

# **The Pension model**

## **User Manual**

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## Introduction

The Pension Model comprises a number of Excel files, associated VBA code and matrix files. For optimal performance, as much memory as possible should be available in Excel. This can be achieved by having only workbooks belonging to the Pension Model open.

A 90-year simulation may require just over one and a half hours to complete but subsequent runs using the same starting parameters will be approximately four times faster.

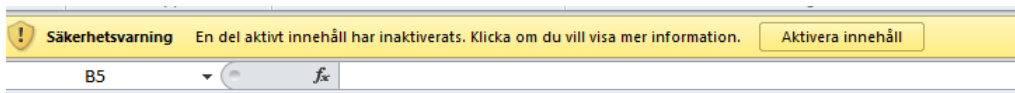
The most important files are:

Main.xlsm	Ledger. The model's centre linking together the various parts. The interface for selection of scenario. Display of results during execution.
DemographicModel.xlsm	Demographics model
PensionSystem.xlsm	Pension system

## Installation

The Pension Model does not require any special installation. The only requirement is that you download all files onto the local hard drive. To use the model, you must have a reasonably modern Windows PC with Excel (version: 32 bit Excel 2007 or later) installed. If the files are located on a server or USB flash drive, performance will be affected negatively. You start the model by opening the file Main.xlsm which is located in the folder **Pensionsmodellen\_filer**.

Depending on your security settings, you may need to activate the content. In that case a security warning appears as below which you remove by clicking on Activate Content.



## Starting the Pension Model

Close all open versions of Excel before opening the model (an alternative is to open a new Excel session). The Pension Model is started by opening Main.xlsm.

The first time you use the model, you must accept the user agreement that appears on the screen, Figure 1.

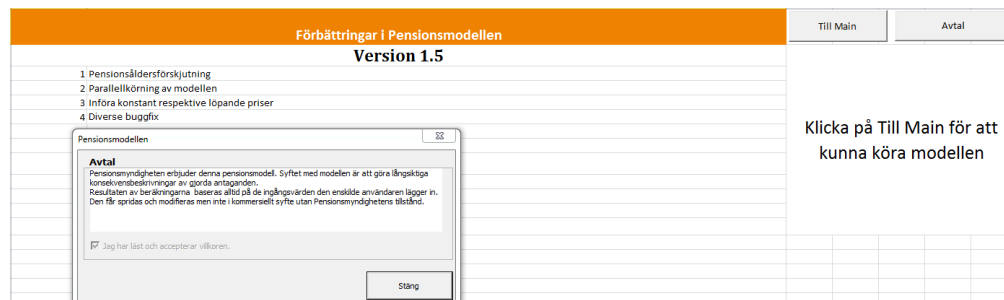


Figure 1

Start the model by clicking on "To Main",

There are three different views, corresponding to user levels, for displaying different parts of the model:

User mode, Advanced mode (and Developer mode). The model first opens in the User mode. The various views are described in more detail later in this document.

In the worksheet Main (Figure 2) you can select the language for texts, title and buttons. Change the language by double-clicking on the desired language.

Clicking on the **Run Scenario** button runs a simulation using the options and conditions that you have chosen. There is also the **Run Group** button to run all scenarios within a group.

Clicking on the **Run Only Demographics** button runs only the population forecast in the model.

In Figure 2, the Base Scenario is shown selected. Another scenario can be selected using the button **Select Scenario & Groups** or **Edit Scenario & Groups**. If you create a new scenario, it must first be saved under a suitable name before you can run the model.

In Simple View, a new set of parameters is always saved as **My Scenario**. That's the only scenario that you, as user, can influence in Simple View ([See section: Scenario management](#)).

The check box for **Clear Output** is used to clear output files where the column **Clean** is set to TRUE (output files are specified in the file **PensionSystem.xlsm**).

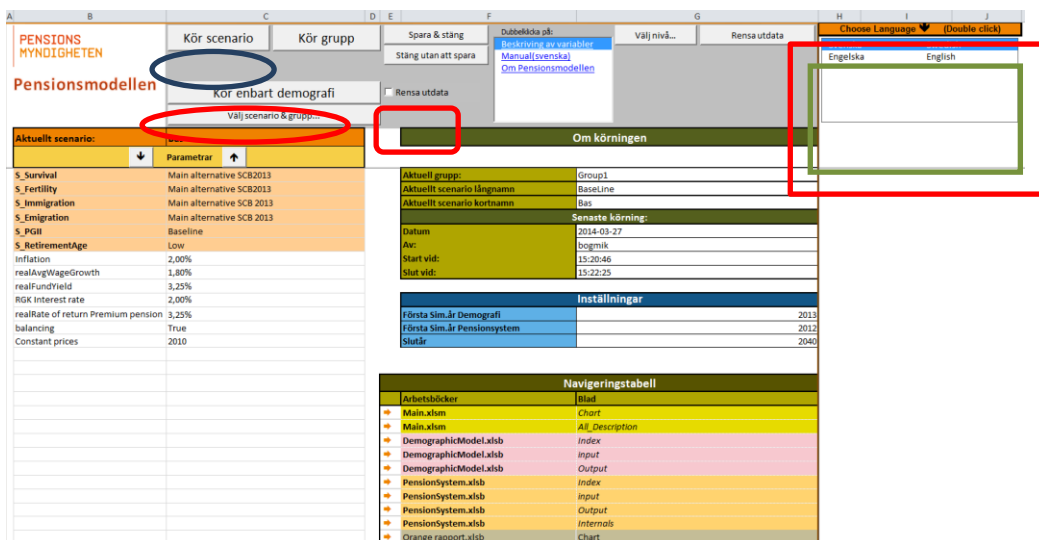


Figure 2

### During execution

During each execution a population forecast is first made, after which the pension calculation starts. During execution, the following graphs are shown:

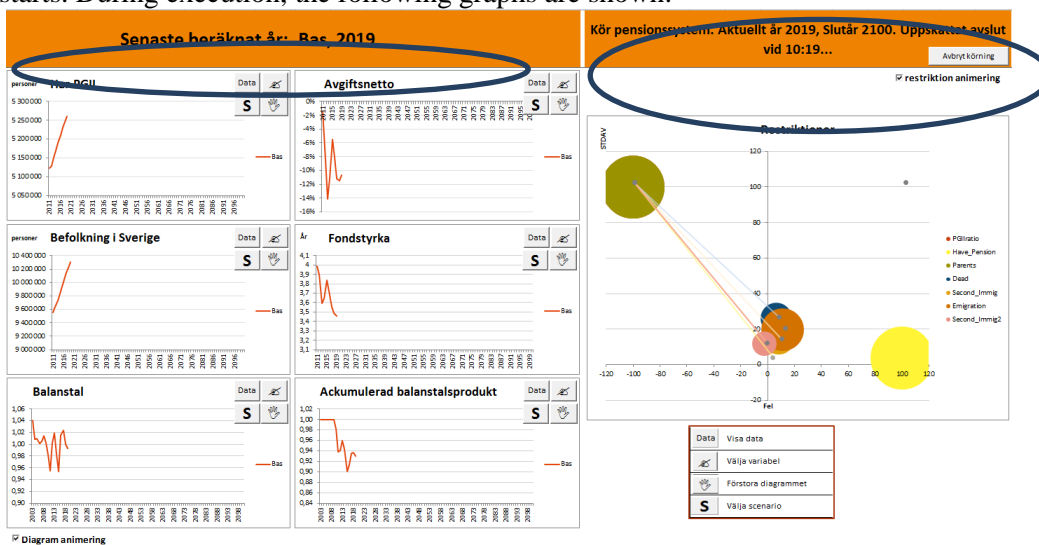


Figure 3

At top left (Figure 3) you see that the last calculated year is 2019. To the right, you see that the current year is 2019, and the final year for the run is 2100. Program execution is estimated to finish at 10:19.

In figure 3, six graphs show the results for the years calculated. On each graph there is a Select variable button which opens a dialogue box allowing you to choose which variable to show (Figure 4).

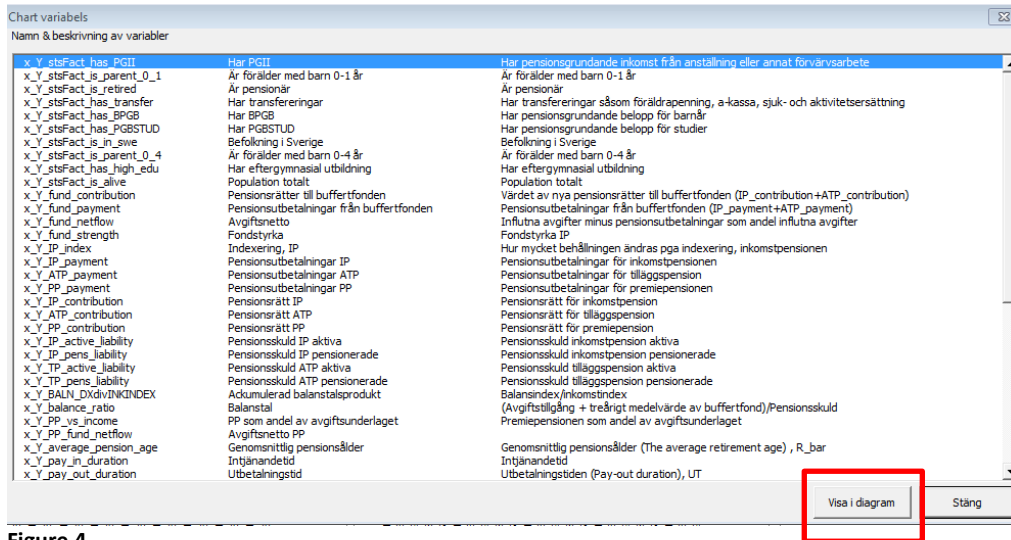


Figure 4

Choose any variable in the list and click the **Show in Chart** button. The variable description is shown in a separate window if you double click on the name. Changing a variable is best done when the run is complete.

