headings of all other variables. The user is not allowed to change the base year and end year headings in other data ranges by editing them manually.

## Base Year Data

Enter base year information for the following variable blocks, paying careful attention to units:

Line **GDP**: GDP *in millions of local currency* for the base year.

Line **Pension Fund Balance**: The pension fund balance *in millions* at the beginning of the base year.

Lines **Total lump-sum Payments to Male/Female Old Age Pensioners:** Total *annual* lump-sum old age pension payments to males/ females during the base year in *millions*.

Lines **Total Annuity Pension Payments to Male/Female Disabled:** Total annual annuity payments made to beneficiaries claiming disability pensions, males/females, during the base year in *millions*.

Lines **Total Lump Sum Pension Payments to Male/Female Disabled:** Total annual lump sum payments made to beneficiaries claiming disability pensions, males/females, during the base year in *millions*.

Lines **Total Payments to Survivors:** Total annual payments made to beneficiaries claiming survivor pensions, males and females together, during the base year in *millions*.

Lines **Number of Survivors/Orphans:** These lines only appear when the option **Stock of Total Contributors and Retirees** is chosen under **Simulation options** for modeling survivors and orphans. Enter total number of survivors/orphans in *thousands.*

## Wage and Pension Brackets and Cumulative Distributions

The variables in this block let you input wage and pension distributions. First, adjust the number of rows in the distribution range according to the data that you have. For example, if you have wage distribution data in quintiles, you need 5 rows for that range. You can insert or delete rows by pressing on "I" or "D" buttons in the left-side corner of the last row of the appropriate range. You have to have at least 3 rows in each of the distribution ranges. The information in the first row should always pertain to minimum wage workers or minimum pension recipients.

Also note, that PROST does not allow to model part time work. Therefore, both numbers of people and wages have to be adjusted in the following manner. The number of

contributors should be calculated as total number of days worked by all contributors divided by the number of working days in a year. This will generally be a lower number than that reflected by weekly, monthly or quarterly statistics. When number of working days is not recorded, the user should try to get the data on a number of weeks or at least a number of months worked, and perform a similar calculation. Then, average annual wage could be calculated by dividing total yearly <u>declared</u> wage bill by the number of contributors derived as described above. Average wage for specific age and gender cohort or income bracket should be calculated the same way. Same logic should also be applied to number of pensioners and average pension.

Column C, **Wage or Pension Bracket**: Input the annual minimum wage *in thousands* in the first income group labeled "Earn Minimum Wage of". The wage should be the annual minimum wage for <u>full time</u> worker. Enter the maximum wage earned by the people in the second income group. Proceed the same way with the other income groups and make sure that the bracket value in each line is higher than the previous one. The last category in your data most probably will include people with wages above certain threshold with no upper bracket. In this case, put what you think is a reasonable upper limit for the last category. Keep in mind that PROST assumes that people in each category are distributed linearly between lower and upper bracket. That is why it is unadvisable to put something close to infinity for the upper bracket for the last category. Rather, choose something reasonably high not worrying too much that you have not captured several richest people in the country. Repeat the same procedure to fill in the cells for the pension distribution.

Columns D-E, **% of Males; % of Females**: Input the percentage of male or female active contributors that are earning minimum wage in the first income group. Enter the percentage of contributors earning the wages below the threshold specified in column C on the next line. Note that the distribution is cumulative, i.e. your percentage in the second income group should include minimum wage earners as well. Continue with the other lines. Make sure your entries are not decreasing with each subsequent line. Note, that the last row should specify 100%. You can put 100% in the line before last to effectively lower the number of categories. Note that you have to have at least one non-100% category, if you want to make use of earnings profile, specified in Labor sheet. If you know the average wage in the economy you can check whether your input sums up to the right average wage. The average wage derived from your input is displayed for you reference in the **User Comments** area, next to the table **Wage Brackets and Cumulative Distributions**. Fill in the required cells for the pension distribution the same way you did it for contributors, <u>make sure that deferred or commuted pension amounts are also reflected in the distribution, even if they are not being paid</u>.

**Demographic Trends**

Enter the following demographic data. It is possible to insert or delete as many years as necessary between the base year and end year columns by using the "I" and "D" buttons at the top of the end year column. Do not use EXCEL Insert Column functions for this purpose. When you insert a column, interpolated values automatically appear. These can

be overwritten. They appear only for the convenience of the user, particularly when the user does not want to specify exogenous values for all the variables in a particular data block.

Line **Sex Ratio at Birth**: The sex ratio at birth is used to convert births for any period into male and female births. Enter the sex ratio in terms of *male births per 100 female births*. A value of 102 implies 102 male births per 100 female births. The usual values for this variable range from 102 to 108 and values outside this range should be checked carefully for assumptions and consistency of the source. For users without access to this information it may be advisable to use the international average of 104.5 male births per 100 female births.

Line **Mortality Rate Multiplier for Disabled**: These multipliers are used to adjust the mortality for this specific group of the population up or down by a specific factor. Thus a multiplier of 110 for disabled individuals would imply that the disabled population has a 10 percent higher risk of death compared to the overall population in each age and gender category.

Line **Mortality Rate Multiplier for Old Age Pensioners:** This multiplier works exactly the same way like the one for disabled, described earlier. In the case where the covered population is different from the overall population, the covered population is usually higher income and more urbanized with better access to health care, and as a result will experience lower mortality rates. Using the population mortality rates will underestimate pension expenditures. These differences will mostly materialize after retirement, since non-accident related mortality before retirement is not very high for both covered and not covered and therefore is assumed to be the same. The number entered in this cell should be below 100 and based on the best available estimates of the mortality differential. As coverage expands and the covered group begins to resemble the overall population, the value for the End Year could be closer to 100 than that for the Base Year. If there is no reason to believe that specific groups have different mortality rates compared to the overall population, a value of 100 should be entered. Since PROST is extremely sensitive to mortality assumptions, it is highly recommended to use a multiplier of 100 for all groups unless convincing evidence exists proving otherwise. Also, it is important to remember that what is relevant for pension system (and PROST), is the number of reported, not actual deaths. The two could be substantially different in remote regions with poor reporting system.

**Macroeconomic Growth Trends**

The next few variables require information and assumptions about the macroeconomic trends of the economy. If required, data for additional years could be inserted between the base year and the end year by using the "I" and "D" buttons.

Line **Option 1: Real GDP Growth** or **Option 2: Real GDP per Capita Growth**: First, the user should choose which option of data entry he or she wants to use by selecting from drop-down list in the column A. Most external GDP projections would

be specified in "Option 1" format, although choosing to input your assumptions in "Option 2" format would allow for easier coordination with productivity growth assumptions. The growth rates should be entered as a percentage. Thus an entry of 10% would be interpreted by the program as a 10 percent rate of growth of real GDP under the option 1.

Line **Productivity Growth of Minimum Wage Worker**: The average percentage increase in the real wage of minimum wage worker for the base year, the end year, and any years in between. Initially, the variable required here was average real wage growth. However, the age of the average worker increases as the population ages. Since the average 45 year old earns more than an average 25 year old, we wanted to separate real wage growth due to normal productivity growth from real wage growth arising from the aging of the population which is already included in the model. For a young and rapidly expanding work force, values for this variable could be about 2% points lower than the values assumed for real GDP growth rates. For more mature pension systems with a stable work force population as in some of the OECD countries, the values may be only 1% point lower than real GDP growth rates. The user is well advised to experiment with a set of values and observe how PROST predicts the ratio of the wage bill of contributors in relation to GDP.

Line **Inflation Rate**: The rate of inflation for the base year, the end year, and any years in between. This information should be entered as a percentage. An entry of 15% therefore implies a 15 percent level of inflation.

> **Note:** Macro-economic variables influence future projections tremendously. The user is advised to ensure that the data entered for future macro economic projections are internally consistent and in harmony with each other and variables entered in other ranges. In particular, the relationship between GDP growth rates, real interest rates and the rate of productivity growth of minimum wage worker should be very carefully analyzed before selecting a final simulation case. Further, the user is advised to experiment with various scenarios for the time paths of these macro-economic variables.

Line **PAYG Pension Fund is Allowed to Borrow (at Government Bond Rate)**: Whenever the PAYG pension fund runs a deficit and has no reserves there are two financing possibilities. Pension fund can borrow money against future contributions, in which case you should check the box. An alternative is to shift the deficit to the government's budget, which will be modeled if you leave the box unchecked. Usually the laws of the country specify which of the two possibilities is implemented.

**Interest Rates (Real)**

Line **Interest Rate on PAYG Investments**: The real rate of return earned on pension fund investments during the base year, the end year and any years in between. If the pension fund invests in more than one kind of asset, the average rate of return across all asset classes would be the appropriate number to enter. This interest rate may be different than prevailing rates in the economy, because pension funds frequently do

not earn market interest rates.  They are often more heavily invested in risk-less assets which carry lower rates of return, are politically forced to invest in money-losing assets, or suffer from bad management.

**Note:** If the pension system does not invest and holds all its reserves in cash, then the real interest rate entered in this field should be equal to $-i/(1+i)$ where $i$ is the inflation rate. This would ensure a zero percent nominal rate of return.

Line **Government Bond Rate**: The real rate of return paid by the pension fund during the base year, the end year and any years in between in the case when the pension fund is forced to borrow to cover the deficits. Such borrowing is usually covered by government guarantee and therefore can enjoy the same interest rates as do government bonds.

Line **Discount Rate**:  The real discount rate during the base year, the end year, and any years in between. This information is used to calculate the present value of future cash flows to or from government or individual pension system participants. This assumption will tremendously influence the value of implicit pension debt.

## Human Resource Policy

Line **Option 1: Net rate of increase of workforce** or **Option 2: Nominal number of new positions**:  This line only appears when option **Nominal Number of Positions** is chosen under **Simulation Options** for modeling contributors.  First, the user should choose the option of how human resource policy will be characterized. The first option is often more appropriate when human resource policy is trying to target the total number of positions and the second is more appropriate when certain number of new hires is being targeted. The choice should be made by the user by selecting an option form drop-down box in column A.

Under the first option the percentage is expressed as an increase in the number of positions as a percent of the previous year employment level.  If a value of 0 is entered, the number of contributors will remain constant, with the number of new entrants exactly matching the number of contributors who died, retired, left, or become disabled last year.  If the number is positive, then the total number of contributors increases by the specified percentage.  If the number is negative, then the total number of contributors falls by the specified percentage.  However, it should be noted that retrenchment periods for civil servants rarely last more than a few years.  As the population grows, the need for teachers, health care workers, and others often included under civil servants also grows.  Since the automatic link with population has now been broken, users should check the output to make sure that the assumption specified here provides an adequate number of workers in these population-sensitive fields.

## Benefit Eligibility

Lines **Male/Female Retirement Age**:  The statutory retirement age in the base year as well as the retirement age for the end year for males/females. This is usually the age specified by law at which individuals may retire without penalty. If the law does not specify such an age, enter the earliest age of retirement. If there is a change in the statutory retirement age during the simulation period, a column could be inserted between the base year and the end year with the new retirement age entered for that year.  The toolkit linearly interpolates between two numerical points. Thus an entry of 60 for the base year would mean that males retire at age 60 during the base year. An entry for 65 for an intermediate year would mean that the retirement age would be 65 for that intermediate year, an increase of 5 years. Between base year and the year at which the retirement age changes, retirement age increases linearly to its new value spread evenly over the years. If no further increases in retirement age are envisaged by planners, the end year retirement age would also be 65. On the other hand, if there are no retirement age changes contemplated during the entire simulation period the end year retirement age should be identical to the base year retirement age of 60.

Lines **Percentage of Length of Service Not Claimed by Males/Females**:  Most PAYG systems have a minimum length of service requirement. People, who do not reach this limit are not eligible to get an annuity from the PAYG pension system and might be either compensated by lump sum payment, usually at big discount, or not get anything from the system at all. In case of the funded system such people would not be eligible for minimum pension guarantee and would only get their own savings back, again usually only as a lump sum. This parameter asks what percent of length of service accumulated by people retiring this particular year will be "lost" or "not claimed" towards PAYG annuity or minimum pension guarantee in the funded pillar. Given shorter average careers of women, this parameter should usually be higher for females.

