ANNEX 2: THE SPSS PROJECT MODEL OF POPULATION, LABOR FORCE, AND PENSIONS IN ARMENIA

Introduction and Basic Concepts

The SPPS Armenia pension model consists of a set of linked Excel workbooks (linked in the sense that changing an assumption in one workbook may lead to a change in numbers calculated in another). What we call a model is, in fact, a series of *modules* consisting of individual workbooks.

The model has two main purposes:

- To project the likely evolution of the current pension system given the most likely evolution of fertility, mortality, migration, labor force participation and unemployment, the number of persons complying with mandatory social contribution rules, indexation of pensions, and all other relevant variables. By convention, a "most likely" scenario of this type is often called a baseline scenario.
- To make it possible to do "if – then" experiments in which one (or more) parameters or assumptions is changed. For example, if compliance were higher than in a baseline scenario, by how much would the balance of the Pillar I pension system move towards surplus? The counterfactual is commonly referred to as an alternative scenario. Alternative scenarios can amount to of simple sensitivity tests, in which only one assumption is changed (from the baseline), to broader depictions of a very different state of the world, in which many assumptions are different than they are in the baseline.

An extended version of the SPSS model takes the baseline-alternative scenario process one step further by making it possible to compare two different pension system structures – one in which the GOAM plan for pension reform is introduced by instituting a fully-funded mandatory second pillar, together with changes in the financing and benefit structure of the zero and first pillars; and one in which the current zero- and first-pillar systems remain unchanged. The scenario entitled "Reform_No reform" on the CD corresponds to this simulation. As far as we are concerned the "Reform" scenario is the baseline; it corresponds to what the GAM intends to do. The "No reform" scenario is an alternative, and by comparing the two we can estimate, among other things, the fiscal costs of reform and the impact on average pensions. The other scenarios presented on the CD are one in which the current economic crisis is hypothesized never to have happened, one incorporating an alternative pension indexation scheme, and one assuming a less fiscally costly reform.

Whether used for analyzing future trends, quantifying the impact of alternative sets of assumptions, or studying different structural approaches to pension provision, the purpose of the model is the same: to serve as a transparent tool generating quantitative estimates that can serve as a basis for policy discussions. The transparency aspect is the most important, as any model is credible only to the extent that its workings are accessible to and understood by its users.

A Few General Rules

First, copy all files into a directory named SPSSModBackup or something similar.

When working with a model as flexible and user-friendly as this one, it is a good idea to have one directory corresponding to each scenario – say, "Low Fertility," "Improved Compliance" or, as on the CD, "Lower Taxes," etc – that contains all model workbooks. The reason for this is to make sure that changes in assumptions made for one scenario do not "contaminate" another.

The fact that the SPSS model contains links between different worksheets requires the user to adhere to a certain amount of discipline:

- When files are saved in a new directory, links are automatically changed, i.e. the model "knows" that it is no longer looking for files in (say) the directory "Reform_No reform" but in the directory "Lower taxes." However, for purposes of comparing with the baseline, the Tables_Charts workbook will always be drawing in numbers from the Reform scenario in "Reform_No reform."
- When a workbook is loaded, you will be asked whether it should be updated using external links to other workbooks. Unless there is a good reason to do otherwise, just say, "Yes." When you close a workbook, you will be asked if you want to save the changes you have made. Again, unless there is a good reason to do otherwise, say, "Yes."
- If you make the slightest structural change to a workbook – say deleting or adding a line -- files that are not open at the time will have no way of "knowing" that you have made this change. When you load another file and update, it will go to the old, pre-change cell references in the workbook you have altered, typically with serious consequences.
- The same goes for changes in the names of workbook or worksheets (the "sections" of workbooks). Any file not open at the time you make the change will have no way of "knowing" what has happened.
- The SPSS model has many dimensions – age, sex, economic sector, formal / informal sub-sector, and rural / urban residence. As a result, workbooks are large; they cannot all be loaded simultaneously. It is not feasible to simply load all workbooks at the same time and rely on Excel's automatic update features to make required model-wide changes when any single module is changed is not feasible.
- Workbook cells are color-coded:
    - Green cells contain data which you, the user, must enter. Sometimes these represent historical data and there is no reason why you would want to change them. Other times, they represent assumptions for future years that you must make in order for the model to solve.
    - Turquoise blue cells contain parameters or assumptions imported from another worksheet or workbook. There is no reason for you to touch them. Often, these data are imported from the worksheet "Notes," which is the first worksheet in every workbook. "Notes" contains assumptions as well as the calculation of basic parameters that are required by other worksheets in the workbook. It often also contains some information on the sources of data.
    - Yellow cells are automatically calculated by the spreadsheet. There is no reason for you to touch them. Note that sometimes a line of cells is yellow for the historical period but green or turquoise for the projection period. Similarly, cells may be green for the historical period but yellow or turquoise for the projection period.
    - In addition in some spreadsheets there can be cells with other colors which are just a guide to show to a user that since that year or for this particular indicator the assumptions are changed or the calculation rules are changed.

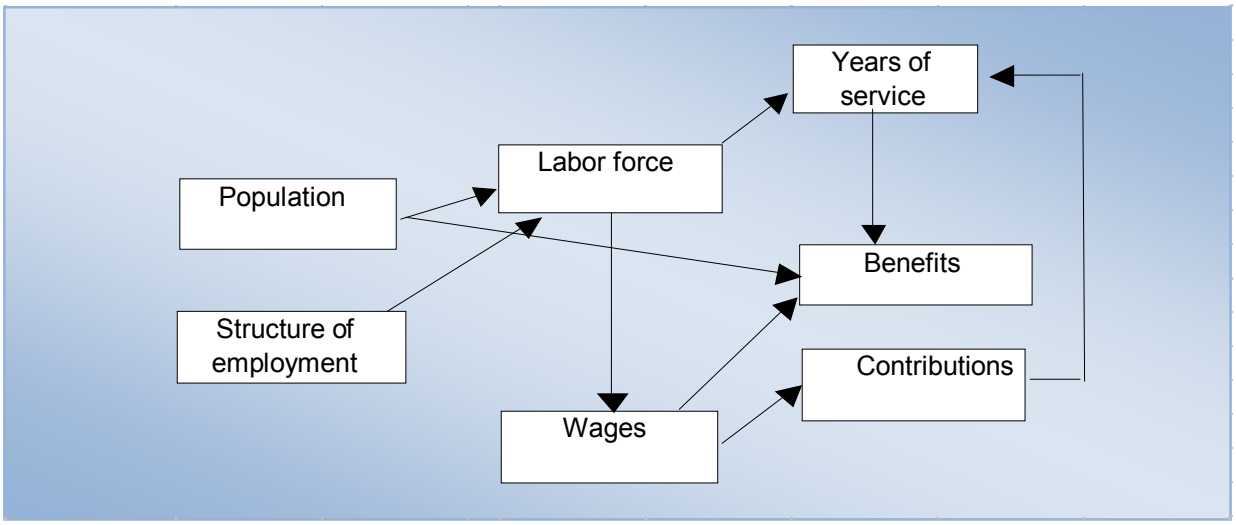
We often refer to "worksheets" inside a workbook. To switch between these, click on the tabs at the bottom of your screen.

Model Summary

The workbooks comprising the model are contained in the directory "Reform_No reform," where workbooks model the pension system in its present form and as it is planned to be under the current reform plan. The files in a different directory, "Indexing" or "Lower Taxes" permit the user to simulate the effects of introducing different indexation rules for pension calculation or for putting a lower income tax on wage incomes.