To the right of the six charts (figure 3) there is a bubble chart showing how the restrictions successively modify the estimation of next year's population so as to meet given targets (see chapter "The Pension System" for more information). Note that the bubbles are not visible if you use already calibrated restrictions (you have already completed a run with the same starting parameters). The x-axis shows the total deviation (error) of the restriction and the y-axis the standard deviation of the error. The size of the bubble indicates how many of the restriction groups have come sufficiently close to the target. A small bubble means that most of the conditions have been met. A large bubble means that few conditions have been met. You need not attach much importance to or interpret how the bubble chart moves. This is mainly to show that the model is busy performing calculations.

At the top right you find the **Abort run Operation** button that allows you to cancel a run. You may have to click several times for the interrupt request to be registered. When the model has registered a break, the text "The run will be terminated" is shown just below. The run will be terminated after the current year has been fully calculated.

There are also two check boxes that make it possible to turn off animation. The speed of a run is not significantly affected by the year charts to the left, while the bubble chart does have a certain impact.

At the bottom (figure 3) you find the **Clear** button for clearing the charts. This may have to be used since the results of each run can accumulate in the charts.

# User mode

## Interface

The interface of the User mode is shown in the image below:

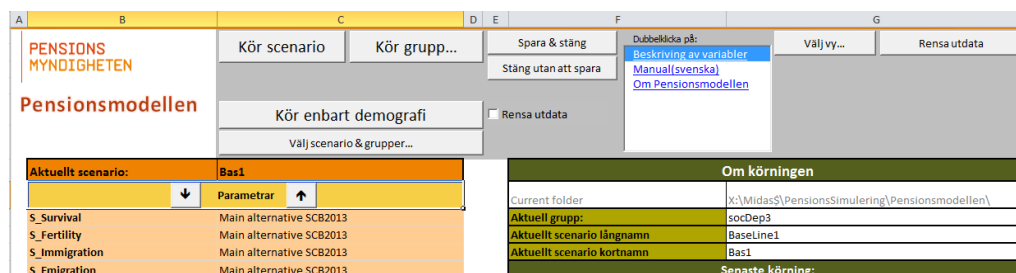


Figure 5

## Navigation - seeing results

Output from the run are available in different output sheets at the bottom of the screen.

From the Main sheet you can also use the Navigations table where desired workbook or sheet can be selected by clicking on the arrow to the left.

Output from the run is administered by the information in the Output worksheet. Both the demographics and the pension system have an Output worksheet where you can indicate which variables are to be printed out. The variables found there will be printed out.

From the Main worksheet, there is an area in the lower right that you can use as a shortcut. Which worksheets are displayed can be changed via a drop-down list (Figure 6). You can select the desired workbook and worksheet by clicking on the arrow to the left.

Navigeringstabell	
Arbetsböcker	Blad
➔ Main.xlsm	Chart
➔ Main.xlsm	All_Description
➔ DemographicModel.xlsm	Index
➔ DemographicModel.xlsm	input
➔ DemographicModel.xlsm	Output
➔ PensionSystem.xlsm	Index
➔ PensionSystem.xlsm	input
➔ PensionSystem.xlsm	Output
➔ PensionSystem.xlsm	Internals
➔ Orange rapport.xlsm	Chart

Figure 6

Some worksheets may be hidden from the current view. This means that the shortcut will not work and a message will appear.

If the drop-down list does not work for any workbook it is because the file is not open.

See the section [Advanced mode](#) for more information.





## Scenario and Group

To select a scenario, click the button **Select Scenario & Group** (Figure 7).

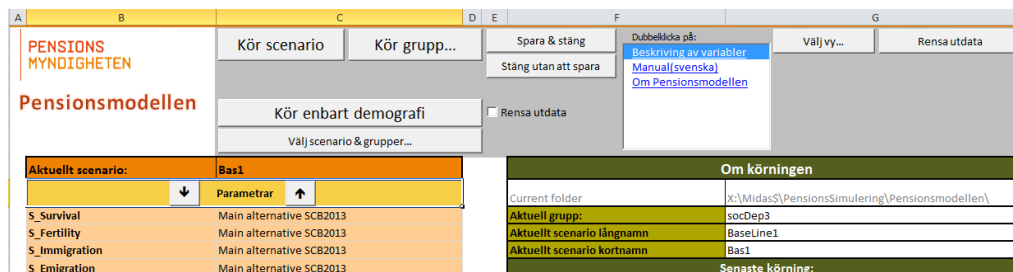


Figure 7

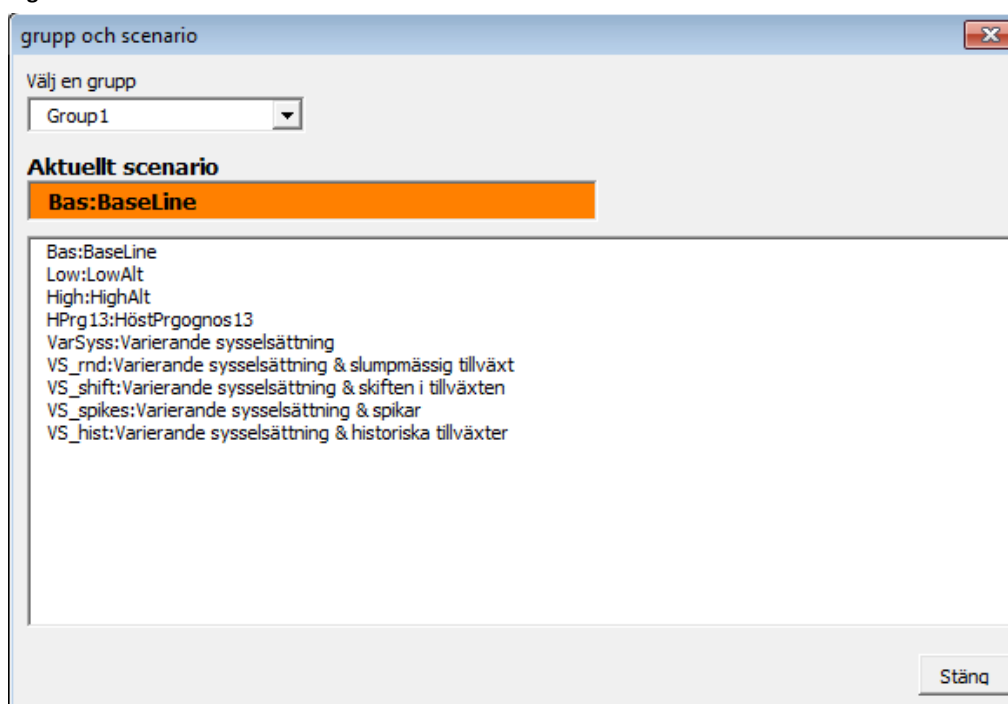


Figure 8

Choose a scenario by selecting the scenario name.

A new set of parameters is always saved automatically with the name **My scenario** in the Simple View. The parameters used for the three scenarios in the Orange Report are entitled Base, Low and High, where Low is the pessimistic alternative and High the optimistic one. See the section [Advanced mode](#) for more information about scenario management.

## Description of parameters and variables

All descriptions of the parameters and variables used in the model are in the file **Main.xlsm**, under the worksheet **All\_Descriptions** (is hidden in User mode).



Figure 9

A parameter and a variable are included in a category and one or more subcategories. When you click on **Description of variables** (Figure 10) a form is displayed where you can select category and subcategory to display the description of the parameter or variable.

The model is designed to include descriptions in multiple languages.