Lines **Average duration of survivorship benefit**:  The user should input the number of years that survivorship benefit lasts on average. This is calculated for the whole survivor pool, lumping together both genders and all ages. This parameter will influence the speed at which changes in average old age pension levels are transmitted to average levels of survivor pensions. The longer the duration of survivorship benefit, the longer the lag with which changes in old age benefits are transmitted.

Line **Automatically Adjust Assumptions Related to Retirement Age Change**. Changing retirement age will also affect other variables like labor force participation, coverage rates, retirement rates etc. Since retirement age changes are a common pension reform, PROST presents the user with an option to model some of these changes automatically. To set the automatic option on check the box. The variables that will automatically be changed in this case are number of employed population, number of nominal contributors, number of disabled, number of pensioners and length of service at retirement. Retirement age change may also affect other variables, which are not being changed automatically (earnings profile, replacement rates, etc.). The user is responsible to manually code these changes. If the user checks this automatic option off, then he/she should manually change all the affected variables.

**Of People Willing, but not Allowed Normal Retirement After Reform**

This range only appears if the checkbox **Automatically Adjust Assumptions Related to Retirement Age Change** is checked in, i.e. if PROST is asked to make automatic adjustments to certain variables. The following parameters are asking what will people denied normal retirement do under the new circumstances. For example, if in the base year retirement age was 60 and in particular future year it is set at 62, there will be a group of people who would have been retired under the old rules, but now are refused an option of normal retirement. Let us call them "people denied normal retirement"

Line **The Following Percent Will Become Employed**, PROST will automatically adjust number of employed based on this parameter. The parameter specifies what percent of people denied normal retirement will be employed under the changed circumstances.

Line **The Following Percent Will Become Nominal Contributors**, PROST will automatically adjust number of nominal contributors based on this parameter. The parameter specifies what percent of people denied normal retirement will be nominal contributors under the changed circumstances.

Line **The Following Percent Will Claim Early Retirement**, PROST will automatically adjust number of old age pensioners based on this parameter. In some cases people denied normal retirement may have an option of early retirement (usually with reduced pension). The parameter on this line specifies what percent of people denied normal retirement option will still choose to retire under the early retirement rules.

Line **The Following Percent Will Claim Disability**, PROST will automatically adjust number of disabled based on this parameter. The parameter specifies what percent of people denied normal retirement will claim disability under the changed circumstances. Note, that PROST assumes, that after these additional disabled people reach the new retirement age they convert to the normal retirement program, i.e. their claim for disability benefits is temporary.

**Replacement Rate**

Lines **For New Survivors as Percent of Average Old Age Pension**:  The average pension received by new recipients of survivor pension as a ratio of the average pension of old age pensioners for the base year, the end year and any years in between. This data is entered as a percent. Thus a value of 20% would imply that on average upon application, survivors get about 20% of the value of the average old age pensioner pension.

Lines **For Orphans as Percent of Average Wage**:  The average pension received by orphans as a ratio of the average wage of contributors for the base year, the end year and any years in between. This data is entered as a percent. Thus a value of 20% would imply that on average, orphans get about 20% of the value of the average wage of contributors.

**Parameters specified below can be changed after the reform**: The following variables will appear on the Reform Sheet as well as here. Therefore, the following entries on this sheet <u>will not</u> affect output of Module 4.

**Contributions**

The variables in this block allow the user to specify contribution rates applied to employees, employers, pensioners and government depending on the income bracket of the contributor. The differentiation by income brackets may be useful in modeling a few different progressive social security policies: high income employees might be asked to contribute higher share of their wage, low income contributors might be subsidized by the government, high income pensioners may be taxed. Finally and most commonly, contribution ceiling might be introduced, above which wages are not taxed by social security contribution. PROST requires the user to specify 4 income categories that can potentially be treated differently with respect to contribution rates. The 4 income brackets should be non-decreasing, with the last bracket in column B specifying overall contribution ceiling.

Columns **Contribution from employees**: The proportion of gross covered wages mandated to be paid to the pension system for the base year, end year or any intermediate years. The data are entered in percentages. Any planned changes in the contribution rate could be accommodated by inserting columns between the base year and the end year using the "I" and "D" buttons. Typical values range from about 5 percent to about 45 percent though lower values have also been empirically observed. Higher contribution rates encourage evasion and other labor market distortions while too low contribution rates would choke the revenues of the pension system. Ideally, the data entered for this field should include contributions *only* to the pension system. If the pension system collects overall payroll taxes, without separating components, use total contribution rate, but include non-pension expense as **Other Pension Fund Expense as % of Pension Expense** under **Costs and other Expenditures** in "General" sheet.

Columns **Contribution from employers**: The proportion of gross covered wages mandated to be paid to the pension system for the base year, end year or any intermediate years. The data are entered in percentages. Any planned changes in the contribution rate could be accommodated by inserting columns between the base year and the end year using the "I" and "D" buttons. Typical values range from about 5 percent to about 45 percent though lower values have also been empirically observed. Higher contribution rates encourage evasion and other labor market distortions while too low contribution rates would choke the revenues of the pension system. Ideally, the data entered for this field should include contributions *only* to the pension system. If the pension system collects overall payroll taxes, without separating components, use total contribution rate, but include non-pension expense as **Other Pension Fund Expense as % of Pension Expense** under **Costs and other Expenditures** in "General" sheet.

Columns **Contribution from Pensioners**:  Enter the contribution rate (as a percentage of gross pensions) of pensioners if they are required to contribute social security taxes which accrue to the pension fund. Thus an entry of 5 percent would imply that pensioners, on average, are required to transfer about 5% of their pensions as payroll tax contributions for social security.

Columns **Contribution from the Government for Employees**:  If the government contributes a certain portion of the payroll tax for pensions on behalf of the employee in a tripartite contribution system, that data should be entered in this field. Data are required for the base year, the end year and any other years in between if necessary. If no such contributions are made on behalf of contributors by the Government, the user can leave the field blank.

## Indexation of Contribution Steps

Enter data regarding indexation rules of minimum wage, wage brackets and contribution ceiling. Many pension systems index these parameters either to nominal wages or inflation (or some combination of both). If the level of inflation is I, and rate of nominal wage growth is G, then the indexation mechanism is described by $[(1+aI)*(1+bG)]$ where a and b are the user input inflation indexation parameters. Data are needed for the base year as well as for the end year (and intervening years if available).

Lines **Minimum Wage Indexation to Inflation / Nominal Wage Growth**:  The data are required for both the base year as well as the end year. A value of 100% implies that minimum wage is fully indexed to a given parameter (inflation or nominal average wage growth). This indexation is applied to the minimum wage initially specified on line 30 of "General" input sheet. Depending on country circumstances values normally range from 0% (no indexation) to 100% (full indexation). Occasionally, when minimum wage is increased substantially by decree, the appropriate parameter for this field might be above 100%. In this case the user should manually unprotect the sheet and change the range of values that are allowed for this cell.

Lines **Step x to Inflation / Nominal Wage Growth**:  The data in these fields should be entered the same way as data for minimum wage indexation. This indexation is applied to the contribution ceiling initially specified in the table **Contributions** of "General" input sheet.

Line **Contribution Ceiling Applies to Employers**:  Options **"Yes"** and **"No"** are available. In the case when **"Yes"** is chosen the wage base for employer's contribution is the same as that for employee's contribution. Under the second option employer's contribution is calculated on the whole employee's salary, even if the ceiling applies for the employee's portion. The "insured wage", used when pension is calculated is still limited by the ceiling.

## Revenue sources

Lines **Collection Rate from Employers and Employees/ Pensioners/ Government**: This variable attempts to capture the efficiency of the pension administration in collecting pension revenues due from its contributors. It is defined as a ratio of total collected and due payroll contributions. The amount of contributions due is computed including both employer and employee shares. However, it excludes contributors who may be officially fully or partially exempt and also excludes the persons who hide from the system completely, by not paying contributions and not collecting future benefits either. Revenue loss from under-declared wages also should not be addressed through this parameter. The data are entered as a percentage for the base year, the end year and intermediate years if necessary. Typical values could range from 25% (meaning that the pension system is only able to collect about 25 percent of the cash revenue due to it) to 100% (meaning that the pension system is efficient enough to collect 100 percent of all the revenues due to it).

Line **Unconditional Budget Transfers to Pension Fund as % of GDP**: This field records unconditional budget transfers to the pension fund (other than the wage-bill based tripartite Government contributions) made by the Government as a percent of GDP. For example, some countries earmark x percentage of the VAT tax to the pension fund. Other countries earmark privatization revenues for supporting the pension system. Neither of these sources of revenue are directly tied to the covered wage bill, contributions from which are the primary source of revenue. Please note that this line does not include transfers from the non-pension Government budget to cover pension system deficits, hence the term **Unconditional,** but only items that are earmarked regardless of the status of the pension system. Data are required for the base year, the end year and any other years in between.

Line **Other Income as % of Employee, Employer & Pensioner Contributions**: Enter any other income received by the pension fund as a percent of total contributions. Thus an entry of 10% would imply that other income sources of the pension fund were able to add to contribution revenues by 10%. This income will be tied to the wage bill since contributions are tied to the wage bill. This line is useful if the pension fund engages in non-pension activities and the user would like to look at the overall budget of the pension fund. However, the non-pension expenditures are specified in a highly aggregated fashion, leading to only crude estimates of the impact on the overall budget of the pension fund.

**Costs and Other Expenditures**

Line **Admin. Costs as % of Employee, Employer & Pensioner Contributions**: The transaction or administrative costs of running the pension system include costs of setting up the pension registry, costs of book keeping, and administering the pension system. The data are needed for both the base year as well as the end year and are entered as a percent of total contributions from employers, employees, and pensioners. Typical values range from about 1% meaning that almost 1% of contributions are being used to administer the pension system to as much as 50% in poorly run systems. In PAYG systems, administrative costs are often expressed as a percentage of total expenses. However, to insure comparability with defined

contribution reforms, administrative costs need to be entered as a percentage of total contributions. Please keep in mind that if contribution revenues are modeled to rise for some reason (rising contribution rates, increased contribution ceiling, coverage expansion) this link will translate into rising administrative costs. The user should be careful to adjust this parameter if such linkage is not intended.

Line **Assets Management Costs as a % of Assets**: The costs required to manage the assets of the pension system. The data are required for both the base year as well as the end year and entered as a percent. These costs are usually a function of the volume of financial assets being managed by the pension system. Typical values range from 1 percent (meaning 1 percent of the previous years fund balances were used for asset management) to about 6 percent (meaning 6 percent of the pension funds assets are used for asset management expenses). If fund management costs are not separable from other administrative costs, they can be lumped together in line 111. It is assumed that these costs are 0 if the reserve is 0 or negative.

Line **Other Pension Fund Expense as % of Pension Expense**: The percent of total expenditures attributed to non pensions related expenditure or "other" expenditures. This data must be entered as a percent for the base year, the end year and any other years in between. If the pension fund is engaging in health care or unemployment, for example, these expenses could be entered here. The crude assumption here is that these expenditures will vary directly with the pension expenditures of the pension fund. These may or may not be correlated in reality, which is why we generally recommend only looking at pension expenditures and revenues with PROST, although information about general orders of magnitude can be useful. Alternatively, detailed projections for the other expenses using other models could be inserted in this space, providing accurate estimates on the overall budget picture.

## Commutation

This range of parameters allows modeling commuted and deferred pension payments. In the case of pension commutation a portion of the benefit is commuted, or taken lump sum at the time of retirement by applying commutation factor, defined in the input sheet "Factors". The remaining reduced benefit is paid until certain age at which time the commuted portion of the benefit is restored. Deferred pension is a special case of commuted pension, where commutation factor is equal to "0" and 100% of pension is commuted until the regular retirement age, at which point the payment of full pension commences.

Lines **Average Portion of Benefit that is Commuted**: The user should input a percentage of the benefit that will be converted into the lump sum payment at the time of retirement. For example, if commuted portion is 30%, then 30% of the pension will be multiplied by commutation factor and the total amount will be paid to the beneficiary. At the same time a regular monthly pension will be reduced to 70% of the original amount which can again be restored to 100% only after the beneficiary reaches pension restoration age.