The following schematic roughly summarizes the structure of the model:

Table 1: The SPPS model: an overall schematic



- The workbook "Structure of employment" breaks down all employment, whether formal or informal, into economic sectors.
- "Population" performs a cohort-component projection of the population, on the basis of the 2001 Census, by single-year age group, sex, and urban-rural residence. In "Population," separate worksheets deal with the urban and rural population.
- Based on the population projection, "Labor force" – actually two workbooks, "Labor force urban" and "Labor force rural" -- calculates labor force and employment (thus, unemployment as well) by single-year age group, sex, and urban-rural residence. It applies the distribution from "Structure of employment" to allocate employed workers across economic sectors. Based on assumed "informality rates," i.e. the proportion of employed persons in a given economic sector who are informally employed), it splits employment into formal and informal employment.
- "Wages," which like "Labor force" consists of separate urban and rural workbooks, estimates nominal wage rates based on recent data; it also imposes assumed male-female and formal-informal (but not urban-rural) wage differentials if desired. Assumptions regarding increase in wage rates are described below, but basically the evolution of wages is taken to follow the evolution of GDP per capita. Wage rates times number of persons employed gives the wage bill.
- The formal sector wage bill is the basis for mandatory social contributions, which are calculated in "Pillar 0_1 Cont." and "Pillar 0_1 Cont. with Reform" files. In order to estimate these, we make assumptions on the compliance rate, i.e. the proportion of formal sector workers who actually make the required contributions). We also adjust downward for under-reporting of income. Separate worksheets within the workbooks deal with urban and rural areas. The "Pillar 0_1 Cont. with Reform" workbook calculates the contribution rates according to the current GOAM pension reform plan that includes a 26% Unified Income Tax

and 5% Individual fully funded contributions. 5% of the Unified Income Tax is assigned to Pillar II, leaving 21% to finance the zero and first pillars.

- Each year that a worker is employed in the formal sector and making required social contributions, he or she accrues one year of contributory service in the Pillar I system. The workbooks "Years of service rural" and "Years of service urban" estimate the number of years of contributory service accumulated by single year age group and sex. When a worker becomes a member of the reformed system, he or she ceases to accrue additional Pillar I rights, but maintains those earned prior to being absorbed into the new system.
- When a person reaches age 63 and retires, first, either he or she is or is not entitled to an old-age insurance benefit. We estimate the number of persons qualifying, i.e. the number of new entrants into the old-age insurance beneficiary pool. In point of fact, the current minimum contributory period is so low that virtually everyone qualifies; this may decline in the future, however, as one of the features of the reform is to increase the minimum contributory period from five to ten years. The size of the benefit that those qualifying will receive in a given year (say 2010) will depend on the basic benefit prevailing in 2010, the number of years of Pillar I contributory service accrued when they retired (which may be some years prior to 2011) and the value attached in 2010 to each one of those contributory years. In "Pillar 0_1 Ben," and "Pillar 0_1 Ben with Reform" we perform all the required calculations, estimating the number of persons reaching 63 each year who are eligible for a Pillar I old-age insurance pension and the size of the pension they are entitled to. We then "survive" them forward in time, each year adjusting the pension they receive based on the changing value of the basic pension and a year of accrued pension rights. As we assume that the both components of the pension are indexed to the Consumer Price Index as now called for in the GOAM plan, the workbooks "Wages" are also relevant to these calculations. In "Pillar 0_1 Ben," and "Pillar 0_1 Ben with Reform" we also calculate, based on "Population" and recent National Statistical Service data, the number of persons entitled to other types of pensions. These include labor and social disability pensions, special pensions (privileged, partial privileged and long service), insurance and social survivors pensions, and finally the old-age social pensions.
- Further modules are used to simulate the proposed Pillar II of the pension system of Armenia according to the GOAM plan and the draft laws prepared by the PRIWG. The "Pillar II Cont" workbook contains worksheets on urban and rural formal sector employees who participate in the mandatory Pillar II system. We assume that, in 2011, all formal sector workers up to age 39 are included, in 2012 all formal sector workers up to age 40, and so on going forward. This represents a simplification, as in reality it is likely that persons over 40 who wish to join voluntarily will be allowed to do so. The fully funded contributions to the Pillar II system are calculated as 10% of the wage bill for both male and female based on the current pension reform plan, in which 5% of gross wages are contributed directly into Pillar II and an additional 5% is paid in by the state, financed by the Unified Income Tax..
- The "Pillar II Accum_ Ben" workbook simulates data on accumulated fully funded contributions of those who participate in the mandatory Pillar II scheme and benefits paid out once they retire at age 63.

That, in a nutshell, is the SPSS model as it applies to the zero, first and second -pillar pension systems in Armenia.

The remainder of this manual goes through the SPSS model workbook by workbook.

Population and Demography

The workbook "Population" performs a standard cohort-component projection of population by sex, rural-urban residence, and single-year age group (0-1 to 100+).
"Population" projects population using a standard cohort-component methodology. Here is how.

Fertility:
The worksheets "Fertility_Urb" and "Fertility_Rur" contain assumptions on age-specific fertility rates (ASFRs), i.e. the number of babies born per woman, by age). Following convention, we use five-year

age specific fertility rates for women aged 15-19, 20-24, and so on up to 45-49 (see Lines 137-143 of the worksheets).

For 2001-2005, we rely on age-specific fertility rates used in the Demographic Yearbook of the National Statistical Service of the RA. In the worksheet "Notes," these are given for 2001 in Lines 130-36, for 2002 in Lines 140-46, and so on. The Demographic Yearbook gives age specific fertility rates for all of Armenia. In order to disaggregate urban and rural, we use differentials calculated from age specific fertility rates presented in the *Demographic Yearbook 2006*[1] (see Lines 182-90).

In the worksheets "Fertility_Urb" and "Fertlity_Rur," age specific fertility rates by five-year age group for 2001-2005 are shaded turquoise to indicate that these have been copied in from "Notes." The total fertility rate (TFR) in Line 145 of the two worksheets is calculated based on age-specific fertility rates. The TFR is a synthetic index which tells us the number of babies that a hypothetical woman would have if she lived from age 15 to 49 experiencing childbirth at the age-specific fertility rates observed in that year. The TFR cells for 2001-2005 are shaded yellow to indicate that these are calculated based on the values in other cells.

For the years 2006-2035, we rely on projections of the TFR and calculate age-specific fertility rates assuming that the age pattern of fertility observed in 2001 remains constant over time. The path of the TFR (see "Notes," Lines 197-217) is consistent with a return to replacement level fertility in 2035. After 2035, the TFR is assumed to remain constant at replacement level.

Having estimates and projections for age-specific fertility rates at 15-19, 20-24, etc., we now want analogous rates by single year age group. In "Fertility_Urb" and "Fertility_Rur" Lines 5-44 we follow the expedient of assuming that the five-year age-specific rate (which is the female population-weighted average of single-year age specific rates) applies to each single-year age group within the five-year range. For example, the age-specific rate at 20 is equal to the age specific rate at 21, 22, 23, and 24; all of them being set equal to the age-specific rate at 20-24 estimated as described above.

Births to women by single-year age group are calculated as the number of women in that age group multiplied by the age-specific fertility rate; these are then split into male and female births using an assumed constant sex ratio at birth. These calculations are made in Lines 48-131 of the worksheets "Fertility_Urb" and "Fertility_Rur."

Mortality:
The worksheets "Mortality_Urb" and "Mortality_Rur" contain estimates and projections for age-specific death rates (ASDRs) by sex. The *Demographic Yearbook 2006* gives number of deaths by sex and age for the age groups 0-4, 5-9, and so on up to 85+. Since these are not disaggregated by urban-rural residence, we have made the assumption that urban and rural mortality rates are the same, while retaining the same urban-rural worksheet structure in case data later become available.