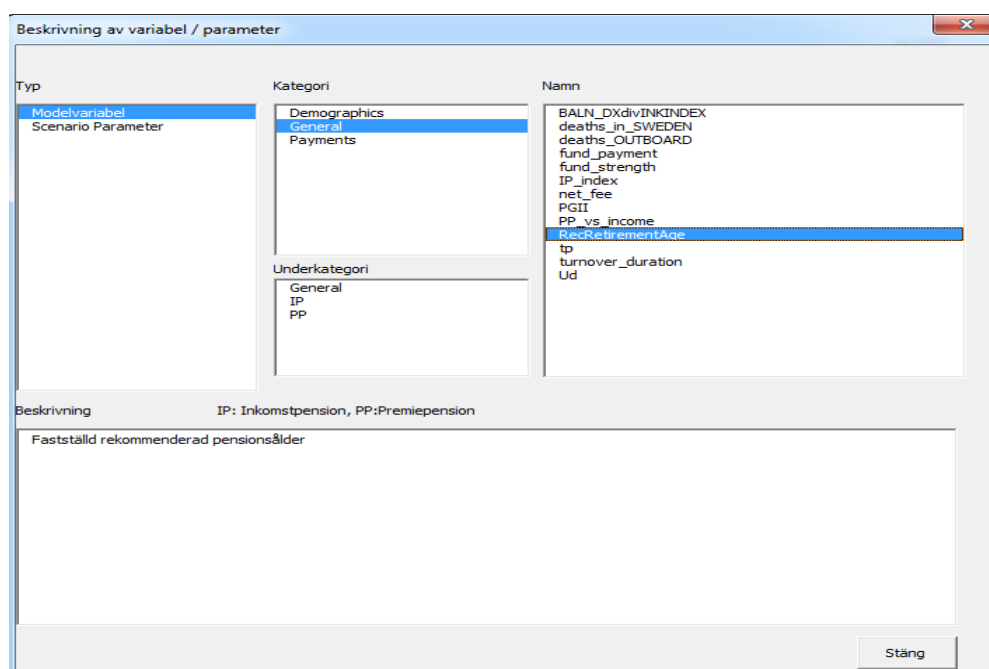


Figure 10

# Advanced mode

## Interface

In the Advanced mode there are additional worksheets, functions and buttons available.

## Scenario management

The Pension Model has built-in scenario management in order to save and manage the model's parameters and assumptions.

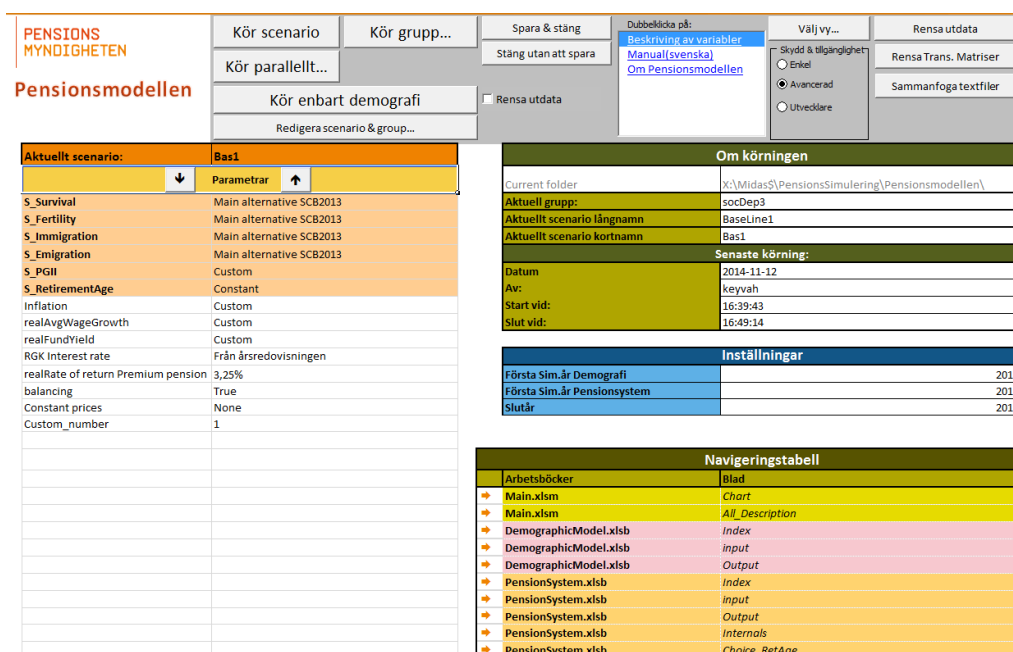


Figure 11

A scenario is a collection of parameters that specify the assumptions on which the forecast projection, calculations is based. The parameters are specified in the **Main** worksheet. In the left column under the heading Parameters the name is given, and in the right column the value or the name of the selected alternative is written (Figure 11).



The buttons above are used to move up or down the parameters in the Main worksheet. Status parameters (orange area - the parameters whose names begin with S\_) cannot be moved.

## Scenario and group

A scenario is a set of parameter values. Multiple scenarios can be formed into a group. If you make changes to a scenario (by changing a parameter value), you must save the scenario before it can be run. You save a scenario by clicking on the **Edit scenario & group** button (Figure 12).

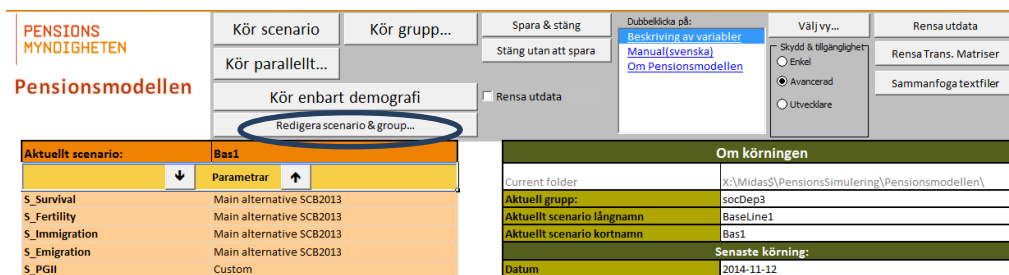


Figure 12

To create a group, do as follows:

(If you wish to update an existing scenario or save a new scenario in an existing group, go to step 2).

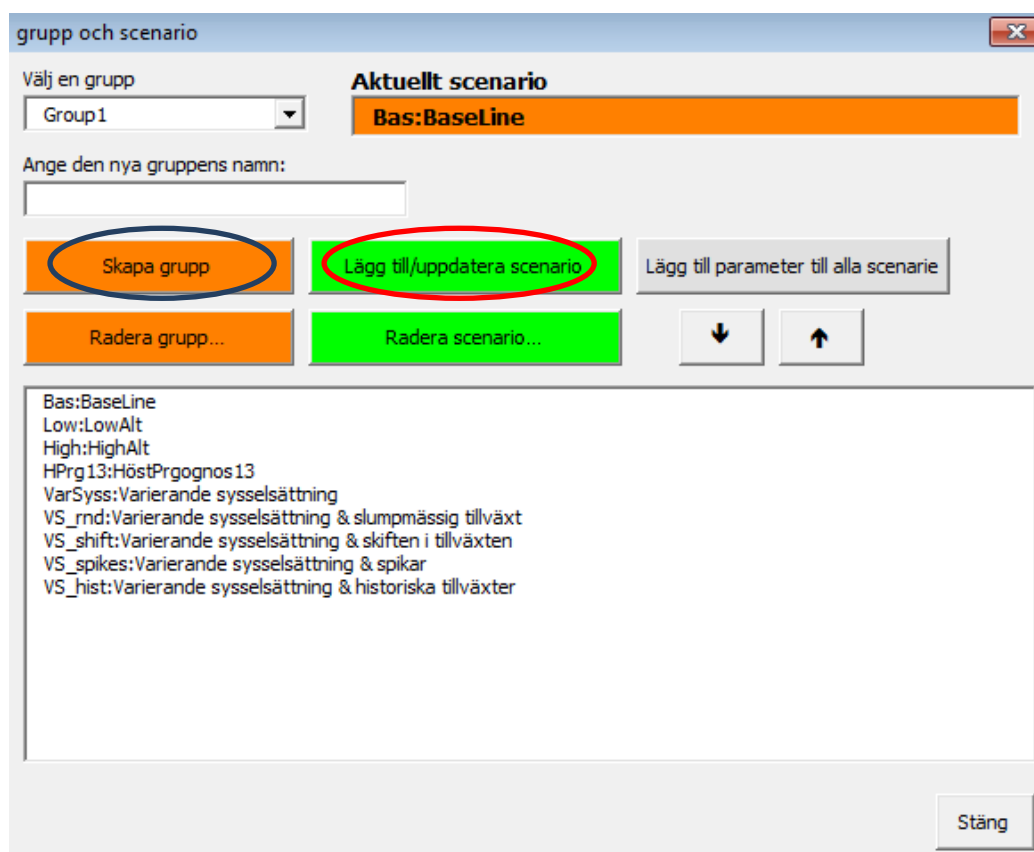


Figure 13

1. Enter the group name in the **Enter the name of the new group** (Figure 13) and click **Create group**.
2. Click the button **Add/Update scenario**. Be very careful **not** to click on the scenario name in the list (figure 13).

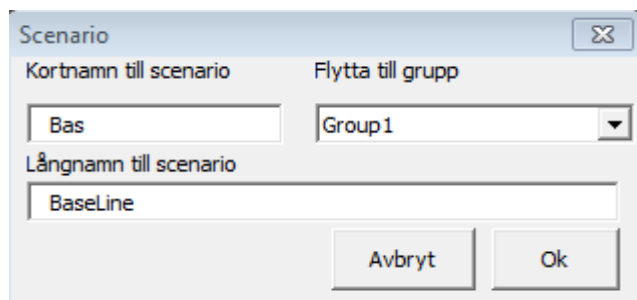


Figure 14

3. This opens a new window (Figure 14).
4. Enter a **Short name** and a **Long name** for the scenario. Select a group from the list **Move to group** if it is empty. When updating a scenario, you keep the Short and the Long name. Click the **OK** button.