Line **Term of Commuted Annuity**: As mentioned above, when calculating commutation lump sums PROST uses commutation factors entered in the input sheet "Factors". In addition, PROST computes and outputs actuarially fair commutation factors for all ages and time periods using corresponding mortality rates, commutation indexation rules, and the term by which commuted part of annuity payment is deferred. The term of commuted annuity is specified in years.

Lines **Average Age at which Commuted Payments are restored for Males/Females**: PROST only allows to model deferral to the specific age as opposed to deferring pension payments for a specific number of years after retirement. The user should input age at which payment of pension calculated at retirement commences. It is assumed that calculated pension is indexed the same way as pensions already in payment are. Commuted portion of the pension can be indexed differently.

**Pension Indexation**

Enter data regarding indexation rules. Many pension systems index minimum pension and regular pensions to either nominal wages or inflation (or some combination of both). If the level of inflation is I, and rate of nominal wage growth is G, then the indexation mechanism is described by $[(1+aI)*(1+bG)]$ where a and b are the user input inflation indexation parameters. Data are needed for the base year as well as for the end year (and intervening years if available).

Lines **Full Pension Indexation to Inflation/Nominal Wage Growth**: The data entered for this variable reflects the indexation of old age and disability pension payments to inflation/nominal wage growth. The data are required for both the base year as well as the end year. A value of 100% implies that pension payments are fully indexed to inflation/wage growth. Depending on country circumstances values could range from 0 (no indexation) to 100% (full indexation).

> **Note:** Pension indexation to inflation is cheaper than nominal wage indexation when real wage is growing, since nominal wage indexation by definition, indexes to real wages as well as inflation)

Lines **Indexation of Commuted Pension Portion to Inflation/Nominal Wage Growth**: Commuted pension portion might be indexed differently than overall pension. For example, commuted pension portion might not be indexed at all, while overall pension might be indexed to inflation. Then if the initial pension is equal to $100, 30% of it is commuted and inflation is equal to 5%, then annuity pension payment the next year will be $100*1.05-$30 = $75.

Lines **Minimum Pension Indexation to Inflation / Nominal Wage Growth**: The data in these fields should be entered the same way as data for pension indexation. This indexation is applied to the minimum pension initially specified under **Pension Brackets and Cumulative Distributions** of "General" input sheet. After the old age pension is calculated, whether at the time of awarding the pension or at the time of

indexation, it is checked if the resulting payment does not fall below minimum pension. If it does, the payment of minimum pension is made to the pensioner instead.

Lines **Maximum Pension Indexation to Inflation / Nominal Wage Growth**:  The data in these fields should be entered the same way as data for pension indexation. This indexation is applied to the maximum pension initially specified under **Pension Brackets and Cumulative Distributions** of "General" input sheet. After the old age is calculated, whether at the time of awarding the pension or at the time of indexation, it is checked if the resulting payment does not fall above the maximum pension. If it does, the payment of maximum pension is made to the pensioner instead.

Line **Use Benefit Formula for the Earnings Related Part of the Pension for Old Age Pensioners**:  By checking this box, the user will be presented with benefit formula range requiring the input of benefit formula parameters for the earnings related part of the pension. These inputs are described under the benefit formula parameters below. If the pension does not depend on individual's earnings, leave the box unchecked. The user will be given an opportunity to specify earnings unrelated component and lump sum component of the pension in the "Pension" input sheet. If the earnings related benefit formula is very complicated it is sometimes easier to approximate it by earnings unrelated component in the "Pension" sheet rather than do it here. The final total benefits will be calculated as a sum of 3 components: earning related annuity, earnings unrelated annuity and lump sum component.

**Benefit Formula Parameters for Old Age Pensions**

This range only appears if the checkbox **Use Benefit Formula for the Earnings Related Part of the Pension for Old Age Pensioners** is checked in.

Line **Required Years of Service for Basic Replacement Rate**:  Minimum years of contribution required to qualify for old age pensions, male/female.  However, the program does not disqualify individuals who do not satisfy this minimum requirement.  Such an individual is awarded the minimum pension.

Lines **Basic Replacement Rate**:  Percent of individual's wage base awarded as pensions after fulfilling minimum contribution period, male/female.

Lines **Incremental Replacement Rate**:  Percent of individual's wage base added to the basic replacement rate for every year of contribution in excess of the basic minimum, male/female.

Lines **Maximum Replacement Rate**: The highest allowed percent of individual's average wage base to be awarded as pension, male/female.

Lines **Years in Final Average Wage**:  Number of years of an individual's work history included in the wage base used to calculate the pension, male/female.  Many countries actually specify a wage base such as the best 3 of the last 10 years, or the best consecutive 3 of the last 10 years.  These distinctions are specific to the

individual and cannot be easily projected by the model.  Instead the model assumes that in these cases the last 3 years were the best 3 or the best consecutive 3.

Lines **Wages are Valorized to Inflation/ Nominal Wage Growth**:  The valorization of the wages included in the wage base to inflation/ wage growth, male/female. Entering 100 implies complete valorization.  Note that this differs from the indexation of the pension.

<u>WORKSHEET II: POPULATION</u>

The *population* worksheet contains data vital for making population projections. Like the previously described worksheet, data are required for the base year as well as for future years. Data for years falling between the base year and the end year, if available, are entered by inserting a column between the base year and the end year by using the "I" and "D" buttons where appropriate.

The spreadsheet is organized a little differently with the variables in columns and ages represented in rows. The template contains ages from 0 to 100. If data is available in single age cohorts for ages beyond 100, the "**I**" button can be used to extend the age ranges further. If fewer years are available, the "**D**" button can be used to decrease the age ranges. One caveat is that all age-specific variables must be entered in the same age ranges. If all the age-specific variables but one are available until age 85, but that one is only available until age 75, the choice would have to be made of either truncating all the variables at 75 or approximating the behavior of this variable between 75 and 85.

Columns **Population Males/Females**: The base year male population in *thousands*. Data are required in single age cohorts. Note that age 0 refers to births and age 100 is the maximum age for pension simulations. The model will project the population in future years, so only the base year values are required.

Columns **Fertility Rate**: Age specific fertility rates for the base year as well as any projections or theories about the way fertility rates are most likely to behave over the simulation horizon. This is an important consideration since fertility rate changes have long lasting effects on the flow of population which in turn directly affects the pension system. The data are to be entered as a *percent*. Thus a fertility rate of 10% would imply that 1 in 10 women of a particular age group would bear a child in that year. According to the World Bank estimates most countries would have a total fertility rate of about 2 children per woman by the year 2030 which would translate to a sum of fertility percentages by age of 200%.

Columns **Probability of dying males/females**: Age specific probability of dying for males/females in the base year as well as any projections or theories regarding the most likely behavior of probability of dying in the future. Data are entered in *percent* terms. Thus a probability of dying of 1% for a particular age group would imply that 1 out of 100 individuals in that age group will die in that year. In most cases, due to economic growth and improving health conditions, probability of dying is projected to decline in the future. A rough rule of thumb is that life expectancy will increase by 1 year every 10 years in countries with lower life expectancy today and by 1 year every 15 years in countries with the highest life expectancy today. Running the **Life Expectancy** tool in Module 1 will produce projections on life expectancy. The user may need to initially provide some estimates and then review the output to determine whether the decrease in mortality rates have been sufficient to generate the normal life expectancy increases. Mortality rate changes are also not uniform across age groups. Children and the elderly generally face the greatest improvements. We hope to provide more guidance to users in this area in the future. However, it should be

noted that in some countries, particularly those afflicted with widespread AIDS or other serious health hazards, mortality may temporarily go up. Thus the user should build in alternative assumptions regarding mortality trends over time. It is also important to note that PROST assumes the last age cohort dying with certainty in the next year, i.e. regardless of the input for the last cohort mortality, PROST will overwrite the number with 100%.

Columns **Net immigration males/females**:   Age specific net immigration (net inflows of population) in each age group. Data are entered in *thousands*. Data are required for the base year as well as for future years. If immigration represents a very marginal and insignificant flow of population, then entering 0 for all the age groups in effect disables the effect of net immigration on population flows and hence in the other pension system calculations.   Note that these are net values, with negative values representing outflow of people to other countries.

This input worksheet contains data pertinent to the labor market conditions of the economy or region under analysis. Both base year as well as end year data are required for the variables in this worksheet. The end year typically would be a projection of the base year value depending on the user's hypothesis about the way the base year parameters are expected to behave. Note that labor market data are often difficult to obtain and interpret and the user should ascertain that the data sources being used for this worksheet are consistent and accurate. If under **Simulation Options** of "General" sheet, the option **Stock of Population** is chosen for modeling contributors and **Stock of Population** is chosen for modeling retirees, then the data entered for labor force participation and unemployment will not influence the projections of the pension fund finances. Also, only columns **Earning Profile in Terms of Min Wage** and **Pension Profile in Terms of Min Pension** appear when the option **Nominal Number of Positions** is chosen for modeling contributors under **Simulation Options** of the "General" sheet.

Columns **Labor force participation males/females**: The proportion of males/females who are either working or looking for work in each age group. The data are entered as a *percent*. Thus an entry of 12 would mean that approximately 12 percent of individuals in that particular age group are in the labor force. This data should not reflect expected changes in labor force participation due to the planned retirement age increase, if the box **Automatically Adjust Assumptions Related to Retirement Age Change** (sheet "General") is checked, i.e. if PROST is asked to automatically adjust numbers of employed population. However, all other anticipated changes should be incorporated.

Columns **Unemployment rate males/females**: The proportion of males/females *in the labor force* who are unemployed in each age group. The data are entered as a *percent*. Data are required for the base year as well as for the end year as well as any year in between if desired. This data should not reflect expected changes in unemployment rate due to the planed retirement age increase, if the box **Automatically Adjust Assumptions Related to Retirement Age Change** (sheet "General") is checked, i.e. if PROST is asked to automatically adjust numbers of employed population. However, all other anticipated changes should be incorporated.

Columns **Earning Profile for males/females in Terms of Min. Wage**: The data in this column reflect the average gross wages of individuals relative to the minimum wage. Thus an entry of 110% for any age group would mean that this age group on the average earned about 10 percent higher wages compared to minimum wage. The minimum value for these cells is 100%. Data are required for the base year as well as the end year and any years in between if desired. In case the earnings profile data conflicts with the wage distribution data entered in "General" sheet, under **Wage Brackets and Cumulative Distributions**, the earnings profile will be automatically depressed or enhanced to match the data on the "General" input sheet. The earnings above minimum wage for all cohorts will be adjusted by the same percentage. In terms of total earnings low wage earners will be adjusted less.

Columns, **Pension Profile for Old Age Pensioners/Disabled in Terms of Min. Pension:** While this is a pension system parameter, it is symmetric with the wage profile and therefore it is entered here. It represents the initial distribution of pensions across pensioners of different ages, both for old age pensioners and the disabled. This variable is important because unless the pensions are fully indexed to nominal wage growth, the older pensioners will have lower pensions than younger pensioners. Reductions in pension expenditures for pensioners who died over the year need to take into account that those most likely to die have lower pensions. It may also be the case that the pensioners retiring at older ages on average retire with lower/higher pensions than those who retire being younger, which may be the other reason why there is a correlation between pensioner's age and his/her pension even in the presence of nominal wage indexation of pensions. The profile for future years will be internally generated by the model.

The *Pension* worksheet contains age specific data describing the pension system including numbers of contributors and beneficiaries, their contribution and retirement patterns and replacement rates.

**Pension system** in base year

Columns **Contributors males/females**: For each age cohort, enter the total number of male/female contributors gross of exemptions. This implies that all those who will receive contribution credit for the base year should be included regardless of whether or not they actually contributed. The discrepancy can be legal, such as mothers of young children who receive contribution credit while caring for the children, or illegal, through evasion and fraud. The data are required only for the base year and are entered in thousands. Thus an entry of 10 would mean that there are 10,000 nominal contributors in the age cohort being considered. For more discussion of how a number of contributors/pensioners is defined please refer to discussion of **Wage and Pension Brackets and Cumulative Distributions** for the "General" sheet, especially the discussion on accounting for part time work.