The implied ASDRs, calculated in Lines 41-78 of "Notes," are copied into Lines 427-67 of "Mortality_Urb" and "Mortality_Rur." As in the case of fertility, we assume that the five-year age-specific death rates obtain at each of the single-year ages in the relevant range (e.g., death rates at 20, 21, 22, 23, and 24 are all assumed to be equal to the observed death rate for persons aged 20-24), except for in the terminal 85+ age group. For age 85, 86, …, 100+ the ad hoc estimates in Lines 83-98 of "Notes" were used. As a check, these were applied to the estimated population by single year age group over 85 and it was confirmed that the resulting ASDR(85+) was close to the one reported in the Demographic Yearbook.

[1] We use the Demographic Yearbook of 2006 as the time we were developing the model that was the latest year the Yearbook was published. Later, we have changed the historical data for number of employed and contributions, as well as pensions paid out, but we did not change the historical data in the population spreadsheets as model assumtions for years 2006-2007 were very close to actual data.

Just as we base projections of ASFRs on assumed changes in the TFR index, we base projections of changes in ASDRs on assumed changes in the life expectancy at birth. This synthetic index, often written E0, is the number of years that a hypothetical person would live if he or she were born and aged experiencing the age-specific death rates observed in a given year. In 2001, E0 in Armenia was 73.3 for both sexes combined (69.6 for men and 77.0 for women). If E0 increases by 1 year every decade (based on international experience) by 2050, this would bring it to 78.6 (75.1 for men and 82.2 for women). Five-year ASDRs are given in Lines 427-67 of "Motality_Urb" and "Mortality_Rur"; the breakdown into single-year age groups is in Lines 5-210. In Lines 217-422, urban and rural deaths by sex and single-year age group are calculated. The male and female life expectancies implied by ASDRS are calculated (for checking purposes only) in Lines 474-678.

Internal Migration:
The worksheet "Rur-Urb-Migration," which has exactly the same structure as the mortality worksheet, contains sex- and age-specific urban-rural migration rates (net rural-urban migration in a given year expressed as a proportion of the rural population). These are currently set equal to zero.

International Migration:
The worksheets "Int_Migration_Urb" and "Int_Migration_Rur" have the same basic structure and calculate the number of net emigrants (persons leaving minus persons arriving) by age and sex. For males aged 15-59, the net international migration rate (number leaving minus number arriving as a proportion of population) is set equal to –4.4 per 1,000 in both urban and rural regions. International migration of women and of males aged under 15 and over 59 is assumed to be zero.

Projecting population:
The base-year population by single-year age group is taken from the 2001 population census of Armenia. In the 2006 Demographic Yearbook, the terminal age category is 85+. The ad hoc distribution of population over 85 shown in the worksheet "Notes" (Lines 12-27) is used to fill out population by single-year age groups up to the terminal category of 100+.

The worksheets that project population forward in time are "Pop_Urb" and "Pop_Rur." In a given year, the population aged 0-1 is taken as the number of births (calculated in "Fertlity_Urb" and "Fertility_Rur"). For all age single-year age groups 1 and above, taking the male urban population as an example:

```
Pop_Urb_Male(a,t)  = Pop_Urb_Male(a-1,t-1)
                   - Deaths_Urb_Male(a-1,t-1)
                   + Rur_Urb_Migration_Male(a-1,t-1)
                   + Int_Migration_Urb_Male(a-1,t-1)
```

The worksheet "Pop_Tot" simply aggregates urban and rural into nationwide population.

Labor Force

The labor force lies at the heart of the SPSS model, not only in its own right, but because the nature of the labor force determines the number of persons making mandatory social contributions, the number of participants in the fully funded Pillar II system, the number eventually qualifying for social insurance benefits and funded annuities, and the level of benefit to which they are entitled.

In the workbooks "Labor force urban" and "Labor force rural," active labor force, unemployment, employment, and employment by major economic sector are calculated by age and sex. Base data from the 2001 Census are given in the worksheet "Notes." The five-year age-specific labor force participation rates (ASLFPRs) for men and women in columns H and I are copied into Lines 425-467 of the worksheets "LF_Urb" and "LF_Rur." The initial age group for labor force participation is 15-19 and the terminal age category in published Census data is 65+. We make the simplifying assumption that labor force participation rates are constant above age 65. Lines 4-209 of the "LF_Urb" and "LF_Rur" worksheets contain ASLFPRs by single-year age groups, estimated by

assuming that single-year rates within broad five-year age groups are the same (and similarly for the terminal 65+ age category).

We make the assumption that age- and sex-specific labor force participation rates remain constant moving forward in time, an assumption that can easily be varied. Lines 215-420 calculate labor force as the product of single-year ASLFPRs and population from the worksheet "Population."

The worksheets "Unempl_Urb" and "Unempl_Rur" are analogous to "LF_Urb" and "LF_Rur." Base-year (2001) unemployment rates for men and women by five-year age groups are copied in from "Notes" and single-year rates are estimated based upon them. In the case of published unemployment data, the terminal age category is 70+.

Whereas we assumed labor force participation rates to be constant over time, we know from recent history that unemployment rates have declined, leading us to believe that they will probably be yet lower in the future. We implement this by making assumptions regarding aggregate unemployment rates for men and women (i.e., total unemployment as a proportion of total active labor force) and then applying the trend to age-specific rates. This is similar to the approach that we took in dealing with fertility and mortality.

In cells B445 and B469 of the worksheets, aggregate unemployment rates for men and women in 2001 are calculated by dividing the total number of unemployed by the total active labor force. For years 2002 and beyond, the worksheet calls for assumptions to be made on the aggregate unemployment rates. To reflect the increase in unemployment during the years of crises the assumptions for unemployment rates in lines 444 and 468 of Unempl_Urb and Unempl_Rur worksheets were slightly modified for years 2009-2011. Afterwards since 2012 we have assumed declines through 2023 and then constant levels thereafter (at 10% for men and 15.5% for women). The proportional year-on-year changes in the unemployment rate are then applied to each age-specific rate in Lines 429-443 (men) and 453-67 (women). This is equivalent to assuming that, whereas the total unemployment rate may change, age structure of the unemployed population will remain the same.

The active labor force minus the number of unemployed persons gives the number of employed persons. We divide employment into eight economic sectors, given in the accompanying table. The workbook "Structure of employment" contains calculations on the sectoral breakdown of employment based on the 2001 population census. In the respective sector worksheets of "Labor force urban" and "Labor force rural," these shares are applied to employment by age and sex to calculate employment by economic sector by age and sex. Economic sector shares, assumed to be constant over time, are copied into Lines 4 and 5. In Lines 13-219, these shares are multiplied by total employment to calculate the number of persons employed in a given economic sector by age and sex. Lines 7 and 8 contain assumptions on the share of employees in a given sector who are in formal employment – i.e., who have a labor contract and are therefore subject to compulsory social contributions. These sub-sector shares are subjective, but when all are aggregated together, they result in a total formal-sector share that matches estimates made by other analysts for the urban and rural economies taken as a whole. To reflect the increase in number of contributors for years 2007 and 2008 and also an assumed decline in formality during the crisis year 2009, with gradual increase after 2010, lines 7 and 8 were modified. These modifications were done in worksheets Empl_Urb_ID and Empl_Rur_ID; Empl_Urb_CO and Empl_Rur_CO; the remaining branches are only modified to reflect increase in number of contributors for years 2007 and 2008. All these assumptions are based on official data received from SSSS on the number of contributors for years 2007 and 2008 and also the National Statistical Service of the RA assessment on economic decline in industry and construction for years 2009. In Lines 225-644, male and female informal and formal sub-sector employment in each economic sector is calculated. The worksheets "Empl_Urb_Tot" and "Empl_Rur_Tot" sum across sectors to give total urban and rural employment by age, sex, and formal / informal sub-sector.