You have now created a group with a scenario containing parameters. It will be displayed in the main form (Figure 13).

To delete a scenario from a group, select the scenario and click the button **Delete scenario** (Figure 13).

To remove the parameter from a scenario, delete the name and values in the Main worksheet. Click the button **Add/Update scenario** (Figure 13). Check that the group and scenario names are correct and then click the **OK** button (Figure 14).

You can delete a group by selecting the group in the list **Select a group** (Figure 13) and clicking the button **Delete group**. All scenarios in the group will be deleted simultaneously.

The existing values of parameters can be changed, and the table below shows where they are stored.

Parameter	Arbetsbok	Arbetsblad
S_Survival	DemographicModel	MortalityRates
S_Fertility	DemographicModel	FertilityRates
S_Immigration	DemographicModel	Immigration
S_Emigration	DemographicModel	EmigrationRates
S_PGII	PensionSystem	PGII
S_RetirementAge	PensionSystem	Choice_RetAge
Inflation	PensionSystem	tsInputs
realAvgWageGrowth	PensionSystem	tsInputs
realFundYield	PensionSystem	tsInputs
RGK Interest rate	PensionSystem	tsInputs
realRate of return Premium pension	PensionSystem	tsInputs
balancing	PensionSystem	tsInputs
Constant prices	PensionSystem	tsInputs

## Parallel processing

Parallel processing makes it possible to run multiple scenarios simultaneously, one of the benefits of which is saving time. This means that the model takes advantage of the fact that computers have multi-core processors (normally 2, 4 or 8) and create new instances of Excel allowing each processor to work optimally. The original model becomes the "Master"<sup>1</sup> and any created instances are "Slaves". In the Master model you can place runs in a queue and start a number of Slave models. The Slave models constantly check the queue to see if a task must be performed. Click on the button **Run in parallel** to create parallel tasks.

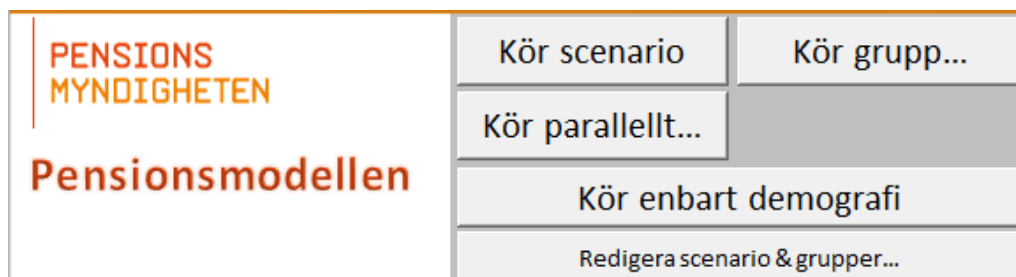


Figure 15

In the dialogue box that opens, select the group and one or more scenarios. Click on the **Add to tasks** button in order to save the task. Normally the task is not directed to any particular "Slave", but it is possible to achieve this by selecting the desired Slave before clicking on **Add to tasks**.

In the box **Max number of slaves** you can indicate how many Slaves you wish to have in total. It is not possible to have more Slaves than the number of the computer's processor cores.

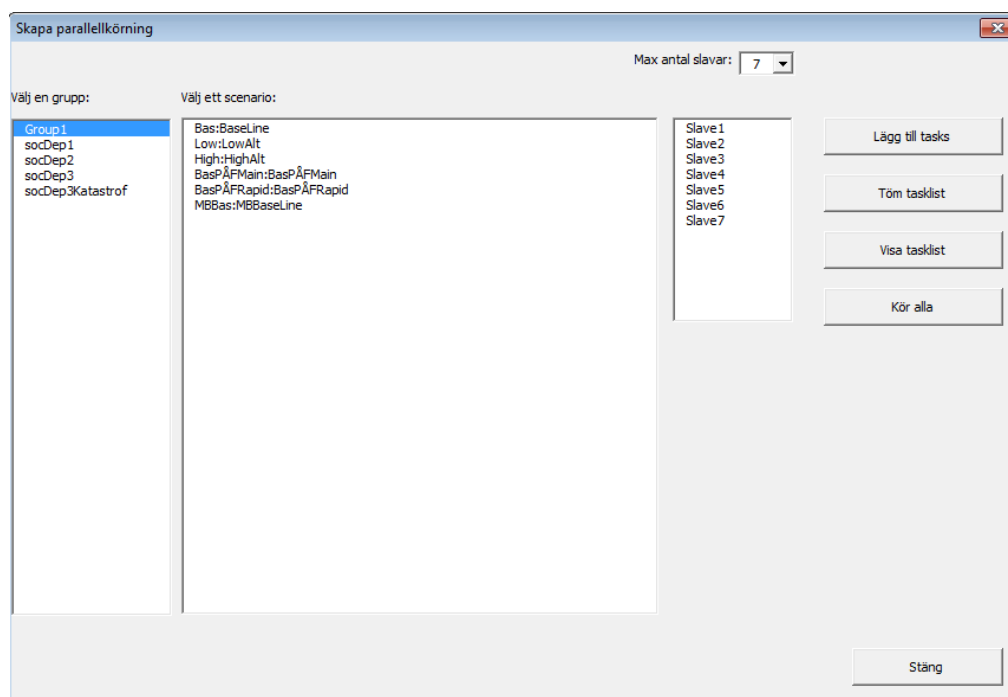


Figure 16

<sup>1</sup> Master – Slave: the Master model creates a task queue, while the Slave models execute these tasks or wait for new tasks to be added to the queue.

If you want to start a parallel operation, click on **Run all**.

The **Clear task list** button is used to delete the task of the selected slave.

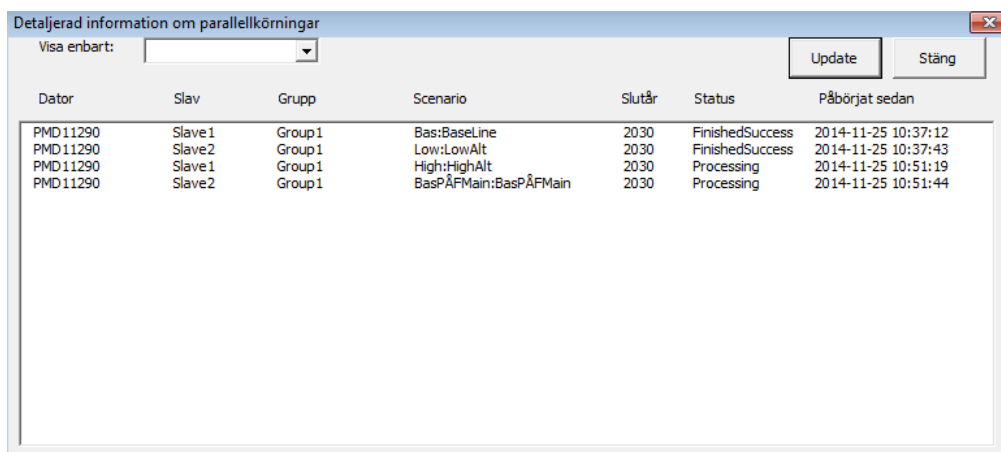
The folder where the parallel processing files are located (named *Slave + serial number*) must be deleted in Windows Explorer in order to recreate the slave or remove old slave runs.

All variables written to a file (they have the property **Location** set to **File**, as indicated in the worksheet Output or Output\_developer in pensionssystem.xlsb) will be printed out in a parallel execution.

Technically, this means that for each Slave a separate folder (for example, Slave1) is created which is a virtual copy of the Master folder. The file Main.xlsm runs as a Slave with all chart animations turned off in order to speed up execution.

The button **Clear task list** (Figure 16) clears all tasks in the model.

The button **Show task list** (Figure 16) gives you an overview of the tasks you have created (Figure 17)



The screenshot shows a window titled "Detaljerad information om parallellkörningar" with a search filter "Visa enbart:" and buttons for "Update" and "Stäng". The table below lists task details:

Dator	Slav	Grupp	Scenario	Slutår	Status	Påbörjat sedan
PMD11290	Slave1	Group1	Bas:BaseLine	2030	FinishedSuccess	2014-11-25 10:37:12
PMD11290	Slave2	Group1	Low:LowAlt	2030	FinishedSuccess	2014-11-25 10:37:43
PMD11290	Slave1	Group1	High:HighAlt	2030	Processing	2014-11-25 10:51:19
PMD11290	Slave2	Group1	BasPÅFMain:BasPÅFMain	2030	Processing	2014-11-25 10:51:44

Figure 17

### Navigation – seeing the results

Output from the run is controlled by information in the Output worksheet. Both the demographics and the pension system have an Output worksheet.

Under the Main worksheet, there is an area in the lower right (Figure 2) that you can use as a **shortcut to see output from the forecast..** Which tabs are displayed can be changed via a drop-down list which is displayed when you click on cells under the heading **Worksheet** (Figure 18).