Columns **Old Age Pensioners males/females**: For each age cohort, enter the total number of old age pensioners (separate for males/females). The data are required only for the base year and are entered in thousands. Thus an entry of 5 for the age cohort 60, males, would indicate that there are 5,000 male retirees in the population of males aged 60. Also, for more discussion of how a number of contributors/pensioners is defined please refer to discussion of **Wage and Pension Brackets and Cumulative Distributions** for the "General" sheet, especially the discussion on accounting for part time work.

Columns **Disabled males/females**: For each age cohort and gender, enter the total number of disabled individuals for the base year in *thousands*. Also, for more discussion of how a number of contributors/pensioners is defined please refer to discussion of **Wage and Pension Brackets and Cumulative Distributions** for the "General" sheet, especially the discussion on accounting for part time work.

Columns **Survivors males/females:** For each age cohort and gender, enter the total number of individuals receiving survivor/widow benefits in the base year in *thousands*. If gender specific information is not available, or most of the benefits are accruing to women (as is often the case), it is acceptable to enter the data for women only. Enter zeros for males. Some countries record the gender of the person who earned the benefit, not the gender of the person receiving the benefit. If your data show more male survivors than female survivors, it is worth double-checking the data. This input is only required if an option **"Stock of Age Specific Population"** is chosen for modeling survivors and orphans under **Simulation Options** of "General" sheet.

Columns **Orphans, males/females**:  For each age cohort and gender, enter the total number of individuals receiving orphanage benefits from the pension fund in the base year. Data are entered in *thousands*. If no gender specific information is available on orphans, data could be entered for any one of the two genders. Fill up the other gender information with zeros. This input is only required if an option **"Stock of Age Specific Population"** is chosen for modeling survivors and orphans under **Simulation Options** of "General" sheet.

**Projection parameters**

Columns **Length of Service at Retirement:**  Average length of service for the new retiree for each age and gender cohort.  Individuals who retire at older ages frequently have the same or fewer years of service than those who retire younger due to factors such as extended periods out of the labor force and later entry to the labor force. Many countries also reduce the service requirement as workers get older. This data should not reflect expected changes in length of service due to the planed retirement age increase, if the box **Automatically Adjust Assumptions Related to Retirement Age Change** (sheet "General") is checked, i.e. if PROST is asked to automatically adjust Length of Service data. However, all other anticipated changes should be incorporated.

The heading for the columns following **Length of Service at Retirement** columns and the required data inputs depend on the option chosen under **Simulation Options** of "General" sheet. This data should not reflect expected changes in numbers of contributors due to the planed retirement age increase, if the box **Automatically Adjust Assumptions Related to Retirement Age Change** (sheet "General") is checked, i.e. if PROST is asked to automatically adjust numbers of contributors. However, all other anticipated changes should be incorporated.

**Contributors as % of Population, males/females**:  Appears only if the option **Stock of Population** is chosen for modeling contributors under **Simulation Options** of "General" sheet;  refers to the proportion of the population that are accruing pension rights that year.  The data entered are in numeric percentages. Thus an entry of 60 for any age cohort and gender would imply that 60 percent of that age cohort and gender are accruing pension rights in that year.  The data for the base year are calculated from base year information on population and base year information on the number of nominal contributors, by dividing the number of nominal contributors in any age and gender by the population for that age and gender. The formulas have already been entered.  For future years, the coverage rates could either change according to user assumptions or remain the same.

**Contributors as % of All Employed, males/females:**  Appears only if the option **Stock of Employment** is chosen for modeling contributors under **Simulation Options** of "General" sheet.  Refers to the proportion of the employed that are accruing pension rights that year. The data entered are in numeric percentages.

Thus an entry of 60 for any age cohort and gender would imply that 60 percent of the employed in that age cohort and gender are accruing pension rights in that year. The employed totals for each age and gender cohort should be derived by applying the **Labor Force Participation Rate** from the *Labor Sheet* to the **Population** in the *Population Sheet* and then subtracting out the unemployed, which are derived by applying the **Unemployment Rate** in the *Labor Sheet* to the labor force participants. If there are inaccuracies in either the labor force participation rate or the unemployment rate, these will be reflected and magnified in the contributor calculation which is why we prefer not using this methodology. For future years, the coverage rates could either change according to user assumptions or remain the same.

**Distribution of New Contributors, male/female:** Appears only if the option **Nominal number of positions** is chosen for modeling contributors under **Simulation Options** of "General" sheet. Refers to the age and gender distribution of net new entrants to the system. This option generally applies to civil servant schemes. The number of new entrants is determined by the data from Human Resource Policy table in "General" sheet. The age and gender distribution of these new entrants needs to be entered here. Thus, 10% under a particular age and gender group means that 10% of the new entrants came from that age and gender group. These can be derived by using the distribution of new entrants from the latest year for which data are available, or if that year is considered abnormal, from an average of the distribution for the past several years. The distribution may also change in the future.

**New Contributors as % of all Employed, males/females:** Appears only if the option **Flow of employment** is chosen for modeling contributors under **Simulation Options** of "General" sheet. Refers to the proportion of total employed that are new contributors to the system. The data are entered in numeric percentages. Employment is calculated as explained in the paragraph on **Contributors as % of All Employed** above. These data can be derived using the numbers of new contributors in the latest year. However, since one year of data may include anomalies, which will then be magnified over the projection period, if employment based projections are required, the **Stock** approach will tend to produce more reliable results.

**New Contributors as % of Population, males/females:** Appears only if the option **Flow of population** is chosen for modeling contributors under **Simulation Options** of "General" sheet. Refers to the proportion of total population in each age and gender group that are new contributors to the system. The data are entered in numeric percentages. These data can be derived using the numbers of new contributors in the latest year. However, since one year of data may include anomalies, which will then be magnified over the projection period, if population based projections are being used, the **Stock** approach will tend to produce more reliable results.

The headings of the following columns also change depending on the option chosen under **Simulation Options** of "General" sheet.

**Old Age Pensioners as % of Population, males/females**: Appears when **Stock of Population** is chosen for modeling pensioners and disabled under **Simulation Options** of "General" sheet, and refers to the proportion of the population that have retired and are receiving old age pensions. The data are entered in terms of numeric percentages and are required for both the base year as well as for the end year (and any years in between if desired). The data for the base year are calculated from base year information on population and the number of old age beneficiaries by dividing the number of old age pensioners in any age cohort and gender by the population of that age cohort and gender. In terms of calculations, the program calculates total retirees in each future year using the percentages specified here, and then derives the new retirees, taking into account the surviving retirees from the previous year, and finally does a consistency check with the coverage numbers. If more contribution years of service have been earned by a cohort than is retiring from that cohort, the new retirement is increased, keeping the age pattern specified here constant.

**Note:** The retirement rate parameter is closely linked to the retirement age, in the sense that if there is a change in retirement age, the retirement rate parameter would also have to be adjusted to reflect that change. There is a button in spreadsheet "General" which does this automatically.

**New Old Age Pensioners as % of last year's contributors, males/females:** Appears when **Flow of Contributors previous year** is chosen for modeling pensioners and disabled under **Simulation Options** of "General" sheet. Instead of looking at the stock of old age pensioners calculated above, these columns now focus on new old age retirees and tie the new old age pensioners to the contributors to the system the previous year. Thus, a value of 20 for 60 year old males implies that 20% of surviving 60 year old males that were contributing the previous year when they were 59 years old are now retiring. This number can not exceed 100% for any age category which does not allow modeling a situation where individuals who were not contributing the year before are retiring. The required input can be derived using the new old age pensioners from the latest year. But again, new old age pensioners in a single year are much more sensitive to peculiar market conditions, expectations of future reforms, etc. Care needs to be taken in projecting future behavior on the basis of the current numbers.

**Disability as % of population males/females**: Appears when **Stock of Population** is chosen for modeling pensioners and disabled under **Simulation Options** of "General" sheet. This variable refers to the proportion (based on population) of disabled individuals in any age and gender cohort. Data are entered in numeric percentage terms. Thus an entry of 10% would imply that 10 in a hundred individuals from that particular age/gender cohort are disabled. The data for the base year are calculated on the basis of information from population and the base year age/gender specific stock of disabled individuals by dividing the

stock of disabled individuals in any age and gender cohort by the population for that age gender cohort. For future years (including the end year) the rates could be made to grow according to some hypothesis or assumed to remain constant.

**New Disabled as % of Last year's Contributors, males/females**:  Appears when **Flow of Contributors previous year** is chosen for modeling pensioners and disabled under **Simulation Options** of "General" sheet.  The proportion of the newly disabled as a percentage of the surviving contributors from the last year in each age and gender category is entered here.  Thus, a value of 2% for 50 year old males implies that 2% of 50 year old males who contributed last year at the age of 49 become disabled this year.  This number can be derived using the newly disabled pensioners from the latest year.  But again, new disability numbers in any given year may reflect anomalies peculiar to that year.  Care needs to be taken in projecting future behavior on the basis of the current numbers.

Columns **Survivors as % of population, males/females**:  Appears only when **Stock of Age Specific Population** is chosen for modeling survivors and orphans under **Simulation Options** of "General" sheet.  The proportion of the population in any age and gender cohort receiving survivor pensions. Data are entered in numeric percentage terms. Thus an entry of 5 would imply that 5 in a hundred individuals from any particular age gender cohort are receiving survivor pensions. The data for the base year are calculated by dividing the stock of survivor pensioners for any age gender cohort by the population of that age gender cohort.

Columns **Orphans as % of population, males/females**:  Appears only when **Stock of Age Specific Population** is chosen for modeling survivors and orphans under **Simulation Options** of "General" sheet.  The proportion of the population in any age and gender cohort receiving orphan pensions. Data need to be entered in numeric percentages. Thus an entry of 1 would mean that 1 in a hundred individuals in that particular age and gender cohort are receiving orphan pensions. The data for the base year are calculated by dividing the stock of orphan pensioners for any age and gender cohort by the population for that age and gender cohort.

Columns **Exemption males/females**:  Some individuals may be legally exempt from payroll taxes (like judges, priests etc…), but are eligible to collect pensions. This variable captures the probability that an individual from a certain age group would fall in one of these categories. There are others who evade completely and never contribute and never collect benefits.  They are not included among the contributors. They may perhaps be included in labor force statistics and employment statistics, but do not enter into the pension system as either contributors or beneficiaries.  The data are entered in *percent* terms. Note that like the retirement rate, this parameter is linked to retirement age as well as to coverage. Thus if the retirement age changes, the exemption rate may also change that year since some individuals who were previously exempt would not be exempt anymore.

Columns **Replacement Rate for New Old Age Pensioners, Males/Females**:  The replacement rate applicable for newly retired pensioners in the base year and future

years. This is an earnings unrelated part of pension and is payable in addition to the earnings related part, specified under **Benefit Formula Parameters** in "General" sheet, and the lump sum component, described later. This variable is driven largely by the rules of the pension system regarding eligibility and therefore depends on age at retirement, years of service, and the specific accrual rates of the pension system. However, it is calculated by dividing the average actual pension received by a new pensioner of a specified age and gender by the economy wide average wage and entered as a percent. These data are used to calculate pension payments to new pensioners by multiplying the data entered here by the overall economy wide average wage.  If the pension system does not have an earnings unrelated component, the user can leave these cells blank. However, in some cases when the earnings related component is very complicated it can be approximated by average replacement rates in terms of average economy wide wage and entered here instead of benefit formula in the "General" sheet. Inaccuracies in the data and complex benefit formulas with special rules for special groups will sometimes yield different results, when modeled different way.

Columns **Lump Sum Payments for New Old Age Pensioners, Males/Females**: Average lump sum payment divided by average economy wide wage and expressed as apercentage, payable only once at the time of retirement. This is a third component of the pension package in addition to earnings related component, under **Benefit Formula Parameters** in "General" sheet and earnings unrelated component, described immediately above.

Columns **Replacement Rate for New Disabled, Males/Females**:  The replacement rate applicable to newly disabled individuals for the base year and future years. This variable is also driven by the rules of the pension system regarding eligibility for disability pensions.  The rates are calculated as the average pension received by a newly disabled person of each age and gender group divided by the average covered wage in the economy.  The data are entered as a *percent*.

Columns **Lump Sum Payments for Disabled, Males/Females**: Average lump sum payment divided by average economy wide wage and expressed as a percentage, payable only once at the time of disability. This is a second component of the disability pension package in addition to the component, described immediately above.