Sector	Abbreviation
Agriculture	AG
Industry	ID
Construction	CO
Transport	TR
Wholesale and retail trade	WR
Social services (health, education)	SS
Public administration	PA
Other services	SV

Wages

Wages, differentiated by sex, economic sector of employment, formal / informal sub-sector, and urban/rural residence, are estimated in the workbooks "Wages urban.xls" and "Wages rural.xls." These are the largest spreadsheets in the model.

The foundation for wage estimation consists of assumptions made about real GDP growth and inflation as measured by the GDP deflator. The GDP deflator (2000: 100) is the only price term in the model; there is no wage deflator or consumer price index (CPI). Assumptions for growth of real per capita GDP and the GDP deflator are entered in Lines 18 and 20 of the worksheet "Notes" in the workbooks "Wages urban.xls" and "Wages rural.xls." The rate of population growth, copied in from the worksheet "Population," is added to the assumed per capita GDP growth rate to calculate the rate of growth of aggregate GDP (Line 17).

A key assumption, entered in Line 12, is the difference between the rate of growth of the average (economy-wide) real wage rate and the rate of growth of real per capita GDP. We have assumed that the average real wage rate grows 0.5 percent per year faster than real GDP per capita through 2025, after which, it grows at the same rate.

Finally, Line 24 of "Notes" contains an assumption on the full-time equivalent factor; while we have set this equal to 100 percent throughout the time period covered, the model allows the flexibility to build in the fact that not all employed workers work full time.

The overall assumptions in "Notes" are then built into each economic sector in the AG, ID, … SV worksheets of the workbooks "Wages urban" and "Wages rural." The average nominal wage rate in each economic sector is available from data in the *Statistical Yearbook 2006* through 2005. We do not have separate data for urban and rural regions, so we assume that there is no wage differential, i.e., we use the same average nominal wage rate for urban and rural regions. In Line 6 of each economic sector worksheet, we project the sectoral average nominal wage rate forward using the growth rate of the economy-wide average nominal wage rate copied in from "Notes." This means that we assume that economic sector wage differentials observed in 2005 (the last year of hard data) remain the same in proportional terms.

The model allows for building in assumptions on two wage differentials in each economic sector – between men and women and between the formal and informal sub-sectors. These differentials are expressed as "multipliers" in Lines 11 and 12, where we (arbitrarily) take the female nominal wage rate and the informal nominal wage rate as numéraires. The interpretation of Lines 11 and 12 is that we assume males in the economic sector earn 20 percent more than females and that the average nominal wage rate in the formal sub-sector of the economic sector is 10 percent higher than it is in the informal sub-sector. We make the same assumptions regarding these differentials in all eight economic sectors, although we are not bound by this simplifying assumption.

At this point, we have an accounting consistency problem to solve. In "Labor force urban" and "Labor force rural" we have estimated the number of male and female, informal and formal sub-sector employees in each economic sector. The weighted average of these labor force totals and the

corresponding nominal wage rates must, by definition, be equal to the average nominal wage rate for the sector. But we have calculated the average nominal wage rate for the sector separately, based on the growth rate of the average economy-wide nominal wage rate. In order to force consistency, we invoke a standard modeling trick in the form of a "squasher." In Lines 17-20 of each economic sector worksheet, we calculate male and female, formal and informal sub-sector nominal wage rates according to the sector male-female, formal-informal wage differentials assumed. Line 17 calculates the sector-wide average nominal wage rate given these wage rates and the structure of the labor force in the sector that emerges from "Labor force urban" and "Labor force rural." In Lines 24-27, we "squash" these wage rates in Line 17-20 to enforce consistency.

We do *not* build in an assumed age-wage curve according to which wages earned vary by age and, implicitly, years of experience. The reason is simple: we already have four wage rates in each sector (male and female, formal and informal); building in an age-wage curve would multiply this to about 350, each needing to be squashed to ensure consistency.

The many remaining lines in each economic sector worksheet of the workbooks "Wages urban" and "Wages rural" calculate total wages paid to male and female, formal and informal sub-sector workers in the sector. Finally, the worksheets "Wages_Urb_Total" and "Wages_Rur_Total" calculate total wage bills (across economic sectors) for males and females in the formal and informal sectors.

To reflect the Ministry of Finance's latest assumptions on changes in real GDP growth and the GDP deflator for years 2009-2011, the lines 18 and 20 in Notes worksheet were modified. Line 6 was updated with the latest NSS RA data on average nominal wage for June 2009.

Zero-First-Pillar Pension System Contributions

The social contributions to the Pillar 0-I PAYG system are modeled in two workbooks: "Pillar 0_I Contr" and "Pillar 0_I Cont with Reform." The latter includes also individual contributions to the fully funded Pillar II system. The logic of contributions to Pillar I is similar in both workbooks. However the difference in numbering of lines is resulted when the lines for modeling fully funded contributions are added in "Pillar 0_I Cont with Reform" workbook.

The worksheets "Contributors_Urb" and "Contributors_Rur" calculate the number of persons making mandatory social contributions to the Pillar I system. In "Notes," the number of contributors in 2005 (from SSSS) is divided by the number of persons employed in the formal sector (imported from the worksheets "Labor force urban" and "Labor force rural" to calculate average male and female compliance rate – average over all age groups (15+), over urban and rural regions, and over sectors of employment. The (roughly) first 200 lines of "Contributors_Urb" and "Contributors_Rur" worksheets in both workbooks calculate total formal sector employment by sex. The next (roughly) 200 lines copy in or calculate age- and sex- specific compliance rates. For 2001-2005, these simply replicate the estimates based on the calculation made in "Notes." For 2006 and beyond, the user enters a number for the average sex-specific compliance rate (in Lines 319 and 424). Age-specific rates are calculating using the implied proportional change from year to year; all this does is to enforce the assumption that all age specific rates are equal to the assumed average. Note that compliance rates under age 15 are assumed to be zero; there is no reason for the user to change this assumption. The worksheet "Contributors_tot" simply sums urban and rural contributors by age and sex.

To line up with the official data on contributors for years 2005-2008 we have performed certain modifications in the respective spreadsheets as follows:

- Lines 319 and 424 in Contributors_urb and Contributors _rur sheets in both workbooks are modified to increase formality by 0.5% every year up until 2029, after which it is kept constant.;
- It is assumed that no one aged 15 to 19 is in the formal sector (green colored column F for lines 233-238 and 338-343)

- For employed persons aged 40+ the formality rate has been increased to line up with actual number of contributors submitted by SSSS for years 2005, 2006 and 2008 (modified columns are in pink).
- Contributors Tot sheet lines 6 and 7 column H and I present the official data on contributors and difference between official and model data. Blue colored columns show the participants in the second pillar.

In Line 3 and 10 (corresponding to men and women, respectively) of the worksheets "Contributions_Urb" and "Contributions_Rur" we calculate the average contribution to the Pillar I system. From 2001-2005, we do this by applying the following social contribution formulae:

Employer: Contribution = AMD 7,000 + [0.15 * (Gross Wage – AMD 20,000)]

Employee: Contribution = 0.03 * Gross Wage

The 3% assumption for the employee contribution is the current rate entered in Line 6 for men and Line 13 for women (Line 18 in Pillar 0_I Cont with Reform worksheet). For gross wage, we import the average gross formal sector wage rates calculated in "Wages urban" and "Wages rural" workbooks.