If the drop-down list does not work for any workbook it is because the file is not open. In the **Settings** worksheet for each workbook you can decide which tabs are to be displayed in the drop-down list.

Arbetsböcker		Blad
➔	Main.xlsm	Chart
➔	Main.xlsm	All_Description
➔	DemographicModel.xlsb	Index
➔	DemographicModel.xlsb	input
➔	DemographicModel.xlsb	Output
➔	PensionSystem.xlsb	Index
➔	PensionSystem.xlsb	input
➔	PensionSystem.xlsb	Output
➔	PensionSystem.xlsb	Internals
➔	Orange rapport.xlsb	Chart

Figure 18

For example, click on the arrow to the left of PensionSystem.xlsb (Figure 18).

There is a list of all variables that are printed out. At the far left there is another link (Link) which takes you to the output worksheet for the current variable.

Link	Name	Print	Scenario	Wide	Location	Worksheet/Path
➔	x_AY_He	Yes	High	SANN	Orange rapport.xlsb	OrangeRapport_Data
➔	x_AY_L_star	Yes	High	SANN	Orange rapport.xlsb	OrangeRapport_Data
➔	x_AY_H	Yes	High	SANN	Orange rapport.xlsb	OrangeRapport_Data
➔	x_AY_L	Yes	High	SANN	Orange rapport.xlsb	OrangeRapport_Data
➔	x_AY_pens_qualify_income_average	Yes	High	SANN	Orange rapport.xlsb	OrangeRapport_Data
➔	x_AY_economic_annuity_divisor	Yes	High	SANN	Orange rapport.xlsb	OrangeRapport_Data
➔	x_AY_Ud	Yes	High	SANN	Orange rapport.xlsb	OrangeRapport_Data
➔	x_AY_ATP_U_gain	Yes	High	SANN	Orange rapport.xlsb	OrangeRapport_Data
➔	x_AY_Uspring	Yes	High	SANN	Orange rapport.xlsb	OrangeRapport_Data
➔	x_Y_average_pension_age	Yes	High	SANN	Orange rapport.xlsb	Chart_Data
➔	x_Y_pay_in_duration	Yes	High	SANN	Orange rapport.xlsb	Chart_Data
➔	x_Y_pay_out_duration	Yes	High	SANN	Orange rapport.xlsb	Chart_Data
➔	x_Y_turnover_duration	Yes	High	SANN	Orange rapport.xlsb	Chart_Data
➔	x_Y_turnover_duration_level_out	Yes	High	SANN	Orange rapport.xlsb	Chart_Data
➔	x_Y_pension_balances	Yes	High	SANN	Orange rapport.xlsb	Chart_Data
➔	x_Y_tp	Yes	High	SANN	Orange rapport.xlsb	Chart_Data
➔	x_Y_pension_credit	Yes	High	SANN	Orange rapport.xlsb	Chart_Data
➔	x_Y_pens_liability_active	Yes	High	SANN	Orange rapport.xlsb	Chart_Data

Figure 19

Clicking on the link x\_Y\_turnover\_duration (turnover time) in figure 19 takes you to the workbook Orange rapport.xlsb and the worksheet Orange Report.

In Figure 20, the variable x\_Y\_turnover\_duration is displayed printed out.

	x_Y_turnover_duration	Omsättningstid						
		1978	1979	1980	1981	1982	1983	1984
Low		28,78	29,20	29,42	29,96	30,09	30,25	30,40

Figure 20



Generally, you can ignore the first bit of each variable (x\_AY, x\_Y etc.). It is the last bit of the name of the variable that is most important. The first bit indicates the type of variable and the number of dimensions in it (O=origin, S=sex, A=age, Y=year).

Most of the variables have a comment and description. Below is a description of those found in the **Output** worksheet.

## Output

The results of the population forecast is in Demographic Models tabs: Population, Born, Deceased, Immigrants, Emigrants and Life Expectancy. Some tabs may be hidden but can be displayed by choosing Output in each Workbook and clicking on the desired link (see previous page).

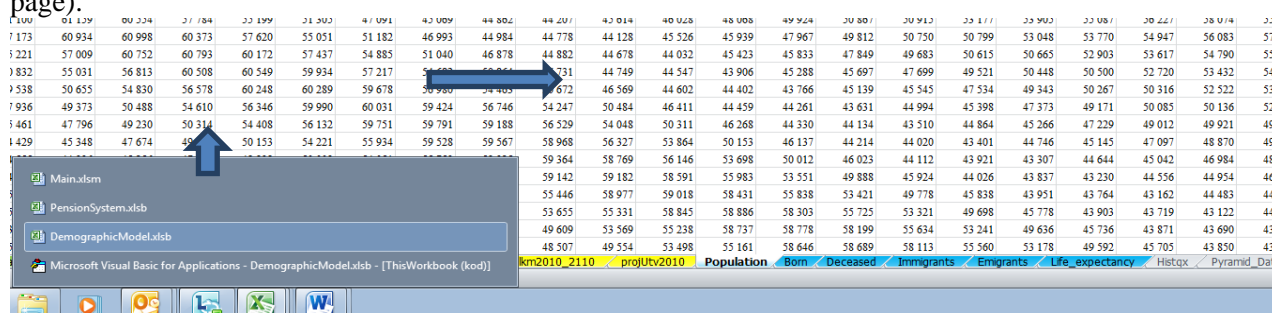


Figure 21

If the whole model is run, the results (Figure 21) are also found as tabs in the file **PensionSystem.xlsm** (with the exception of Life expectancy).

X in the variable name means that it is an export variable, that is, a variable that can be printed out.

x_AY_He	The development of pension disbursements due to deaths
x_AY_L_star	Proportion of outstanding payments to age group
x_AY_H	Development of the proportion of people who have been credited with pensionable income or pensionable amounts and are not registered as deceased
x_AY_L	Proportion of people in age group
x_AY_pens_qualify_income_average	An average pension credit for calculating the income period (Orange Report, Appendix B formula 3.1.2)
x_AY_economic_annuity_divisor	Economic annuity divisor
x_AY_Uspring	Spring disbursements of inkomstpension and supplementary pension
x_Y_average_pension_age	The average retirement age, $R_{bar}$
x_Y_pay_in_duration	Income period
x_Y_pay_out_duration	Sum of pension disbursements in December
x_Y_turnover_duration	Turnover time
x_Y_turnover_duration_level_out	Smoothed turnover duration, $OT_{bar}$
x_Y_pension_balances	Sum of pension balances
x_Y_tp	Estimated value of supplementary pension to people who have not started to claim their

	supplementary pension
x_Y_pension_credit	Estimated pension credit for inkomstpension
x_Y_pens_liability_active	The pension liability for pension obligations that have not begun to be paid out (PB+IPR+TP)
x_Y_IP_pens_liability	Pension liability inkomstpension retirees
x_Y_TP_pens_liability	Pension liability supplementary pension retirees
x_Y_pens_liability_retired	Pension liability to retirees in distribution system regarding pensions being paid out
x_Y_pens_liability	(SA+SP)
x_Y_contribution_revenue	Contribution revenue to the distribution system
x_Y_contribution_revenue_level_out	Smoothed contribution revenue to the distribution system
x_Y_contribution_asset	Contribution assets
x_Y_buffer_fund	The total market value of assets of 1st-4th and 6th AP Funds
x_Y_buffer_fund_level_out	Smoothed value for the buffer fund
x_Y_balance_ratio	(Contribution assets + three-year average of buffer fund)/Pension liability
x_Y_PBB	Price-related base amount
x_Y_HBB	Increased price-related base amount
x_Y_IBB	Income-related base amount
x_Y_income_index	Development of average income
x_Y_balance_index	When balancing is activated the income index is used instead of the balance index
x_Y_fund_netflow	Accrued contributions minus pension disbursements as a proportion of accrued contributions
x_Y_fund_strength	Fund strength IP
x_Y_IP_payment	Pension disbursements för inkomstpension
x_Y_ATP_payment	Pension disbursements for supplementary pension
x_Y_PP_payment	Pension disbursements for premium pension
x_Y_fund_payment	Pension disbursements from the buffer fund (IP_payment+ATP_payment)
x_PP_Fund_active	Pension liability premium pension active people
x_PP_Fund_retired	Pension liability premium pension retirees
x_PP_Fund	Pension liability premium pension (PP_Fund_active+PP_Fund_retired)
x_PP_Fund_strength	Fund strength PP

The demographics and pension system has, besides Output, also the tabs Input (input to the model) and Internals (output variables are defined). In addition, there is an index worksheet where there are links to all tabs in each workbook.

## Merging text files

If you want to merge the text files in order to use them, for example, in a pivot table, click the button **Manage printed text files** (Figure 22).