## <u>WORKSHEET V: PROFILES</u>

The *profile worksheet* contains data about specific individuals. These profiles will later be used by PROST to investigate the equity and distributional aspects of the system. The program will evaluate how well each of the specified individuals is treated by the pension system. A better understanding of the distributional impact of the pension system between genders or across generations can be analyzed by looking at how different 'types' of individuals fare under the same pension regime.  It is not necessary to fill out this worksheet to run the rest of the model.  This worksheet is required only by Module 5, **Individual Retirement Accounts,** and while the Module draws on parameters from other

worksheets, there are no automatic linkages from this sheet or the output of Module 5 back to the other parameters.

The user can fill out information for six different types of individuals at one time and the model will calculate output for these six individual types all of whom begin work during the base year and for these same six types who begin work the following year and for all subsequent years in the projection horizon. If analysis on more individual types is required, the model can be run again with a different set of 6 individuals specified. The line numbers below refer only to Profile 1. For some variables, there is a drop down box, from which the appropriate choice may be made.

Column I, **Individuals With Profiles 1&2, 3&4, 5&6 Buy Joint Annuities**. **Individual Retirement Accounts** module can be run to evaluate the system both from single and from married individual's point of view. If the user clicks this option **On**, 3 families are created by joining profiles 1 and 2, 3 and 4, 5 and 6. After one of the family member dies the longer lived of the 2 individuals will receive his own and a survivor pension from the PAYG system. Under the funded system the longer lived individual would receive both pensions until he/she dies. If this option is not enabled, individuals would only be receiving their own annuity, calculated based on individual mortality table.

Line **Gender**: Gender of the individual.

Line **Starts Working at Age**: The age at which an individual begins his career. Most low income and rural workers enter some form of employment earlier than high income group workers who enter late after having spent more time in the education system.

Line **Plans to Retire at Age**: The age at which retirement takes place.

Line **Mortality Multiplier**: The ratio of an individual's mortality rate to the mortality rate of the average individual in the economy at the retirement age. For high income workers with better access to health services and improved standards of living, this mortality multiplier may be less than 100% which would imply that they have a lower mortality rate compared to an average individual. Low income individuals may have mortality multipliers above 100%.

Line **Starting Wage as % of Cohort Avg**: An individual's starting wage as a percent of the wage of an average individual of the same age and gender. This variable may also vary among the profiles as a function of the income level.

Line **Productivity Growth Multiplier**: An individual's average wage increase as a percent of the wage increase of an average individual of the same age and gender. Different profiles could have different values for this variable differentiated by urban high income or rural poor income values. For the former profile, it may be assumed that productivity increases faster than the norm whereas in the latter case, it could be assumed that productivity does not change too much with respect to the norm.

Line **Percentage of Benefit Left to Survivor**: Share of individual's pension left to survivor. This is determined either by law (in the case of PAYG system) or by choice at the time of buying joint annuity (in the case of funded system). This value is only relevant if the joint annuity option in column I is on.

**Noncontributory Years**: There are two bars with age specifications to the right of the other data. Click on the first bar after you have made the other changes and it will reset to conform to what you have specified. You can then highlight years when this particular individual did not contribute. Note, that resetting of the bar is required every time you reset the start and end of the career.

**Exempt Years**: The second bar to the right of the data allows the user to specify when an individual was legally exempt from contributions but continued to earn credit towards the pension (the government has to actually contribute to individual's account during such periods in the presence of notional PAYG or funded pillar. For the conventional PAYG pillar usually only individual's record of length of service is being increased each year with no actual contribution being made). The bar is filled with ages corresponding to the years when an individual was not contributing (the values are automatically taken from the first bar). The user can then mark the years when individual was exempt.

<u>**WORKSHEET VI: FACTORS**</u>

The *Factors* worksheet contains actuarial tables for annuitization, commutation and pension reduction due to early retirement.

Columns **Annuitization Factors in Notional PAYG/ Funded Pillar, Males/Females**: To convert account balance accumulated either in Notional or Funded pillar into annuity the account balance is divided by an age and gender specific number called annuitization factor. This factor is normally derived based on projected mortality rates, pension indexation rules and given a specific discount rate is supposed to transform the account balance into a stream of payments with the expected net present value equal to the account balance (see PROST calculus manual for details). The factors used in practice may or may not be actuarially fair, i.e. net present value of expected pension stream derived using actual factors may be different from the value of the account. In these columns PROST asks the user to input annuity factors that are actually used by the pension institution which PROST will use for projecting pension system expenses. Actuarially fair factors are outputted as part of PROST results file.

Columns **Pre-reform / Post-reform Commutation Factors with xx% Nominal Discount Rate, Males/Females**: When a PAYG pension system allows commutation of a portion of benefit stream this proportion of pension is converted into a lump sum payment by multiplying it by age and gender specific number called commutation factor. This factor is normally derived based on projected mortality rates, pension indexation rules and given a specific discount rate is supposed to equalize the net present value of the given portion of the benefit stream with the lump sum payment. The factors used in practice may or may not be actuarially fair, i.e. net present value of expected pension stream may be different from the lump sum payment derived using that factor. In these columns PROST asks the user to input commutation factors that are actually used by the pension institution which PROST will use for projecting pension system expenses. Actuarially fair factors are outputted as part of PROST results file. The discount rates used to derive actuarially fair commutation factors are taken from the numbers specified in columns J and N in line 4 of this range.

Columns **Pre-reform / Post-reform Pension Reduction Coefficients with xx% Nominal Discount Rate, Males/Females**: When a PAYG pension system allows retirement before statutory retirement age it often imposes a penalty by applying a reduction coefficient to a regular pension amount. The coefficient usually depends on individual's age and gender. It is normally set based on projected mortality rates, pension indexation rules and given a specific discount rate is supposed to equalize the net present value of the reduced benefit stream given at the earlier age and a regular benefit stream awarded at the statutory retirement age. The reduction coefficients used in practice may or may not be actuarially fair, i.e. net present value of the two expected benefit streams may be different. In these columns PROST asks the user to input reduction coefficients that are actually used by the pension institution which PROST will use for projecting pension system expenses. Actuarially fair reduction coefficients are outputted as part of PROST results file.

The "ReformGeneral" worksheet contains non-age-specific data about systemic reform specifications. Thus this and the "ReformPension" sheet can be used to simulate the impacts of moving from a typical PAYG system to any combination of the following possibilities: a mono-pillar reformed PAYG, a mono-pillar Notional PAYG and a mono-pillar Funded DC Scheme, or a multi-pillar scheme combining any two or three of the above.  Reformed PAYG pillar should always be included in any combination to accommodate existing pensioners who are unlikely to be moved to the new system.  At the top of this input file, the user is given a series of options to choose from. These options define the main reform rules, number of pillars and how the accrued rights will be compensated. The rest of the input file variables that are visible depend on these selections. These variables define how the new pillars would operate. As always, the user can use the "I" and "D" buttons to insert and delete data columns if necessary.

**Systemic Change Options**

> Line **Reform Year**:  The year in which pension reform is expected to occur.  This year must be later than the base year.  In other words, the base year should be chosen to be at least one year prior to the reform taking place. As will be evident from the following discussion PROST also allows modeling the ongoing multi-pillar system. In this case "Reform Year" simply means the first year, for which the results of the multi-pillar system will be projected.

> Lines **Pillars after the reform**:  Check the pillars that will exist after the reform. Available choices are:

> **Conventional PAYG**          **Notional PAYG**                **Funded DC**

> The user may choose all or any of these systems depending on the purpose of the simulation.  If the reform is simply a reform to a conventional PAYG system, the user can either model this as changes over time to the parameters in the first four worksheets or can enter them here.  If the new parameters apply to some cohorts and not others, it would most likely be easier to model them here. Please note that retirement age changes which may accompany the systemic changes must be modeled through the first 6 worksheets.

> **Conventional PAYG** refers to defined benefit plans where contributions from current workers are being used to pay pensions to current beneficiaries based on a formula combining some portion of the beneficiaries' earning history, economy wide average covered wage, and the years of service of the beneficiary.  These systems may or may not have an accumulated reserve.

> **Notional PAYG** refers to defined benefit plans where contributions from current workers are also being used to pay pensions to current beneficiaries, but in this case the pensions paid to the beneficiaries are related in some fashion to the contributions the individual beneficiary made during his/her lifetime.  These systems also may or may not have an accumulated reserve.

**Funded DC** refers to defined contribution plans where individual contributions accumulate in accounts which are then invested. At retirement a pension is paid from the amount available in the account, the contributions with the accrued interest.

Lines **Accrued rights are paid out as**: All reform options keep pensions in payment untouched, although the indexation on these pensions can be changed as a component of a reform. However, the reform has to address the issue of the rights accrued to contributors who have not yet met the eligibility criteria to retire, but have made significant contributions to the old system and therefore have claims against that system. Select how accrued rights should be disbursed to these contributors. Choices are:

**Proportional PAYG Benefit** - Benefits are based on the proportion of the full PAYG pension benefit that individual have accumulated before the reform. Thus if for example a country's pension system allows for a replacement ratio of about 60% after 30 years of service, an individual with only 15 years of service would be given a life annuity consisting of approximately 30% of projected wages. This annuity would be paid at the time of retirement.

**Notional Capital** - This option is only visible when a **Notional PAYG** pillar checkbox is checked in. Instead of beginning the notional account system with zero balances, individuals are given starting balances which are based on their accrued rights under the old system. How the accrued rights will be converted will be specified by the user below.

**Recognition Bond** – This option is only visible when a **Funded DC** pillar checkbox is checked in. Since funded systems pay benefits out of the money accumulated in the individual's account, one approach the Government could take would be to give individuals bonds in recognition of past service, which earn some specified interest rate and that the combined balance from both the recognition bonds and accumulated contributions after switching to the new system would be available to the beneficiary upon retirement.

**They are Calculated Based on**: This option applies only to Accrued Rights paid as Notional Capital or as Recognition Bond and determines how accrued rights are calculated. The user has two options:

> **Promised Benefits**: Accrued rights are calculated as a proportion of the pension that had been promised. Using the example from above, if the original law said that an individual with 30 years of service was entitled to 60% of the last salary, and the individual had contributed only 15 years, this individual would be entitled to 30% of last salary. **Past Contributions**: Alternatively, the Government could take the stance that the system is now changing, so the old system is being shut down. Under either a notional account system or a defined contribution system, the Government could attempt to determine what the account balances would have been had the new system been in place throughout a worker's career. Complete information is never available to correctly make this calculation so

choices have to be made to determine how this calculation will be made. These parameters will be chosen below.

These two methods will almost always yield different outcomes. Generally, if the current system is generous, providing higher internal rates of return than the market would, the government will find it cheaper to base accrued rights on **Past Contributions**. If the current system is not so generous with low rates of return, **Promised Benefits** will be cheaper. However, the actual choice made by a country often depends not on cost, but on the political economy. **Past Contributions** are more likely to be viewed as reneging on a past contract.

If **Accrued Rights** are paid out as **Proportional PAYG Benefit** and either one or both Notional PAYG and Funded pillars are present after the reform, a user can specify directly the amounts credited to initial account balances in Notional PAYG or Funded Defined Contribution systems in the year of the reform. The following two options become visible under **If Ongoing Defined Contribution Scheme** only if **Notional PAYG** or **Funded** are checked in under **Pillars After the Reform,** and if the option **Proportional PAYG Benefit** is chosen under **Accrued Rights Are Paid Out As**.

**Direct Initial Capital NDC / FDC**: If checked in, these options will open **Initial Capital (Notional) As % of Avg Wage** or **Initial Capital (Funded) As % of Avg Wage** input columns in the **ReformPension** worksheet. Then, the average accrued rights can be calculated outside the PROST for each age and gender and fed into PROST as direct initial capital. These options might also be useful in modeling ongoing individual account systems, when average accrued values of the accounts can be inputted as direct initial capital. Also, under **Direct Initial Capital** option the PROST allows paying accrued rights through proportional PAYG benefit (see **Rules for accrued rights calculation** below) in addition to direct initial capital, which is credited to individual account balances in Notional PAYG or Funded DC system.