In Lines 4 and 11, for 2001-2003 we calculate employers' implied average mandatory social contribution rate, dividing the calculated average employer nominal contribution by the average nominal gross wage. In 2004 and thereafter, we invert the approach: we make an assumption regarding the average employer contribution rate and calculate the average nominal employer contribution (Line 5 for men and Line 12 (17) for women) as the assumed rate multiplied by the average gross wage. The main reason for this inversion is that the current employer contribution calculation formula is always adjusted by inflation and the growth of real wage and has been changed in 2007, 2008 based on the changes in the minimum wage. In addition with introduction of the Unified Income Tax after 2011 the total wage tax will amount to 26%, plus 5% paid in directly to the fully funded Pillar II system as reflected in the "Pillar 0_I Contr. With Reform workbook.[2] Lines 11 and 21 show the 5% contribution rate to the Pillar II system. To repeat and emphasize: over the projection period, the average employer and employee contribution rates represent assumptions based on current reform plans.

It is no secret that, not only do many persons evade making any mandatory social contributions at all, but many of those who do under-report income. Lines 7 and 14 allow the user to make an assumption of the extent of this by entering an "evasion factor" defined as the proportion of owed contributions that are actually made (by those who have not evaded the system altogether; we have already built that assumption into the worksheets "Contributors_Urb" and "Contributors_Rur") in both workbooks on contributions.

Lines 8 and 13 in these spreadsheets of Pillar 0_I Cont workbook sum the employer and employee contribution rate, then multiply by the evasion factor, to calculate average effective male and female contribution rates, again for those who are not evading mandatory social contributions the system altogether. Once reform is introduced 5% from total 26% contributions of employees and employers paid to the Pillar I system are allocated to Pillar II system. Thus lines 13 and 25 in the "Contributors_Urb" and "Contributors_Rur" worksheets in the "Pillar 0_I Contr. With Reform workbook present the old system contribution rates after transfer to the fully-funded Pillar II system. These worksheets contain also individual contributions to Pillar II accounts for both male and female (lines 243 and 351).

[2] For non reform scenario we do, however, assume that the 3 percent employee contribution rate remains the same, although the assumption can of course be changed.

The remaining lines of the worksheets "Contributions_Urb" and "Contributions_Rur" calculate contributions by age and sex, and these are summed in "Contributions_Tot." worksheets in both workbooks. Contributions to the fully funded Pillar II system are colored in aqua, while participants in the fully funded system are colored in blue in the Contributors Tot worksheet.

First-pillar (and zero-) Pension System Benefits

As benefits are calculated according to years of contributory service, the first worksheets we will be concerned with are "Years of service urban" and "Years of service rural."

There is no real substitute for tracking each single-year age cohort through its lifetime labor market history, cumulating for each year the insured accrual credit gained. In order to do this, we need to "backcast" far into the past using rule-of-thumb estimates. Fortunately, results moving forward are not terribly sensitive to the assumptions that we make about the past.

For example, consider a woman reaching 63 in 2001. Her estimated years of contributory service would be:

Pr (the woman was employed in formal sector aged 15 in 1953) x first-pillar compliance rate in 1953

plus

Pr (the woman was employed in formal sector aged 16 in 1954) x first pillar compliance rate in 1954)

…

plus

Pr (the woman was employed in formal sector aged 62 in 2000) x first-pillar compliance rate in 2000

plus

Years credited for military, maternity, and higher education

For a woman reaching age 63 in 2010, the accumulation would begin in 1964 rather than 1953, and so on. Note that we deal with single year age cohorts rather than individuals, so we are speaking of the *average woman* reaching 63 in the given year.

In order to apply this approach, we need to "backcast" formal sector employment rates and first-pillar compliance rates, that is, the proportion of formal sector workers who actually contribute as required (albeit perhaps not in the amount required). We do this according to the simple set of rules given in the following box. In a nutshell, we assume that levels of informality and unemployment observed in 2001 applied throughout the period 1989-2000 and that in prior years there was no unemployment and no informality.

These calculations are done in the workbooks "Years of service urban" and "Years of service rural," each of which consists of only one worksheet. Lines 2 and 3 of the worksheets contain assumptions on the proportion of male and female employees who work in the formal sector. From 2001 forward, these are copied in from the workbooks "Labor force urban" and "Labor force rural," hence, these cells are shaded in turquoise. For 1989-2000, assumptions are set equal to their level in 2001 hence these cells are shaded yellow. From 1926-1988, assumptions must be entered manually, so these cells are shaded green.

Lines 5 and 6 contain assumptions on men's credit for military service and higher education and women's credit for maternity and higher education. We assume 2 years' credit for both sexes throughout the time period covered.

Assumptions underlying estimates of years of contributory service				
		1988 and prior	1989-2000	2001 -
Labor force participation rate		As in 2001	As in 2001.	2001 Census data by age, sex, and rural-urban residence; assumed constant moving forward.
Unemployment rate		*Nil*	As in 2001.	2001 Census data by age, sex, and urban-rural residence; adjusted to reflect Labor Force Survey data 2002-2007 and adjusted downward moving forward.
Proportion of employed in formal sector		*Nil*	As in 2001.	Authors' estimates by economic sector (agriculture, industry, etc.); same for all ages, men and women, urban and rural.
Proportion of formal sector employed complying		All	As in 2001.	2008 SSSS data for males and females (urban and rural combined, all ages taken together).
Years of credit for military, maternity, and higher education		2 years credit for all men and all woman, whatever year they retire.		

Lines 10 through 110 give, year by year and by single-year age group, the number of years of formal sector employment accumulated by men. For 2001 and forward, this is calculated based on data imported from "Labor force urban" and "Labor force rural." In Year t the number of years spent in formal sector employment accumulated by a person aged "a" is:

Labor force participation rate (A,t) x [(1 – Unemployment rate (A,t)] x Proportion of employment in formal sector in year A

where the labor force participation rate and unemployment rate are age-indexed but the proportion of all employment that is in the formal sector is not.

For 1989-2000, formal-sector employment accrual is assumed to be the same as observed in 2001. For 1926-1988, we assumed zero unemployment and no informality (so that the number of years of formal-sector employment accrued is equal to the labor force participation rate).

Lines 111 and 217 give the number of years of formal sector employment that would be accrued by an average person who survived to 100 according to the labor force participation, unemployment, and formal – informal sector breakdown of employment in a given year. Clearly very few people survive to 100, and this is for informational and tracking purposes only. Of more interest are Lines 221-226

and 230-235, which give the average number of years of formal sector employment accrued by the average man and woman aged 60, 61, 62, 63, 64, and 65.

Years of formal sector employment history is only half the story; we need to know how many years of contributory history were accrued. In Lines 239-339 (man) and 344-445 (women), we multiply years of formal sector employment by compliance rates imported from the workbook "Pillar 0_I Contr" (where they were assumptions). From 1989-2000 we assume that compliance rates were equal to their 2001 level; previous to that, we assume that there was universal compliance (as well as coverage).

Lines 340 and 446, for tracking purposes only, show the number of years of contributory history that would be accrued by a person who survived to 100 experiencing the labor force participation, unemployment, informality, and compliance rates estimated for that year.

Of more importance are lines 450-455 (men) and 460-465. These give the result we are after; the average number of years of contributory history accrued by a member of the single year age cohort retiring in that year. This is a "backward looking" variable; it builds in the entire labor market history of the cohort between the ages of 15 and retirement. While we focus on retirement at 63, we provide estimates for ages 60-65. Lines 456-457 and 466-467 are of interest later when we simulate the transition to a different pension system, because these divide years of accumulated contributory history into years accumulated under the pre-reform Pillar I and years accumulated under the post-reform Pillar II systems. To line up with the GOAM pension reform plan when years of contributory service reach 25 in lines 453 and 463 we keep it constant.