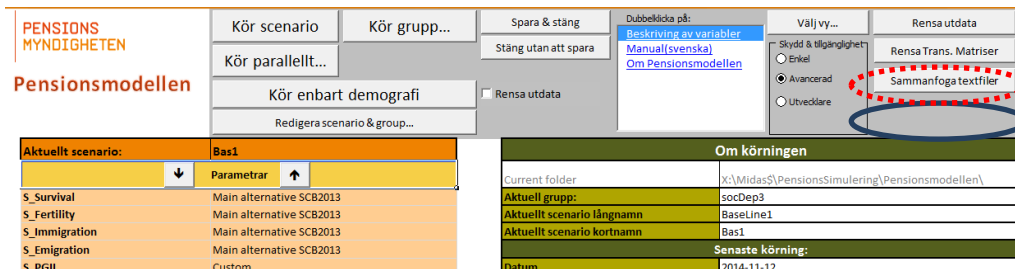


Figure 22

All input and output variables (that is, those beginning with *i\_* or *x\_*) that have the same dimensions are merged into a separate text file.

The button **Clear Trans. matrices** (Figure 22) is used to remove probability matrices created for the current scenario. In general, this is only required if new data has been inserted/created. The model will recreate the matrices from scratch, which means the run will take longer.

# Developer mode

## Interface

In Developer mode there are several tabs, functions and buttons available in addition to those found in Advanced Mode.

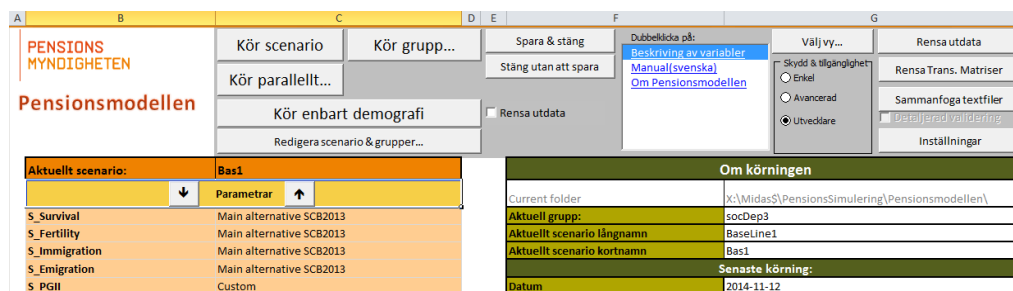


Figure 23

Developer mode is intended for developers.

## Demographics

The population forecast is constructed in the same way as in the model that Statistics Sweden uses for the preparation of the official population forecast. The source code of Statistics Sweden's program is not available, but the model has been developed using the documentation found in the publication 'The Future Population of Sweden 2012-2060' (Statistics Sweden, The Future Population of Sweden 2012-2060, ISBN 978-91-618-1564-7) pages 177-179.

Assumptions, etc, are partly taken from the Statistical Database at Statistics Sweden. The results of the runs are close to the forecast results that Statistics Sweden has reported using corresponding forecast alternatives **but not exactly the same**. For one thing, the model uses a simpler version for the calculation of births and not the parity-specific incidence rate used in the Statistics Sweden model. **The assumptions available in the Statistical database at Statistics Sweden does not always show the exact input they used in their model.**

### Population forecast

Aktuellt scenario: Bas		Om körningen	
	↓ Parametrar ↑		
S_Survival	Main alternative SCB2013	Aktuell grupp:	Group1
S_Fertility	Main alternative SCB2013	Aktuellt scenario långnamn	BaseLine
S_Immigration	Main alternative SCB 2013	Aktuellt scenario kortnamn	Bas
S_Emigration	Main alternative SCB 2013		Senaste körning:
S_PGII	Baseline	Datum	
S_RetirementAge	Low	Av:	

Figure 24

After starting the pension model, one sees the image above (Figure 24). On the left, under the heading Parameters, one may select different alternatives concerning mortality, fertility, immigration and emigration in the population forecast.

Above is the main alternative from Statistics Sweden's population forecast 2013. It is possible to make other choices, such as selecting High Mortality, according to the Statistics Sweden 2013 forecast, and Low Fertility, according to the Statistics Sweden 2013 forecast. The list of alternatives (Figure 25) to choose from regarding, for example, mortality (Survival) is displayed by clicking on the box to the right of Survival and then clicking on the arrow that appears. This produces several forecast alternatives to choose from. It is possible to select combinations of assumptions that have not been published by Statistics Sweden.

7	Aktuellt scenario:	Bas
8	↓	Parametrar ↑
10	S_Survival	Main alternative SCB2013
11	S_Fertility	Main alternative SCB2013
12	S_Immigration	Main alternative SCB2012
13	S_Emigration	Low mortality SCB2012
14	S_PGII	High mortality SCB2012
15	S_RetirementAge	Main alternative SCB2011
		Low mortality SCB2011
		High mortality SCB2011
		Steady state (Main alt 2012 level) SCB2012

**Figure 25**

Similarly, the desired alternative for fertility, immigration and emigration can be selected. The different alternatives may be taken from Statistics Sweden's various population forecasts or be alternatives of one's own.

In the 2011 forecast, there was no alternative with high and low mortality in the forecast published by Statistics Sweden. These two alternatives have been developed using the same principles as those used in previous forecasts from Statistics Sweden. High mortality corresponds to an assumption that the risk of death remains unchanged throughout the forecast period, low mortality corresponds to an assumption that the risk of death continues to decline at the same rate throughout the forecast period.

Steady state is another alternative not included in the SCB population forecast. The choice of steady state for survival, fertility, immigration and emigration results in a population forecast with a long-term constant population and age distribution. There are many other possible alternatives which also result in a constant future population and age distribution. In other contexts, steady state is usually called stationary population.

Under the heading Settings (Figure 2, page 5), one can among other things choose the starting year for the population forecast. If the first forecast year (First SimYear Demography) is set to 2012, the starting population for the forecast will be the population at the end of 2011. For example, if 2030 is chosen as the first forecast year, a population forecast is made using the selected forecast alternatives for the years 2030 up to and including the year selected on the row for End Year. The years before 2030 are provided with data on population, number of births, number of deaths, number of immigrants and emigrants according to Statistics Sweden's main alternative.

The population forecast can be run separately (without the Pension System running) by clicking on the button **Run only demographics** (Figure 2).

# Retirement Age Offset

It is possible to choose a parameter for the age of retirement (the model uses the parameter **S\_RetirementAge**). The model is roughly based on the proposal of the Retirement Age Investigation (SOU 2013: 25) that there should be a target age for when to retire. The target age should follow life expectancy.

1. The 61-year limit for the earliest withdrawal of old-age pension will be increased to 62 years from 2015, and, according to current forecasts, to 63 years from 2019.

FirstRetAge means the earliest pension age and RecRetirementAge means the recommended pension age).

2. The 65-year limit (target age) for guarantee pension, sickness allowance and similar benefits will be raised to 66 years from 2019, according to current forecasts.

There are a number of predefined parameters for the change in the retirement age. The Main alternative is to let the demographics decide.

AgeOffset	Main	
Year	FirstRetAge	RecRetirementAge
2012	61	65
2015	62	65
2019		Demo

Figure 26

According to Figure 26 above, the 61-year limit applies up to 2015, when it raised to 62. Note that subsequently there is always a 3-year difference between the "can retire" and the target age. As of 2019, it is the demographics that decide. In conjunction with the other parameters from the base scenario, this means:

- 2021 the target age is raised to 67
- 2036 the target age is raised to 68
- 2053 the target age is raised to 69
- 2073 the target age is raised to 70
- 2096 the target age is raised to 71

You can also determine manually when regulatory changes occur, for example:

AgeOffset	Low1	
Year	FirstRetAge	RecRetirementAge
2012	61	65
2015	62	65
2050	63	66
2070	64	67

Figure 27

The retirement age offset as shown in Figure 27 means that the target age is raised to 66 in 2050 and to 67 in 2070.

The parameter value Constant means the same age limits as today.

## The Pension System

The pension system is a macro model with high resolution. The population's dimensions are sex (sex 0 = male /1 = female), age (age 0-120), country of origin (origin 1-7) and 498 status groups, providing a resolution of 51 288, see Appendix 1 for details of groups and variables. The aim is as far as possible to mimic the micro models' accuracy without coming into conflict with integrity issues.

The population is simulated year by year using a transition matrix indicating the probabilities of changing from one state to another.

### Example of a transition from one year to the next

Year 2014	Year 2015	
Starting point	Probability of change of state	State
Woman aged 40 born in Sweden, Status group 45	95 %	age 41 born in Sweden, Status group 45
	2 %	age 41 born in Sweden, Status group 56
	0,2 %	age 41 born in Sweden, Status group 1 (dead)
	2,8 %	age 41 born in Sweden, Status group 58

### Restrictions

Once the transition matrix has been applied, we have a preliminary population for the new year. The demographics model provides us with important data that we use to correct the preliminary results.

One example is the number of dead. A summation is made of the number of dead in the preliminary calculation. This is compared with how many dead there should be (goal). If the error is larger than allowed, the probabilities are adjusted for all rows in the transition matrix that affect the number of dead. An adjustment is always followed by a normalization (the sum of the probability must always be 1 for one state). A new calculation is then made, and this procedure is repeated until the discrepancy falls within the margin of error. You can follow how the restrictions are more and more closely met for each iteration in the right-hand graph of the Chart worksheet in the Main workbook.