**Rules for accrued rights calculation**

These lines are only activated when **Notional Capital** or **Recognition Bond** are chosen. Under **Proportional PAYG Benefit**, the accrued right is simply the old replacement rate (in the non-reformed system)multiplied by the proportion of length of service completed . No further calculation is necessary. However, in the case when **Notional Capital** or **Recognition Bond** is the way of compensating for accrued rights, more complicated calculations are required to convert completed years of service into a fixed monetary value. These also depend on whether the accrued rights are going to be calibrated according to (1) **the promised level of benefits**, or, (2) **past contributions.**

**Past Contributions**

Line **Wage Data Is Available Inclusive Since Year**: What is the earliest year when good wage history records are available for contributors. In most cases, complete contribution earning histories are not available. However, data appears to exist on

years of service. The most frequent method of constructing "synthetic" wage histories is to use the average wage from the earliest available year to now and use this as defined below to construct a wage history, from which the contribution history can be derived. We will refer to this as the known average wage.

Line **Actual Wages Used for Averaging are Valorized To Inflation / Nominal Wage Growth**: Are the wages used in determining the wage base valorized/adjusted for inflation/ wage growth? If so, enter the valorization factor as a percent. Thus 0% would imply no valorization of past wages while 100% would imply that past wages should be valorized perfectly for inflation / wage growth. For example, if it is determined that accurate wages exist from 1994 to 2004, should the nominal wages from 1994 to present be adjusted to reflect inflation, so that this average is expressed in real 2004 wages?

Line **Av. Wage Used for Pre-reform Wages Is Discounted to Inflation / Nominal Wage Growth**: Should the wage data for years prior to the earliest available year be derived by discounting data available from the earliest year to inflation levels/ past wage growth? If so, enter the discount factor as a percent (between 0% and 100%). If 0% is entered here and in the next line, then the same known average wage will appear for all unknown years. If 100% is entered here, then the known average wage will be reduced for inflation/ wage growth each previous year.

Line **Post-reform Wages Enter Unavailable Av. Wage Calculations**: **Yes** or **No** need to be entered here. If the known average wage is currently from 1994 to 2004, and this known average wage is to be used to create the synthetic wages for all those who retire with unknown wages, the appropriate answer is **No.** However, for those retiring in 2006, wage histories from 1994-2005 will actually be available, and for those retiring in 2007, wage histories from 1994-2006 will be available. If the user would like the known average wage used to create the unknown wages for those retiring in 2006 to be the average wage from 1994-2005 instead of 1994-2004 and so forth, increasing the length of the averaging period as more wages become known, the appropriate answer is **Yes.**

Line **Real Interest Rate Credited on Past Contributions**: What real rates of return are being applied for past contributions? Enter the rate as a percent.

**Historical Data Used for Accrued Rights Calculation**

Line **Contribution Rate Credited to the Individual Account**: Enter the time profile of historic contribution rates (going back 50 years from the base year) as a percent. The previous lines determine how the "synthetic" wage history is calculated. These values determine how contributions are determined. If contribution rates have changed over the past 50 years, the user should be credited with contributions based on contribution rates relevant in previous years rather than with today's contribution rate.

Line **Assumed Real Average Wage Growth / Inflation Rate**: Enter the assumed rate of growth of real wages and inflation for years prior to the base year. The future path of average wage growth and inflation is entered in the "General" sheet.

**Promised Benefits**

There is no one universally accepted method of converting a stream of expected future pension benefits into a finite value today, which would be required if the government either offered initial notional capital or a recognition bond. Instead the policymaker has a number of choices. The choices will have an impact on transition costs, but will also depend on political feasibility.

Line **Wage used in calculations**: The pension rules of the original system generally state that the individual is entitled to x% of the last wage or average of the last y years when he retires. When the pension is being converted to a finite value, the question of what to use for the last wage arises. Since the model is doing projections into the future, the program knows what wage the individual will receive at the time of retirement. That wage could be used, **Projected wage of the contributor,** or the wage that the individual was receiving at the time of the reform could be selected, **Last wage of the contributor.** Generally, **Projected wage of the contributor** will be more expensive than **Last wage of the contributor**, but **Last wage of the contributor** is a known amount and the growth of wages can be reflected in the interest rate offered, in the case of a recognition bond.

Line **Discount Rate Used in Calculation**: Since the pension was to be paid in the future when the person retires, not at the current moment, the stream of benefits needs to be discounted back to the present. The user can choose the discount rate to be used for this. This may be the same as the market interest rate, but it is also a policy variable that the government can choose, which will impact the assessed accrued rights tremendously.

**After the Reform PAYG Benefits to Disabled and Orphans**

The reform, as modeled here, currently only reflects changes to the old age pension system. However, often reforms also incorporate changes to disability and orphan benefits as well. Survivor benefits change also, but they usually are specified as a portion of PAYG old age pension, which is what PROST assumes in its calculations. Often insurance companies take over or supplement the payments to either one or all of these groups. In other cases, even though the old age benefits now come partly from a funded pillar, the disability pensions remain defined benefit and from the PAYG pillar. The variations across countries in multi-pillar arrangements for disability and survivor payments are enormous. In future versions we may try to model this insurance company behavior and incorporate some of these variations. However, doing so makes the comparison of benefits before and after reform more difficult. In this version, we give the user only two options. After the reform PAYG Benefits to Disabled and Orphans could either **Remain at Pre-Reform levels,** with

the benefits to these groups continuing to be paid from the public pension agency, or could **Decrease or Increase By the Same Proportion as PAYG Old Age Benefits.** If a funded pillar is included in the reform and the user chooses **Remain at Pre-Reform levels**, the individual's accumulated fund balance is turned over to the public pension agency and the benefits are paid by the agency.  This is almost equivalent to a topping up system, where the individual receives his/her own balance and the necessary money from the public agency to top up that balance to the level guaranteed in the law.  However, should the individual's balance exceed the amount guaranteed in the law, the model assumes that the entire balance is turned over to the public pension agency while the individual only receives the legally guaranteed amount, while a topping up system would result in the individual receiving the higher benefits with no intervention on the part of the state.

If the proportional change option is chosen, then if the pension for new old age pensioners paid by the PAYG system falls by half as some of the contributions are diverted to a funded pillar, a the disability payments from the PAYG pillar will also fall by half, with the assumption that there will be supplemental disability payments coming from the funded pillar or through an insurance company as well.  In line **Money Dedicated to Pay Benefits Other than Old Age as % of Contribution**, the user is asked to specify the percentage of contribution which is dedicated to paying benefits other than old age.  The model assumes that all of that revenue is distributed annually among these other beneficiaries, the disabled and survivors, on top of their remaining balances.   The user can then look at the benefits received by these recipients to see whether they are sufficient and if not, can adjust the revenue dedicated to these payments in line **Money Dedicated to Pay Benefits Other than Old Age as % of Contribution**.  Thus, there is a direct link between the generosity of the benefits paid to the disabled and survivors and the overhead charged to each contributor which lowers the amount available to accumulate in the contributor's old age account.

**Collection Rate (Conventional PAYG, Notional PAYG, Funded)**

Collection rate is the percentage of the contributions from contributors received by the pension system.  The assumption is that the collection rate on all three pillars, if they exist, is exactly the same.  This assumes that either the contributions are collected together by the tax authorities, by the public pension agency, or by a separate clearinghouse agency or that even if collected separately, there is sufficient cross-checking to prevent individuals from paying one set of contributions and not the other.  The presumption in most reforms is that the reform process either improves incentives to contribute or is accompanied by administrative reforms which improve the efficiency of collection.  If neither is true, the user can enter the same values as in the table **Revenue Sources** of the "General" sheet.

> Lines **From Switchers and Their Employers/From Non-Switchers and Their Employers/From Pensioners/From Government:** A good pension reform should increase transparency, fairness, and provide good value for contributions.  Under these conditions, switchers might have greater incentive to contribute than non-

switchers.  If the user believes these conditions will be fulfilled, higher values may be entered for switchers than for non-switchers.  If the conditions are not fulfilled, then the values for switchers and non-switchers would generally be the same, although they may be higher due to administrative reform than in the original system.  Lines **From Pensioners/From Government** incorporate collection rates from pensioners and from the government where these are relevant.  A value of 100% implies that the collection system is completely efficient and fraud and arrears amount to 0%.

**PAYG Fund Parameters (Notional + Conventional)**

This group of parameters corresponds to some of the lines from the tables **Revenue Sources** and **Costs and Other Expenditures** of "General" sheet.  If nothing is expected to change after the reform, the same values used there can be entered here.  However, if the parameters are expected to change, the new values should be entered here.  The parameters for notional and conventional PAYG pillars are lumped together here because these systems are both public systems and if they are run concurrently they are run by the same public agency.

> Line **Unconditional budget transfers to pension fund as % of GDP**:  This field records unconditional budget transfers to the pension fund (other than the wage-bill based tripartite Government contributions) made by the Government as a percent of GDP. For example, some countries earmark x percentage of the VAT tax to the pension fund.  Other countries earmark privatization revenues for supporting the pension system.  Neither of these sources of revenue is directly tied to the covered wage bill, contributions from which are the primary source of revenue.  Please note that this line does not include transfers from the non-pension Government budget to cover pension system deficits, hence the term **Unconditional,** but only items that are earmarked regardless of the status of the pension system.  Data are required for the base year, the end year and any other years in between.

> Line **Other Income as % of Employee, Employer and Government contributions**: Enter any other income received by the pension fund as a percent of total contributions. Thus an entry of 10% would imply that other income sources of the pension fund were able to add to contribution revenues additional 10%.  This income will be tied to the wage bill since contributions are tied to the wage bill.  This line is useful if the pension fund engages in non-pension activities and the user would like to look at the overall budget of the pension fund.  However, the non-pension expenditures are specified in a highly aggregated fashion, leading to only crude estimates of the impact on the overall budget of the pension fund.

> Line **Assets Management Costs as % of Assets**:  The costs required to manage the assets of the pension system. The data are required for both the base year as well as the end year and entered as a percent. These costs are usually a function of the volume of financial assets being managed by the pension system. Typical values range from below 1 percent (meaning less than 1 percent of the previous years' fund balances were used for asset management) to about 6 percent (meaning 6 percent of the pension funds assets are used for asset management expenses).

Line **Administrative Costs as % of Employee, Employer & Pensioner Contributions**:   The transactions or administrative costs of running the pension system, excluding the asset management costs included above. This includes costs of setting up the pension registry, costs of book keeping, and administering the pension system.  The data are needed for both the base year as well as the end year and are entered as a percent of total contributions from employers, employees, pensioners. Typical values range from about 1% meaning that almost 1% of contributions are being used to administer the pension system to over 50%.

Line **Other Pension Fund Expense as % of Pension Expense**:  The percent of total expenditures attributed to non pensions related expenditure or "other" expenditures. This data must be entered as a percent for the base year, the end year and any other years in between.

Line **Pensioner Contribution Rate on PAYG Pension Payments**:  If pensioners are required to contribute towards social security, enter the average rate of contribution as a percent of their gross pensions.

### Indexation of Minimum Pension on All Income

Lines **For Switchers/Non-switchers to Inflation/Nominal Wage Growth.** Given that pension benefits can potentially come from the three different pillars the program applies the minimum pension to the sum of all annuities regardless from which pillar the benefits come. In reality minimum pension is sometimes applied to the benefits from just one pillar, in which case the user will have to produce 2 input files – one with the pillars to which minimum is applied and another with the pillars that do not offer minimum pension guarantee, or offer another separate guarantee. PROST allows for 2 different guarantees – one for the switchers and one for non-switchers. The parameters on these lines ask the user to specify how these different minimum guarantees for switchers and non-switchers will be indexed to inflation and wage growth.

### Minimum Pension Guarantee Calculations and Payment Options

Line **Mode of Payment.** In this version of PROST only one option of payment is allowed, which is the option of yearly guarantee. This means that sum of all annuity payments from all pillars is calculated each year and compared against the minimum pension guarantee. If the guarantee is higher than total benefits from all funds the top-up will be paid from PAYG pillar.

### Notional Pillar Information

The next set of variables is only visible to the user if the simulation case involves the presence of a Notional PAYG Pillar after the reform and the user has checked Notional PAYG as an option.