Having estimated years of contributory history, we are in a position to estimate benefits according to the prevailing formula. This is done in the workbook "Pillar 0_I Ben" for the unreformed Pillar I system and "Pillar 0_I with Reform" for the reformed Pillar I system. Since these workbooks are constantly using population date, we put a worksheet at the end, "Pop_Tot" that simply imports population data from the workbook "Population." That way, worksheets can import population data from within the workbooks.

Information from SSSS on the level and structure of benefits as estimated (budgeted, actually) for 2007 are contained in the worksheet "Notes." Lines 6-14 give population in various age groups relevant for Pillar I benefit programs. In the following table, we specify these. Some are approximate, for example, there may be a few persons qualifying for special pensions before age 50. By and large, however, the table gives a reasonable picture of the target populations for various first- and zero-pillar pension programs.

Lines 19-26 give the number of beneficiaries as reported by SSSS in various age groups relevant for Pillar I benefit programs.

Lines 34-41 give the proportion of eligible populations receiving the benefit, as reported by SSSS; Lines 45-54 give the total benefits paid out, and Lines 58-64 give the average benefit level. Note the importance of always distinguishing between annual and monthly figures; these are always explicitly marked in the various spreadsheets but it is easy to get confused nonetheless! Lines 69-77 annualize the monthly figures calculated above. Finally, Lines 83-93 contain the calculation for an adjustment factor to years of service that we will discuss later.
Now we will go through the calculation of various benefit levels and payments. By far the most important of these from the standpoint of Pillar I finances is old-age insurance pensions. These are dealt with in the worksheet "OldAgeIns."

A crucial assumption is to be entered for old age insurance pension benefits in Lines 4-5 – the proportion of the population turning 63 that qualifies for an old-age insurance pension. We have assumed in our baseline that this proportion is 75% percent for men and 90% percent for women up until 2007. In 2007 the share of eligible population are taken from Notes, hence the turquoise shading. For years starting 2008 to 2011 we assume the same rates, while since 2012 with GOAM plan to

increase the eligibility years of contributory service from 5 years to 10 years between 2011 and 2015 we assume decreasing eligibility both for men and women. The decline in share of eligible population ceases in 2041 on the assumption that the generation turning 63 b y that time is one that faced lower unemployment and higher formality during their working years.

Lines 7 and 8 import average years of contributory service from "Years of service urban" and "Years of service rural." Since we do not have rural-urban disaggregated on benefits or contributions from Pillar I system, we aggregate the rural and urban years of service estimates into a weighted average using the shares 2/3 urban and 1/3 rural.

Line 9 contains an adjustment factor used to reconcile average years of service from "Years of service urban" and "Years of service rural" with average years of service estimated base on SSSS data. These are the calculations in Lines 83-93 of "Notes" referred to earlier. According to SSSS, in 2007 278,393 persons began to receive old age insurance pensions (we make the assumption that this was at age 63) with 26 or more years of contributory service while a little more than 50,000 retired with less than 26 years of contributory service. The first group retired with a pension of about AMD 15,482 per month while the second group retired with an initial benefit of about AMD 8,394. Because we have the Pillar I old age pension benefit formula, we can use this to assume that the first group retired with an average of 37.9 years of contributory history while the second group retired with an average of14.1 years of contributory history. Because we have the shares, we can "back out" that the average person who began receiving an old-age pension benefit in 2007 did so with 34 years of contributory history. "Years of service" estimates an average contributory period of about 27.5 years, suggesting that we should impose an upward adjustment of 6.5 years in 2007 in order to line up. All of these calculations are approximate and, for simplicity, we apply an upward adjustment of 5 years over the entire period of model calculation. It is important to note that, given the fact that the basic pension is so high as compared to the accrual component the size of the adjustment will not make much difference to the calculated pension. Lines 11 and 12 contain the final calculated years of service at retirement, starting at about 34.2 for men and 28.9 for women in 2007. Lines 11 and 12 in the "Pillar 0_I _Ben with Reform" workbook were modified to show declining years of service in Pillar I after 2035 when the first stream of pensioners participating in Pillar II will retire. Starting from the year 2043 the years of service in Pillar 1 go down to 0 for those who were aged 25 at the year Pillar II was introduced.

Lines 14 and 15, like Lines 11 and 12, are crucial to the calculation of pensions. Line 10 contains the basic pension, i.e. the component of the old-age insurance pension that is not related to years of contributory service). Line 15 contains the accrual value of a single year of contributory history. Lines 14 and 15 in the OldAgeIns spreadsheet in both workbooks are modified to reflect the GOAM plan on basic pension and average pension through 2021 and social pension for 2021. These modifications are linked with lines 23 and 24 which are our assumptions for faster increase in basic pension and the accrual factor as compared with CPI.

For 2001-2009, these figures are historical. For 2010 and beyond, they are calculated by multiplying the previous year's parameter by an indexation factor, given in Line 20 for the basic pension and 21 for the service-related component. We discuss the calculation of the indexation factor in a moment; for the moment, what is important to keep in mind is that the indexation factor, and the basic pension / accrual value of a year's service are both in nominal terms.

Lines 17 and 18 simply replicate, for tracking purposes, the average monthly benefit for a person retiring in year t at age 63 as calculated in Lines 757 and 864.

The nominal indexation factors in Lines 20 and 21 are calculated with reference to the growth of the nominal formal sector wage rate, calculated in Line 25 based on the average (over men and women, urban and rural) formal sector wage rate. This is calculated, in turn, based on data imported from the workbooks "Wages urban," "Wages rural," "Labor force urban," and "Labor force rural"; hence the turquoise shading. In our baseline scenario both basic pension and service-related component are indexed to inflation (CPI) as now called for in the GOAM plan.

Line 28 calculates the monthly total old age insurance pension benefits paid out to men and women; Line 29 multiplies by 12 to annualize this. Lines 31-32 calculate average male and female monthly pensions by dividing the monthly total by the number of pensioners.

We now have a line-up or consistency issue. By the mechanisms described above, we will have calculated average male and female old-age pensions in 2007. But SSSS has reported its budgeted estimates of the average male and female old-age insurance pension in 2007. To force consistency, we compare the average pension calculated with the model in 2007 to the average pension observed, calculate a "squasher," and apply this to every age-specific pension benefit as described below. In theory, every time the model is rerun with any changes affecting 2007 the "squasher" must be re-estimated; in point of fact, so long as a reasonably close line-up with 2007 is acceptable, it is alright to leave the squasher alone. If it is desired to re-calculate it, do via an iterative process:

SquasherMale (i) = SquasherMale(I-1) x [Average old age insurance pension male 2007 SSSS / Average old age insurance pension 2007 calculated from model(i)]

SquasherFemale (i) = SquasherFemale(I-1) x [Average old age insurance pension female 2007 SSSS / Average old age insurance pension 2007 calculated from model(i)]

where i indexes the first, second, third, etc. iteration Three or four iterations should be sufficient to line up for 2007. Note, of course, that if the required squasher is assuming large proportions, one must question whether there is not something erroneous or unreasonable about the assumptions that have been made for 2007. In this way, the squasher serves not only as a convenient line-up device but as a reality check as well.

Having calculated the squasher for 2007 and applied it to age-specific pension benefits, we apply it to all other years of the model solution, as well. This is required to avoid jump-off problems. We do not update the value of the squasher according to 2008 data due to short time limits, although the squasher for men will be 1.003 and for female 1.0.

Lines 40-51 contain various variables calculated for tracking purposes. These include the average real pension (deflated by the GDP deflator imported from "Wages urban") and the ratio of the average monthly pension to the average monthly formal-sector wage.