Currently there are seven restrictions:

1. Have\_Pension
2. Emigration
3. Dead
4. Second\_Immig
5. Second\_Immig2
6. Parents
7. PGIratio

Restrictions conflict with each other. When we have reached, for example, a number of dead, and apply the five remaining restrictions, it is not at all certain that the number of dead will still be adequate because the other restrictions have affected the probabilities relevant to the number of dead. This means that the last restriction will be met, but the results for the previous ones will have changed to greater or less degree.

To reduce the problem for the restrictions made early on, sequencing is important. For example, the restriction Have Pension requires many adjustments (iterations) so it makes sense to place it first and thus avoid having it totally re-adjust all preceding restrictions.

Another way is to impose limits on how much the probabilities may be adjusted. Adjustments are made in five stages. In the first stage (rough adjustment), we allow large adjustments and also a large error. In the next stage, we allow rather fewer adjustments and smaller errors. The last stage has small adjustments and the final margin of error. This way we avoid one restriction "taking over".

### **Printing variables**

Variables specified in the Output or Output\_developer worksheet can be printed to an Excel file or a text file if the Yes option is selected in the column Output destination.

If you select Excel file, you must also specify which worksheet and start cell (or Name field) to print to. If the file or worksheet does not exist, it is created automatically.

If you select text file, you must also specify the path to where the text file will be created.

In the column Location, select or type the text 'File' and in the column Worksheet/Path, type the path to the folder.

A folder with the same name as the variable is created. A text file is created after each run and the text file receives the name of the scenario.

Each text file contains the results of the run, though without headings.

If you run the same scenario, the old file is replaced by the new one.

In the folder of the text file a sub-folder named Info is automatically created in which a text file is saved containing information about the current run.

## Advanced settings

### New parameter

For the scenario parameters (found in the **Main** worksheet) which may have a limited number of values it is best to create a drop-down list. This is how you do it:

Right-click the correct cell, that is, the cell that will contain the parameter value.

1. Select **Add input list**.
2. In the box that opens, select the cells that contain the parameter's value alternatives (Figure 28).
3. This creates a so-called data validation and the cell acts like a drop-down list.

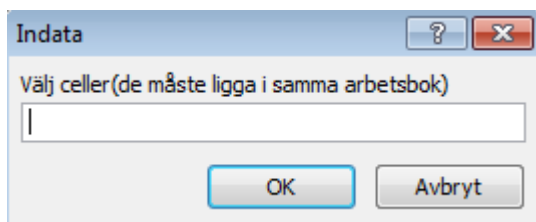


Figure 28

To delete a drop-down list, right-click the cell and then select Remove Input List.

Answer Yes to the confirmation request that pops up.

To delete a parameter, select the parameter name in the **Settings** worksheet and then click the button Remove Inputlist.

Note that the parameter is deleted from all scenarios in all groups.

A parameter can be added to a scenario or to all scenarios in the same group by clicking the **Manage parameters** button in the Settings worksheet (Figure 29).

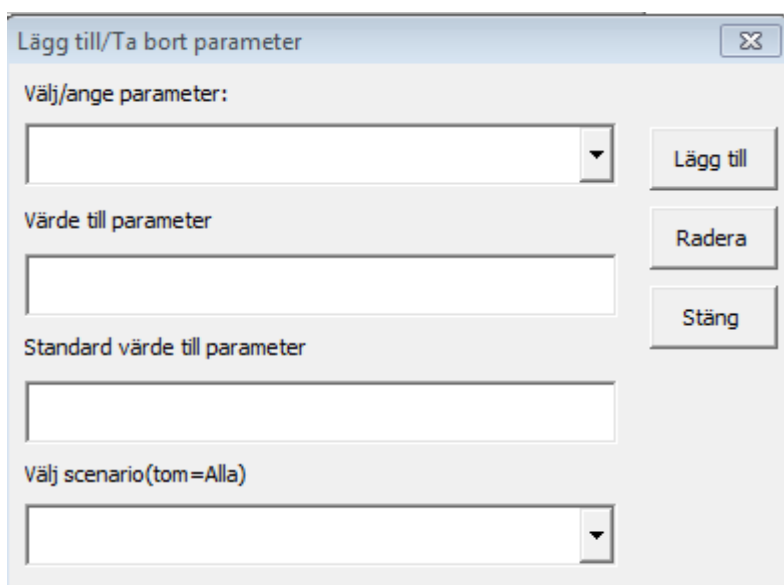


Figure 29

## Demographics

### Own assumptions in the forecast

Assumptions about future immigration, fertility, migration and mortality are stored in four separate tabs. Each worksheet can be reached most easily from the Navigation Table by selecting DemographicModel.xlsb input (Figure 2). Links to the four types of assumptions will then appear. By selecting a particular Link, you come to the worksheet where all assumptions are collected together (Figure 30).

Input and intermediate variables						
Link	Name	Read	Keep	Location	Worksheet/Path	RangeName
➔	i_OSAY_Immigration	Yes	FALSK	Thisworkbook	Immigration	D6
➔	i_OAY_FertilityratesInput	Yes	FALSK	Thisworkbook	FertilityRates	C5
➔	i_SAY_MortalityratesInput	Yes	FALSK	Thisworkbook	MortalityRates	C5
➔	i_OSAY_EmigrationratesInput	Yes	FALSK	Thisworkbook	EmigrationRates	D6
➔	i_OSAY_Initial_Population	Yes	FALSK	Thisworkbook	InitialPopulationinSweden	D5
➔	i_SY_Born_Proj2010	Yes	SANN	Thisworkbook	foddaproj2010	B5
➔	i_OSAY_Immigrants_Proj2010	Yes	SANN	Thisworkbook	projInv2010	D5
➔	i_OSAY_Emigrants_Proj2010	Yes	SANN	Thisworkbook	projUtv2010	D5
➔	i_OSAY_Deceased_Proj2010	Yes	SANN	Thisworkbook	projDod2010	D5
➔	i_OSAY_Population_Proj2010	Yes	SANN	Thisworkbook	folkm2010_2110	D5
➔	i_Hist_Mort	Yes	SANN	Thisworkbook	Histqx	D5

Figure 30

It is possible to make one's own assumptions but in that case it is important to retain the same format as the existing assumptions. The easiest way is to copy an existing alternative, and paste it in with a blank line to earlier data. All values of ORIGIN, SEX, AGE and YEAR must be included in the table (the mortality assumption is not divided up according to ORIGIN), For example, in the case of Immigration assumptions, the first row must begin with the word Immigration followed by an explanation in column B of which assumption is intended. This explanatory text then appears among the alternatives that can be selected (Figure 24).

The year 2011 must also be included even if the cells are empty. The example (Figure 30) shows the main assumption of Statistics Sweden from the 2012 forecast gathered in rows 6 to 1489 followed by the next alternative from row 1491 (Figure 31).

Input data for the starting population is in the worksheet Initialpopulationsweden.



# Example: Update scenario or create new scenario

Let us assume you have a scenario named Bas1 with parameters as in the figure below.

<b>Aktuellt scenario:</b>	<b>Bas1</b>
<b>Parametrar</b>	
S_Survival	Main alternative SCB2013
S_Fertility	Main alternative SCB2013
S_Immigration	Main alternative SCB2013
S_Emigration	Main alternative SCB2013
S_PGII	Custom
S_RetirementAge	Constant
Inflation	Custom
realAvgWageGrowth	Custom
realFundYield	Custom
RGK Interest rate	Från årsredovisningen
realRate of return Premium per	3,25%
balancing	True
Constant prices	None
Custom_number	1

## Update the scenario

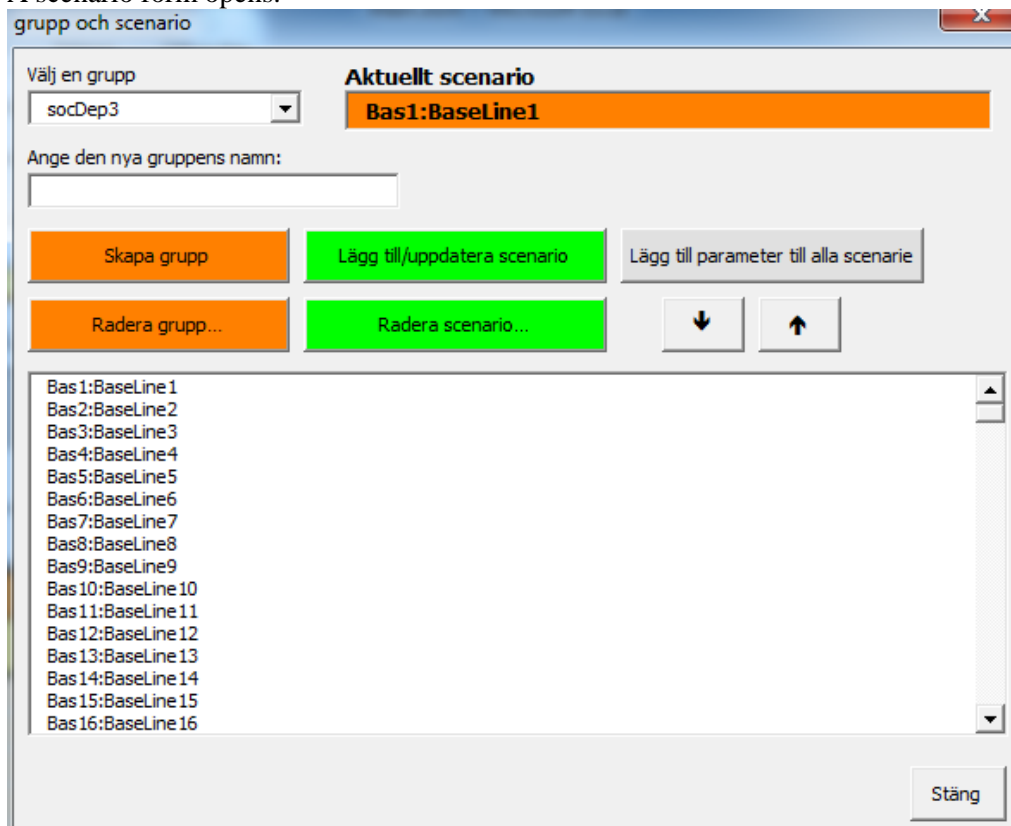
Make sure you have chosen Advanced or Developer mode.