### Notional Real Interest Rate Determination

As explained above, under a notional accounts system, the hypothetical balances derived from recording contributions each year are given interest on the balance every year. Unlike a funded system, where the contributions are being invested, the contributions are actually being used to pay current contributors.  The government can then decide what real interest rate to pay on these hypothetical balances.

Line **Base Notional Real Interest** refers to the case where the government chooses to pay a fixed real interest rate, which the user may specify as a percent for the base year, the end year and any other years in between. Zeroes could be entered for the remaining parameters in this range, if for example, the government declared that the notional interest rate would be 3%.  On the other hand, the government could declare that the notional interest rate would be 1% plus the growth rate of wages.  In this case, 1% would be complemented with the entries in the subsequent fields.

Line **Option 1: GDP; Option 2: GDP per capita**. First, the user should choose which option of data entry he or she wants to use by selecting from drop-down list in the column G. The notional interest rate could be tied to either **GDP** or **GDP per Capita**. The parameters in columns K-L have to reflect which proportion of GDP or GDP per capita growth will be added to the base notional real interest rate (which could be zero).

Line **Option 1: Wage Bill; Option 2: Average Wage**. First, the user should choose which option of data entry he or she wants to use by selecting from drop-down list in the column G. The notional interest rate could be tied to either growth of **Wage Bill,** which is the rate of growth of PAYG revenues or **Average Wage**. The parameters in columns K-L have to reflect which proportion of wage bill or average wage growth will be added to the base notional real interest rate (which could be zero).

**Contribution**

Line **Contribution Rate From Switchers**:  Enter the contributions to the notional system as a percent of insured wage made by those who have switched to the notional account system.

Line **Contribution Ceiling for Switchers as % of Total Overall Ceiling**:  Some countries choose to limit PAYG system (Notional in this case) by lowering the ceiling on insured wages, often leaving remaining part of wage to be insured by mandatory or voluntary funded pension system. This parameter asks to express the new ceiling as a percent of the ceiling of unreformed system, specified in the table **Contributions** of "General" input sheet.

Line **Contribution Rate From Employers of Switchers**:  Enter the contributions as a percent of wage made by employers of those who have switched to the notional account system. The wage can be insured wage or gross wage, depending on the choice in line **Switcher Contribution Ceiling Applies for their Employers**.

Line **Switcher Contribution Ceiling Applies for their Employers**:  **"Yes"** would mean that ceiling specified in line **Contribution Ceiling for Switchers as % of Total Overall Ceiling** applies to employers. **"No"** would mean that gross wage is calculated to determine employer's contribution amount. In any case only insured wage under the ceiling is added to notional capital of the individual.

Line **Government Contr. Rate for Switchers**:  Enter the contributions as a percent of gross wages made by the Government to switchers' notional accounts. Use 0% if no such credits are given by the Government.  These do not include government contributions for special categories; only government contributions to all individuals under a tripartite contribution system should be included here.

Line **Total Contribution Rate Credited to Switcher's Account**:  Because a notional account system is notional and not funded, there may be a difference between what is credited to the individual's account and what is actually paid.  Lines **Contribution Rate From Switchers** and **Contribution Rate From Employers of Switchers** refer to what is actually paid and therefore revenue to the system.  The amount credited to the account could be less than what is paid if the government is claiming a solidarity payment to help cover transition costs or if contributions are being used for other insurance plans or if contributions are covering administrative costs.  Conversely, the amount credited could be greater than what is paid.  This could be viewed as a government contribution in the sense that the government is obligated to pick up deficits from notional account systems.  The contribution is different from the direct government contribution made in line **Government Contr. Rate for Switchers**, which is paid annually while an individual works. In this case the Government only makes a promise to pay when there are deficits in the future.

Line **Government Contr. Rate for Exempt Switchers as % of Min. Wage**:  The Government can choose to make contributions on behalf of special categories of exempt individuals, such as mothers caring for young children.  Note that in the "Pension" sheet, the user specified how many people of each age and gender category were receiving credit for service without paying.  In notional account systems in order for the individual to receive credit, a contribution must be made.  But the wage on which that contribution should be based is not determined since the person is not actually earning.  If the government only makes contributions on the basis of the minimum wage, the contribution rate should be entered here.  If the government makes contributions on the basis of the average wage of individuals in that age and gender cohort, then the contribution rate should be entered in line **Government Contr. Rate for Exempt Switchers as % of Imputed Wage**.

Line **Government Contr. Rate for Exempt Switchers as % of Imputed Wage**:  Enter the contributions as a percent of imputed gross wages made by the Government on behalf of exempt individuals.  Imputed gross wages are the average wage of individuals in that age and gender cohort.

**Indexation (%)**

Enter data regarding pension indexation rules for the notional pillar. Many pension systems index pensions to either nominal wages or inflation (or some combination of both). If the level of inflation is I, and rate of nominal wage growth is G, then the indexation mechanism is described by $[(1+aI)*(1+bG)-1]$ where a and b are the user input inflation indexation parameters. Data are needed for the base year as well as for the end year (and intervening years if available).

Lines **Switcher Pension Indexation to Inflation / Nominal Wage Growth / Nominal Notional Interest**: The data are required for both the base year as well as the end year and are entered as a percentage. Differently from pension payments from other pillars, notional pillar allows indexation of the pension to notional interest. This would allow continuity of policy after the person retires, as account value before the retirement also grows at the notional interest rate.

Lines **Maximum Switcher Pension Indexation to Inflation / Nominal Wage Growth / Nominal Notional Interest**: The data in these fields should be entered the same way as data for pension indexation. This indexation is applied to the maximum pension initially specified by the maximum pension indexation rules before the reform, specified in "General" input sheet. After the old age pension is calculated, whether at the time of awarding the pension or at the time of indexation, it is checked if the resulting payment does not fall above the maximum pension. If it does, the payment of maximum pension is made to the pensioner instead.

**Rules for Annuitization**

Under notional accounts, when a person retires, the balance in the notional account is then converted into a pension payment. In the simplest case, the balance is divided by the life expectancy of the individual, given his or her age of retirement and then indexed as specified above. This assumes that the only interest rate being paid on the balance post-retirement is what has been specified as indexation. Full inflation indexation would result in a zero real interest being paid; nominal wage growth indexation would result in a real interest rate equal to real wage growth, etc.

Line **Real Interest in Decumulation Phase:** This refers to the interest rate provided on the notional account balance after the pension has started to be paid. The user choices are **None,** which allows the indexation to determine the interest rate being paid, **Notional,** which pays an additional interest rate equal to whatever has been specified as the notional interest rate, and **Discount Rate,** which is the market interest rate. Note that this interest rate is in addition to what is being paid through the indexation.

Line **Decrease in Interest Due to Annuitization:** The aim of notional account system is to imitate funded system of individual accounts. In the funded system insurance companies would charge a premium for taking longevity risk of an individual at the time of retirement. This premium is usually expressed as a reduction in interest rate from the level that the company would otherwise offer for purely managing individual's funds. In the notional system this longevity risk is taken by the

government which at least theoretically can also charge such premium. For example, an input of 1% here means that assumed future interest rates are reduced by 1% of assets when the account balance is converted into annuity at retirement.

**Funded Pillar Information**

The next set of variables is only visible to the user if the simulation case involves the presence of a Funded DC component after the reform and the user has checked **Funded** as an option.

**Contribution**

Line **Contribution Rate from Switchers**: Enter the contributions as a percent of insured wage made by switchers.

Line **Contribution Rate from Employers of Switchers**: Enter the employer contributions as a percent of insured wage.

Line **Government Contribution Rate for Switchers**: Enter the contributions as a percent of insured wage made by the Government to switcher's DC accounts. Use 0% if no such credits are given by the Government. Again these are statutory tripartite contributions on the part of Government, not residual covering of the deficit.

Line **Government Contribution Rate for Exempt Switchers as % of Min. Wage:** Enter the contributions made by the Government on behalf of an exempt individual who has switched as a percent of the minimum wage in the economy. Exempt individuals are those who receive credit for contributions, but are not making contributions themselves. If the Government makes those contributions, which is the only way to get credit in a funded system, and the Government makes the contributions on the basis of minimum wage, the contribution rates should be entered here.

Line **Government Contribution Rate for Exempt Switchers as % of Imputed Wage**: Enter the contributions made by the Government on behalf of an exempt individual on the basis of an imputed wage. The imputed wage is the average wage earned that year by an individual of the same age and sex cohort as the exempt individual.

Line **Contribution Floor as % of Minimum Wage**: Some countries set up the funded DC system in such a way that only income above certain threshold is insured by funded system (income below this threshold is usually insured by PAYG system). Enter this threshold as a % of minimum wage (the value should be above 100%). Enter 100% if all income is insured by funded pillar.

Line **Credit to Switcher's Account as % of Contribution**: In a funded system, the full contribution rate might not be credited to the individual's account since some of the contribution may be used to cover disability and survivor premiums and

administrative costs.  These are indicated on lines **Fees for fund administration as % of switcher and employer contribution** and **Money dedicated to Pay Benefits Other than Old Age as % of Contributions** below.  Ideally, the sum of lines **Fees for fund administration as % of switcher and employer contribution** and **Money dedicated to Pay Benefits Other than Old Age as % of Contributions** should equal 100.  However, it is possible that the insurance companies are building a hedge fund in the initial years of the system to protect themselves against future disability risks.  In that case the money paid out to the disabled and survivors this year and administrative costs spent this year plus what goes in one's account may not sum up to 100.  Similarly, if the insurance companies later draw down that hedge fund, the sum may exceed 100. Thus, the insurance premium paid by the contributor is being split in 2 or 3 segments:  line **Fees for fund administration as % of switcher and employer contribution** reflects the administrative costs included in the insurance premium, line **Money dedicated to Pay Benefits Other than Old Age as % of Contributions** reflects the actual amount paid to other beneficiaries each year, and the building of a hedge fund is reflected as the difference between 100% and the sum of lines **Fees for fund administration as % of switcher and employer contribution** and **Money dedicated to Pay Benefits Other than Old Age as % of Contributions**.

Line **Fees for fund administration as % of switcher and employer contribution**: The percentage of the contribution used to cover administrative costs. This entry should exclude insurance payments to the disabled, survivors, and orphans. However, it should include the administrative costs of the insurer as well as those of the fund manager.

Line **Money dedicated to Pay Benefits Other than Old Age as % of Contributions**:  The percentage of contribution used to cover premiums for disability, survivors, orphans, or life insurance.  Each year the disabled and survivors are paid out what remains in their own or in the deceased's account plus the amount specified here.

Line **Asset management Fee as % of Assets**: Asset management fees assessed as a proportion of funds under management  in each account each period.

Line **Contribution Ceiling for Switchers as % of Total Overall Ceiling**: Some countries choose lower or higher level of the ceiling on insured wages for funded DC than for PAYG pillar. This parameter expresses the new ceiling as a percent of the ceiling of unreformed system, specified in the table **Contributions** of "General" input sheet.


**Transition Cost Financing**

Here the user can describe how transition costs of switching to the multi-pillar system are financed. The transition cost here is defined as additional cash requirements for the

PAYG system due to the introduction of the multi-pillar system. There are 3 different financing options described below.

Line **Borrowing**: Lines **Borrowing**, **Privatization Revenues** and **Tax Financing** should always sum up to 100%, signifying that all transition costs have to be financed in one of the three ways. It is assumed that all cash requirements not satisfied by privatization revenues or tax financing will have to be satisfied by borrowing at government bond interest rates.

Line **Privatization Revenues**: Percent of the transition costs financed by privatization revenues.

Line **Tax Financing**: Percent of the transition costs financed by raising general taxes or reducing spending for other government programs.

### Interest Rates

Line **Real Interest Earned on Recognition Bonds**: As noted above in the discussion of accrued rights, once the recognition bonds have been provided to individuals with accrued rights in the old system, these bonds generally earn some rate of interest, which is a policy variable on the part of the Government.

Line **Real Interest Earned on Individual Accounts**: This is generally higher than risk free market interest rates, since individuals in general hold some risky assets that earn higher interest rates on average. Government regulations may limit the extent of such risky investments. Generally, a stable economy requires a risk free real interest rate 1-2 percentage points above the rate of real GDP growth.