The remainder of the workbook calculates number of beneficiaries, the personal adjustment factor, years of contributory service, average pension received, and total pensions paid out by sex and age. Lines 52-260 calculate the number of beneficiaries. From 2001-2007, this is simply the ratio of pension recipients to population aged 63+ observed in 2007 multiplied by population. From 2008 on, however, we implement a more structural, survival-based, approach. New retirees at age 63 are calculated as the assumed proportion of 63 year-olds eligible (Line 4 for men and Line 5 for women multiplied by the population aged 63. In every year 2008, 2009, 2010 … the number of new entrants into the old-age insurance pension beneficiary pool is calculated based on assumed eligibility and the population aged 63.

As each single year cohort of new beneficiaries ages, we adjust population down to account for mortality and net international out-migration (although we assumed in "Population" that there was no migration at older ages, we keep the migration rate in this formula in case we ever want to change the simplifying assumption). Thus:

Male old-age insurance pension beneficiaries(64,2009) =
Male old-age insurance pension beneficiaries(63,2008)
x [1 – Mortality rate(63, 2008) + NetIntMigRate(63,2008)]

Male old-age insurance pension beneficiaries(65,2010) =
Male old-age insurance pension beneficiaries(64,2009)
x [1 – Mortality rate(64, 2009) + NetIntMigRate(64,2009)

… and so on

Lines 261-473 calculate average years of service at retirement for each age cohort for male and female pulling in the numbers from lines 11 and 12. Average years of service at retirement for the cohort remains constant for all the life of the cohort.

Lines 476-688 calculate personal adjustment factors based on SSSS formulae as follows: if average years of contributory service are more than 25 years the number exceeding 25 is multiplied by 0.02 and added to 1, thus if person had contributed for more than 25 years to Pillar I system his/her pension at retirement would be higher by at least 2%. If contributory history is less than 25 years the adjustment factor is equal to 1 (according to SSSS the adjustment coefficient is 0.04, but we use 1 because with participation in the fully funded Pillar II system the years of Pillar I contributory history will gradually reduced to 0).

Lines 692-902 calculate average pension benefits by single-year age cohort. For a person entering the beneficiary pool at age 63, the average benefit received will depend on the basic pension, the accrual value of a year of contributory service, both measured in the year of retirement, personal coefficient and years of contributory service. For example,

Average monthly benefit(63,2008) =
Index-adjusted basic pension (2008) +
[Estimated years of contributory history (63,2008) x Index-adjusted worth of a year of contributory service x personal adjustment coefficient (2008) x squasher]

Average monthly benefit(63,2009) =
Index-adjusted basic pension (2009) +
[Estimated years of contributory history (63,2009) x Index-adjusted worth of a year of contributory service x personal adjustment coefficient (2009) x squasher]… and so on

As beneficiaries age, we need to look backwards because, for example, if our 63 year-old who retires in 2007 survives to be 64 in 2008, his/her average pension will be:

Average monthly benefit (64,2008) =
Index-adjusted basic pensions (2008) +
[Estimated years of contributory history (63,2007) x Index-adjusted worth of a year of contributory service (2008)]

Average monthly benefit(65,2009) =
Index-adjusted basic pension (2009) +
[Estimated years of contributory history (63,2007) x Index-adjusted worth of a year of contributory service (2009)]

… and so on

Remember two things:

- "average" here does not mean average over all members of the single-year age cohort, it means average over all members of the single-year age cohort who qualify for the old-age insurance pension.
- Not shown in the boxes, but described above, the average pension in each age group in 2007 is "squashed" to ensure consistency with the average pension over all age groups observed in that year and the "squasher" is applied to each year going forward.

Lines 907- 1114 calculate pension benefits paid out to each age cohort by multiplying the average pension for the age group by number of beneficiaries in that age cohort.

The calculation of other types of pension is much simpler. The worksheet "DisIns" deals with labor disability pensions. Column H, Lines 4 and 5 contains the proportion of the population aged 20-62 eligible, copied in from "Notes." Lines 7 and 8 of the same column contain the average pension level, from the same source. For 2008 and beyond, we assume that the proportion of the population eligible remains constant; hence the green shading. For 2001-06 we assume that the rates are lower compared to 2007. For 2008 going forward, we adjust the average benefit level by the indexation factor in Line 10; this is, in turn, assumed to be same as the indexation factor for the basic pension and is copied in from the worksheet "OldAgeIns." For history, we assumed on an entirely ad hoc basis that the level of the labor disability pension increase at 5 percent per year.

The remaining lines of the spreadsheet calculate benefits paid out by age and sex.

The approach implemented for survivor's insurance in the worksheet "SurvIns" is exactly the same, the only difference being that the eligible population is aged 0+.

The approach implemented for special pensions (privileged, partial privileged, and long service) in the worksheet "Privileged" is exactly the same, except that the eligible population is aged 50-62 and the proportion benefited is reduced in 2009 and beyond. Lines 4 and 5 in the "Privileged" spreadsheet in both workbooks are modified to reflect the GOAM plan on gradual elimination of the privileged pensions. The share of recipients is higher among female due to the nature of these pension thus number of male recipients gets 0 by year 2024, while for female in year 2055.

The approach implemented for social disability pensions in the spreadsheet "SocDis" is the same; the eligible population group being the population aged 0+.

The approach implemented for social survivor's pensions in the worksheet "SocSurv" is the same; again, the eligible population group is the population aged 0+.

The approach implemented for old-age social pensions in the worksheet "OldAgeSoc" is slightly different. As elsewhere, 2007 data on the proportion of the eligible population (65+) benefiting and the average monthly pension received are imported from "Notes."

Again, we make the ad hoc assumption that the social pension increased 5 percent per year between 2001 and 2007 and that after 2007 the social old age pension is indexed to the basic pension. The "OldAgeSoc" spreadsheet in both workbooks was modified to line up with the GOAM plan on old age social pension which should be equal to basic pension until the later reaches 100% of the consumer basket, afterwards the social pension should be 80% of the basic pension.. We estimate the proportion of the eligible population benefiting, however as, taking 2011 as an example:

Proportion population 65+ receiving old-age social pension (2011) =
Proportion population 63+ receiving old-age insurance pension (2011) –
Proportion population 63+ receiving old-age insurance pension (2010)

This is a purely ad hoc means of implementing the assumption that, if eligibility for the old-age insurance pension declines, the proportion of the eligible population receiving the old-age social pension rises.

Second Pillar Pension System Contributions

In addition to Pillar 0_I Contributions with Transition and Pillar 0_I Ben with Transition worksheets which present the reformed Pillar I system we have created separate workbooks to model total contributions and accumulations in Pillar II system and benefits paid out to participants.

To understand the logic of the workbooks the user had to have certain knowledge on proposed pension reform in Armenia. The text box below provides brief description of the reform scenario approved by the GOAM in November 2008.