### Rules for Annuitization and Pension Payout

In the case of a funded system, usually payment is made in one of three ways: as a lump sum, as a scheduled withdrawal, or as an annuity bought through an insurance company. A lump sum allows the beneficiary to withdraw all or some of the money in the account upon retirement. This lump sum could be used to purchase an annuity; in fact in most countries, the purchase of a minimum annuity is required if the entire sum is withdrawn as a lump sum. A scheduled withdrawal is like an annuity, but a little different. The account continues to earn interest rate at market rates even while the pensioner withdraws funds, but the amount of the pension each year is recalculated taking into account the accumulated balance with interest and the remaining life expectancy of the individual. Since the pension is recalculated each period, nothing is automatically indexed. While a scheduled withdrawal can result in very low pensions at the end of life if a person lives a very long time, if a person dies early, the remaining balance is turned over to survivors in addition to whatever survivor insurance had been purchased.

Line **Decrease in Interest Due to Annuitization:** While the account balances had been accumulating interest at market rates, annuities generally pay lower interest

rates, which compensate the insurance company for the longevity risk. Enter the reduction in interest rate from the market rate paid on the annuity. For example, if you enter 1%, the annuity will be assumed to pay an interest rate 1 percentage point below the market rate.

Lines **Indexation of Annuity to Inflation / Nominal Wage Growth:** Insurance company provided annuities may or may not be indexed to inflation. The user is asked to specify. While it is extremely rare that an insurance company can offer an annuity indexed to nominal wage growth, if the PAYG pension is indexed to nominal wage growth, the user may want to specify the same indexation for both the PAYG pension and the annuity from the funded pillar to be able to add pensions from different pillars to get a sense of the true change in replacement rates pre and post reform.

Line **Mode of Benefit Payments:** this parameter determines how benefits are actually paid from the pension fund, whether by scheduled withdrawal, lump sum or annuity.

**Reformed PAYG Pillar**

PROST assumes that Conventional PAYG pillar is always present after reform, at least to continue pay the benefits for current retirees. More generally, conventional pillar can be present with two sets of contribution and benefit specifications, one of which is for switchers and the other for those who do not switch to multi-pillar system (in this case parameters for non-switchers can still encompass the reform).

**Contribution**

The contribution collection rules towards the reformed PAYG system broken down by source and according to whether the individual is a switcher (i.e. someone who is now in the new system whether it is a reformed mono-pillar PAYG or a multi-pillar system) or a non-switcher (the individual remains in the mono-pillar PAYG system). Note that in the other pillars, Notional Account and Funded, contributions were only taken from switchers since it is assumed that these pillars did not exist initially. However, here there may be differential contribution collection rules from switchers and non-switchers.

Line **Contribution Rate from Switchers**: Enter the contributions as a percent of insured wage made by switchers.

Line **Contribution Ceiling for Switchers as % of Total Overall Ceiling**: Some countries choose to limit PAYG system by lowering the ceiling on insured wages, often leaving remaining part of wage to be insured by mandatory or voluntary funded pension system. This parameter asks to express the new ceiling as a percent of the ceiling of unreformed system, specified in the table **Contributions** of "General" input sheet.

Line **Contribution Rate from Employers of Switchers**: Enter the contributions as a percent of wage made by employers of those who have switched to the multi-pillar system. The wage can be insured wage or gross wage, depending on the choice in line **Switcher Contribution Ceiling Applies for their Employers**.

Line **Switcher Contribution Ceiling Applies for their Employers**: **"Yes"** would mean that ceiling specified in line **Contribution Ceiling for Switchers as % of Total Overall Ceiling** applies to employers. **"No"** would mean that gross wage is calculated to determine employer's contribution amount.

Line **Contribution Rate from Government for Switchers**: Enter the contributions as a percent of insured wage made by the Government on behalf of switchers.

Line **Contribution Rate from Non-switchers**: Enter the contributions as a percent of insured wage made by non-switchers.

Line **Contribution Ceiling for Non-switchers as % of Total Overall Ceiling**: Some countries choose to limit PAYG system by lowering the ceiling on insured wages, often leaving remaining part of wage to be insured by mandatory or voluntary funded pension system. This parameter asks to express the new ceiling as a percent of the ceiling of unreformed system, specified in the table **Contributions** of "General" input sheet.

Line **Contribution Rate from Employers of Non-switchers**: Enter the contributions as a percent of wage made by employers of those who have not switched to the multi-pillar system. The wage can be insured wage or gross wage, depending on the choice in line **Non-switcher Contribution Ceiling Applies for their Employers**.

Line **Non-switcher Contribution Ceiling Applies for their Employers**: **"Yes"** would mean that ceiling specified on line **Contribution Ceiling for Non-switchers as % of Total Overall Ceiling** applies to employers. **"No"** would mean that gross wage is calculated to determine employer's contribution amount.

Line, **Contribution Rate from Government for Non-switchers**: Enter the contributions as a percent of insured wage made by the Government on behalf of non-switchers.

Line **Use Benefit Formula for Old Age Pensioners**: Check this box if the reformed PAYG system simulations would require the use of an earnings-specific benefit formula. This would be an additional part of the pension on top of earnings unrelated part, described in the sheet "ReformPension". It is possible to be inconsistent with what is entered in the "General" sheet in which case the final benefit will be a weighted average of the two benefits putting more and more weight on the benefit formula of "ReformGeneral" sheet for more remote periods in the future.

Lines **Benefit Formula Parameters for Old Age Pensions:** This range will be visible only if the **Use Benefit Formula for Old Age Pensioners** box is checked in, and describes the earnings specific part of the pension. The parameters are identical to those in "General" sheet. The user is asked to specify the parameters that apply to those who have switched to the mono-pillar PAYG or multi-pillar and those who have not and those that apply to those who did not switch. The parameters for those who do not switch do not have to be exactly the same as the original parameters, as reforms often impose some changes on those who remain in the old system as well. During the transition period, the actual replacement rates for new old age pensioners will be a weighted sum of these rates and the rates under the old system.

**Commutation**

The **Commutation** table requires similar inputs as discussed for commutation in "General" sheet. These parameters after reform will apply to both switchers and non-switchers.

**Pension Indexation**

The user is asked to specify the indexation of the PAYG pension. Note that there is no difference in the indexation between pensions of those who switched and those who did not. If the user feels that a distinction is necessary, a rough approximation may be achieved by changing the indexation in the year when all retirees are expected to be switchers. However, the indexation of maximum pension is allowed to be different for switchers and non-switchers. Usually, if those two classes of contributors contribute at different contribution rates having two different policies on maximum pension would be expected.

Lines **Pension Indexation to Inflation/Nominal Wage Growth**: The data entered for this variable reflects the indexation of pension payments to inflation/nominal wage growth. The data are required for both the base year as well as the end year. A value of 100% implies that pension payments are fully indexed to inflation/wage growth. Depending on country circumstances values could range from 0% (no indexation) to 100% (full indexation).

**Note:** Pension indexation to inflation is cheaper than nominal wage indexation when real wage is growing, since nominal wage indexation by definition, indexes to real wages as well as inflation)

Lines **Indexation of Commuted Pension Portion to Inflation / Nominal Wage Growth**: Commuted pension portion might be indexed differently than overall pension. For example, commuted pension portion might not be indexed at all, while overall pension might be indexed to inflation. Then if the initial pension is equal to $100, 30% of it is commuted and inflation is equal to 5%, then annuity pension payment the next year will be $100*1.05-$30 = $75.

Lines **Maximum Switcher / Non-switcher Pension Indexation to Inflation/ Nominal Wage Growth**: The data in these fields should be entered the same way as data for pension indexation above. This indexation is applied to the maximum pension initially specified by the maximum pension indexation rules before the reform, specified in "General" input sheet. After the old age is calculated, whether at the time of awarding the pension or at the time of indexation, it is checked if the resulting payment does not fall above the maximum pension. If it does, the payment of maximum pension is made to the pensioner instead.

<u>**WORKSHEET VIII: REFORM PENSION**</u>

This sheet allows the user to input age-specific parameters pertaining to the structural multi-pillar reform and complements those from "Reform General" sheet.

Columns **Percent of Switchers**: During a reform, not all age groups are treated alike. Frequently older age groups are left in the old system with all their benefits intact. In many cases, younger workers are given the choice of switching to the new system or remaining in the old system. New entrants up to a certain age at the time of reform and often the youngest groups of workers are generally only allowed to enter the new system. The parameters in this group allow the user to determine what the switching behavior will be. The user is asked for a switching pattern for each age group or an estimate of expected switchers as a fraction of the contributing population in each age cohort specified.

Cell **New Entrants up to Age**: Specify the upper age of new entrants who may become switchers or non-switchers as specified below in **Percent of Accrued Rights that is Recognized, Switchers / Non-switchers, Male / Female**. The age here is defined at the time of reform.

Cells **Contributors at Ages** 0 to maximum age indicate the ages of contributor cohorts, who are in the system at the time of reform. The range of ages can be increased or decreased by using buttons "I" and "D" located at the bottom of column **Age**.

In the cases of voluntary switching, it is possible and, in fact, recommended that after a particular switching pattern is chosen, the output be carefully reviewed to determine whether switchers' benefits are lower or higher than benefits for non-switchers retiring in a particular year. If non-switchers have substantially higher benefits than switchers, then few people are likely to switch in that age group. Conversely, if switchers have higher benefits than non-switchers, then more people are likely to switch in the age groups retiring in that particular year.

Columns **Initial Capital (Notional / Funded) As % of Avg Wage** are activated only if **Direct Initial Capital NDC / FDC** options are checked in the worksheet ReformGeneral. The average accrued (prior to the reform year) rights are calculated outside the PROST for each age and gender and entered into these columns as the starting amount of direct initial capital in the reform year.

**Percent of Accrued Rights that is Recognized, Switchers / Non-switchers, Male / Female** applies only to the accrued rights that are paid out as Notional Capital or as Recognition Bond (see description under Worksheet VII: ReformGeneral above). Accrued rights are also not always treated symmetrically across age groups and even within age groups, sometimes distinctions are made between those who switch and those who do not. The rationale is that older workers close to retirement have little ability to benefit from a new system and should be protected as much as possible from uncertainties imposed by the new system. Younger workers, on the other hand, may not value their pension benefits as much and have a longer working career to adjust to the

new system and could be protected less. Furthermore, those who switch to the new system, which might generate higher returns, may be willing to switch with little compensation for their old contributions.

The user is asked how much of accrued rights are going to be honored by the pension system (or actually disbursed) as a percent of the full value of accrued rights. This information is necessary for both switchers (those switching to a new pension system) and non-switchers (those remaining in the old PAYG pension system). Thus, for switchers, an entry of 30% in the age group 20-25 and an entry of 80% for the age group 50-55 would imply that 30% of the value of accrued rights would be paid to all switchers in the age group 20-25 whereas 80% of the value of the accrued rights would be paid to those contributors in the age group 50-55. It should be noted that paying 100% of accrued rights to younger workers might actually result in the affected workers receiving higher pensions than they would have under the old system since the financial markets may be more generous than the PAYG system. The honoring of accrued rights also affects the incentives of individuals to switch. The government may want to alter these incentives to manage the fiscal costs of transition to a funded system.

**Note:** Pensions already in payment are 100% protected. They are affected only by changes in indexation parameters after the reform.

Columns **Replacement Rates for Male/Female Switchers/Non-switchers:** The replacement rate ranges are identical to what was entered in the Pension Sheet, with replacement rates for new pensioners specified by age of retirement and gender for each year as a percentage of the economy wide average wage. The user is asked to specify replacement rates for switchers and non-switchers separately. The parameters for those who do not switch do not have to be exactly the same as the original parameters, as reforms often impose some changes on those who remain in the old system as well. During the transition period, the actual replacement rates for new old age pensioners will be a weighted sum of these rates and the rates under the old system.

Columns **Lump Sum Payments for Male/Female Switchers/Non-switchers:** The lump sum ranges are identical to what was entered in the Pension Sheet, with lump sums for new pensioners specified by age of retirement and gender for each year as a percentage of the economy wide average wage. The user is asked to specify lump sums for switchers and non-switchers separately. The parameters for those who do not switch do not have to be exactly the same as the original parameters, as reforms often impose some changes on those who remain in the old system as well. During the transition period, the actual lump sums for new old age pensioners will be a weighted sum of these parameters and the parameters under the old system.