Reform Proposal: The final GOAM proposal provides as follows:

- For those with at least 10 years of social tax payment, some of which are prior to the effective date of the reform, an Employment Pension (First Pillar) financed by a unified income tax of 26% of wages; the First Pillar consists of two parts: 1) a flat Basic Pension, this pension is the basis for all other benefits; and 2) an amount reflecting years of contributions prior to the reform;
- For those whose years of social tax payment are entirely after the effective date of reform, only the Basic Pension is to be paid to those with 10 years of social tax payment;
- A social pension (Zero Pillar) for those without 10 years of social tax payment, set to be 80% of the Basic Pension;
- Automatic indexation of Zero and First Pillar pensions;
- Individual funded pension accounts (Second Pillar) financed by contributions of 10% of wage, 5% paid by workers and 5% by the state, up to a ceiling; when the ceiling is reached high income workers will pay more than 5% in order to reach the full 10%; the employer share is part of the 26% unified income tax, meaning the labor burden now will be 26% + 5% = 31% -- a five percentage point increase on current obligations;
- A new unified income tax, collected by the SRC, will replace the income tax and social contribution tax; SRC responsibility will also include collection of personified data for the second pillar replacing the PARNAS system established at SSSS;
- The data collection will be electronic;
- Transfer of Second Pillar savings to a centralized depository that will serve as a clearinghouse and storage of individual data, as well as a custodian, transmitting assets on the individual accounts of workers to asset managers chosen by workers;
- Investment by licensed asset managers chosen by individuals; and
- Third Pillar voluntary individual pension system

The "Pillar II Contr" workbook contains data on participants in and contributions paid into the fully funded Pillar II system. The workbook consists of spreadsheets "Contributors urb" and "Contributors rur" that pull in data from "Labor Force Urban" and "Labor Force Rural" workbooks on formal sector employment and formality. Lines 2-212 calculate the number of formal sector workers by multiplying the formality levels by number of employed from for "Labor Force Urban" and "Labor Force Rural" workbooks both for male and female. Lines 216-422 calculate the shares of participants in Pillar II system for each age cohort based on shares of contributors among formal employed from "Contributors urb" and "Contributors" rur spreadsheets of the "Pillar 0_I Contr with Reform" workbook: thus the Turquoise blue color for age groups 15-39 since 2011 with gradual coverage of all employed both for male and female.

Lines 422-634 calculate the number of contributors who pay in to the Pillar II system. All these calculations are similar for both the "Contributors urb" and "Contributors rur" spreadsheets. "Contributors tot" simply adds up data from the "Contr urb" and "Contr rur" spreadsheets.

The "Pillar II Contr" spreadsheet is constructed on the assumption that the reforl commences in 2011 and no one aged 15-20 is participating in Pillar II. The modifications are done automatically without any special colors except for a pink line in "Contributors_Tot" worksheet that shows the assumption on participants at age 15-20. The three colored descending rowss are eventually used to calculate the number of beneficiaries in the "Pillar II_Accum_Ben" workbook.
"Contr_urb" and "Contr_rur" worksheets calculate the Pillar II contributions for Pillar II system participants. The contribution rate for each individual is estimated at 10% for both men and women, corresponding to a 5% mandatory personal contribution and a 5% by the state to individual accounts. To line up with assumptions on evasion used in the "Pillar 0_I Contr. With Reform" workbook we have 9% actual contribution rate on line 5 and 9. From line 11 we have monthly Pillar II contributions of each age cohort participating in the Pillar II system.

Line 224 gives grand totals of monthly contributions of both men and women.

The "Contributions tot" worksheet sums up the urban rural monthly contributions in line 2 and line 3 and annualizes by multiplying by 12.

Pillar II Accumulations and Benefits

To calculate the fully funded accumulations and benefits we start with assumptions that the operation costs will be 3% of assets under management at the initial stage and gradually decline to 1% by 2022, remaining constant thereafter. The nominal rate of return is assumed to be 7% at initial stage and 6% after 2022. We assumed no early withdrawals from the system. Up to age 63, no adjustment to cohort-specific assets is made to reflect mortality. One way of looking at this is that, on death of a member, the accumulation is either transferred into the account of his or her spouse (assumed to be the same age) or, if that spouse does not have an account, a new one is created. Mortality before –"is not common, so overall results are not very sensitive to this simplifying assumption.

To summarize, the individual accumulations of each cohort are calculated by multiplying the amount of total contribution of the cohort in particular year pulled in from Pillar II contributions worksheet by the rate of return minus operation costs minus early withdrawals and adding the accumulation of the previous year. Taking 50 year-old men in 2040 as an example:

Accum (males, 50 years of age, 2040 =

Accum (males, 49 years of age, 2039 x

(1 + rate of return – operating cost rate – rate of early withdrawals)

+ Contr (males, 50 years of age, 2050)

At 63, participants are issued a 20-year annuity or, if preferred, a phased withdrawal that mimics a 20-year annuity. The first cohort to qualify for benefits does so in 2035. To calculate total benefits paid out in the first year of their retirement, we take the total accumulation of the cohort from the "Accumulation" spreadsheet and divide by 20; then add half of the accumulation multiplied by the difference between the rate of return, operation costs and early withdrawals. While the formula is not exact, it approximates a 20-year annuity.

Average benefit levels are calculated by dividing total benefits paid out by the number of beneficiaries. To estimate the number of beneficiaries we look back to the contributory history of that cohort and calculate the average number of contributors during the whole period before their retirement. To do so we pull in the number of contributors from the "Contributors tot" worksheet in "Pillar II Contr" and sum up the number of annual contributors of that cohort adjusted by mortality and divided the sum by the number of years that cohort participated in the system. This approach is applied for each cohort that turns 63. After retirement the number of beneficiaries is adjusted downward by mortality each year. To reflect current GOAM planning, the benefit received by each coort of retirees is not adjusted downward to reflect mortality until they reach age 70; i.e., if a beneficiary dies his or her spouse (assumed to be the same age) continues to receive the benefit until age 70.

If a beneficiary dies after age 63, his/her remaining accumulation is divided among fund participants (both contributors and beneficiaries using age- and sex- shares. In this way, money once in the Pillar II fund never leaves it except in the form of annuity payments, which appears to be the architecture that the GOAM has in mind.

After retirement, the accumulated assets of a cohort are debited every year to reflect the fact that a portion is being paid out in the form of an annuity. This raises the possibility, at advanced ages and in to outer years of the simulation, that assets will reach zero. At this point, a logical "if-then" statement reduces benefits paid out to zero.

Tables and Charts

The workbook "Tables and Charts" extracts highlights from the model solution and presents a series of tables and charts for use in report writing. All are in printer-friendly format.

The worksheet "Key Assumptions" contains a summary table in which major assumptions are summarized for 2008, 2009 and 2010-60 in ten year intervals. Each indicator is imported from the relevant worksheet.

In the workbook "Reform_No reform," the worksheets "Pillar I_Rev_Exp with reform" and "Pillar I_Rev_Exp with no reform" present Pillar I system accounts consistent with the model solution both in reform and withour reform scenarios. Line 4 contains revenues in the form of mandatory social contributions. Lines 16-10 import insurance pension expenditures from "Pillar 0_I Ben." And Pillar 0_I ben with Reform" In Line 11, we estimate that funerals, internal payment costs, and Pillar I administration cost ten percent of total insurance pension expenditure. In making this estimate we have been guided by the need to approximately line up on SSSS accounts for recent years and budgeted expenditure in 2007. Note that the lineup is approximate, however -- we do not claim to precisely reproduce SSSS's historical budget (but we come close). In Line 13, we add another 10 percent to insurance pension expenditure to account for maternity and unemployment benefits and the purchase of external payment services. The balance in line 15 refers to those payments that are financed by mandatory social contributions.

Lines 19-21 display Pillar 0 social pension expenditures. Payment costs, administration, etc. are estimated at 10 percent. We make no attempt to account for military pensions.

Line 25 calculates the Pillar I balance as a share of GDP.

Lines 27-29 calculates Pillar I insurance program, Pillar 0 social program, and total expenditures as shares of GDP.

In model scenarios analyzing the costs of the economic crisis and the impacts of different indexation approaches and levels of taxation, analogous worksheets present baseline and alternative scenarios for Pillar I revenue and expenditure.

In each workbook, a worksheet Tables presents baseline and alternative scenario comparison tables for major variables. A worksheet Charts contains selected charts.

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