To update the scenario (that is, keep the name but with changed parameter values) by changing the value of **realRate of return Premium pension** to 3.50%, do as follows:

1. Change the value of realRate of return Premium pension to 3.50%.
2. Click the button **Edit scenario & groups**.

The screenshot shows the 'Pensionsmodellen' interface. At the top left, it says 'PENSIONS MYNDIGHETEN'. Below that, there are several buttons: 'Kör scenario', 'Kör grupp...', 'Kör parallellt...', 'Kör enbart demografi', and 'Redigera scenario & grupper...'. The 'Redigera scenario & grupper...' button is highlighted with a red rectangle. Below the buttons is a table showing the current scenario 'Bas1' and its parameters, identical to the table above.

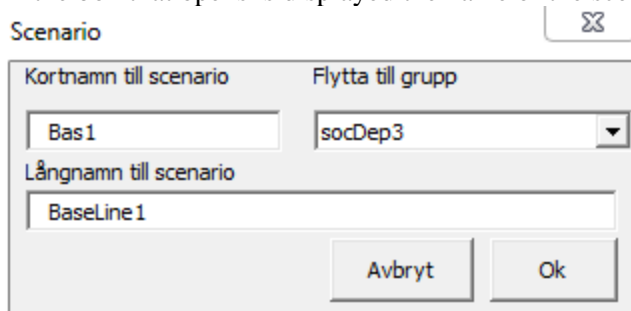
3. A scenario form opens.



4. NB! **Do not click on a scenario in the list. If you do, all the values will be restored to the latest saved values.**

Click on button **Add to/Update scenario.**

5. In the box that opens is displayed the name of the scenario and the group.



6. Do not change anything, but click the button **OK**. Now you have updated the scenario.

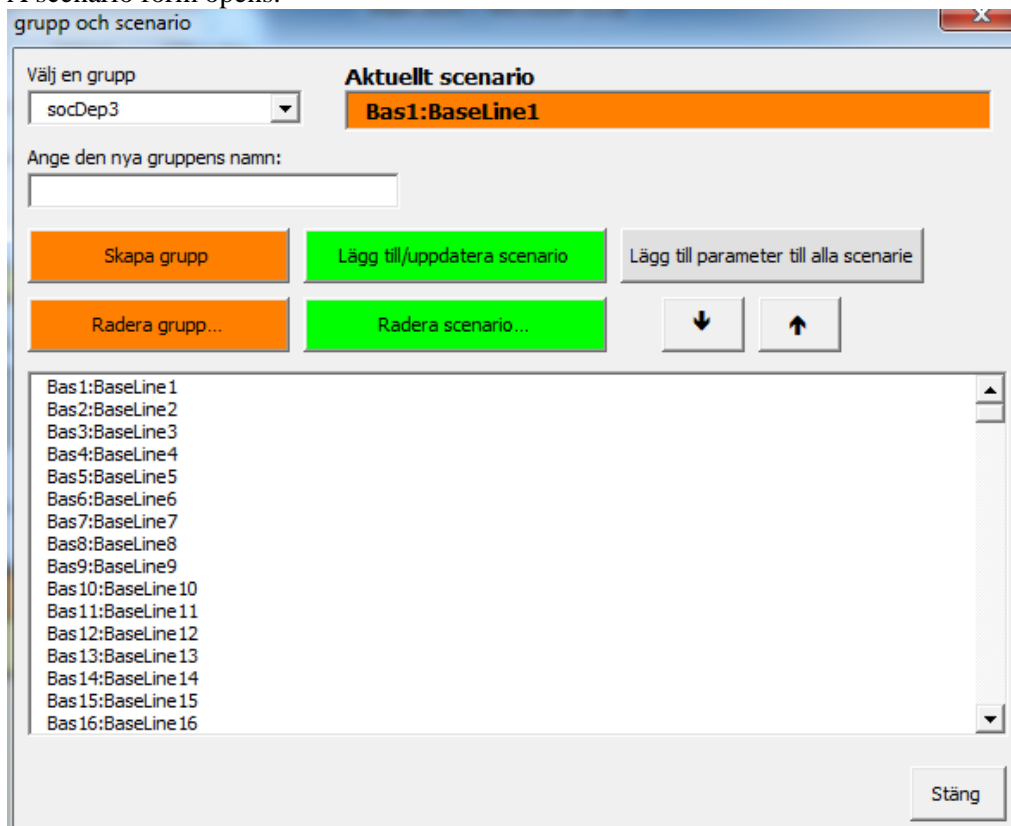
## Create a new scenario

To create a new scenario with the value 3.5% for **realRate of return Premium pension** changed to 3.50%, do as follows:

1. Change the value of realRate of return Premium pension to 3.50%.
2. Click on button **Edit scenario & groups**.

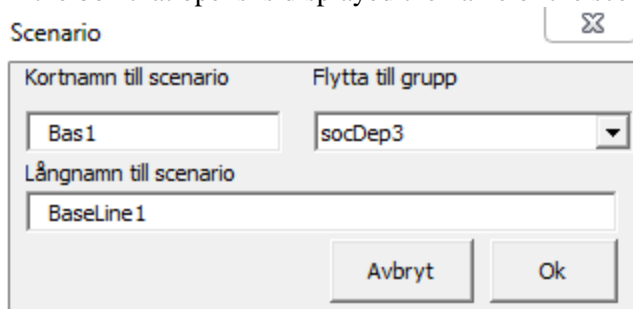
A	B	C	D
<b>PENSIONS MYNDIGHETEN</b>  <b>Pensionsmodellen</b>		Kör scenario	Kör grupp...
		Kör parallellt...	
		Kör enbart demografi	
		Redigera scenario & grupper...	
<b>Aktuellt scenario:</b>		<b>Bas1</b>	
		↓	↑
		Parametrar	
S_Survival	Main alternative SCB2013		
S_Fertility	Main alternative SCB2013		
S_Immigration	Main alternative SCB2013		
S_Emigration	Main alternative SCB2013		
S_PGII	Custom		
S_RetirementAge	Constant		

3. A scenario form opens.



4. NB! **Do not click on a scenario in the list. If you do, all the values will be restored to the latest saved values.**  
Click the button **Add to/Update scenario**.

5. In the box that opens is displayed the name of the scenario and the group.



6. Change the short and long name as desired and click the button **OK**. Now a new scenario has been created. If you also change the group, the scenario will be created in the selected group.



# Troubleshooting

## **You cannot close Excel**

The easiest way to terminate the pension model is to use the buttons "**Close without saving**" or "**Save & Close**" in the **Main** worksheet. This closes down the pension model and terminates Excel. Otherwise, you must first close all workbooks except "**Main**" which must be the last workbook closed. Workbooks that do not belong to the pension model are handled manually.

If you cannot close the model using the above-mentioned buttons, you can always close Excel via Windows Task Manager.

## **There is a folder named "Data" containing binary files**

The **Data** folder partly contains files necessary for the system to run, and partly calibrated probabilities (which speed up pension model runs).

## **Graphs showing restrictions being calculated are not updated**

This can have various causes. Either the check box "Restriction animation" is unchecked in the Main worksheet (and this also applies to "Chart animation" in the **Chart** worksheet), or maybe saved matrices are being used to speed up the runs, in which case restrictions animations are not updated.

## **The error message is "Out of memory"**

The memory used by Excel can run out if you re-run the pension model very many times. To fix this, restart Excel.

## **It says: Security Warning Automatic Update of links has been disabled**

Click "Enable Content", and then "Continue".

## **You get the message "End Year is not the same as the last run End Year". Charts and all data will be cleaned. Do you want to continue?**

Due to the new run having a different end year than the previous run, all diagrams animated in the worksheet **Chart** are cleared. This is done so that the year axes will be consistent with the new end year.

# Appendix 1

## Detailed description of the pension model

### Description of parameters

Sex 0, 1

Age 0 – 120

Origin 1 – 7

Sweden	1
Nordic countries excl. EU	2
EU excl. Nordic countries	3
Europe excl. EU	4
Countries with high HDI excl. Europe	5
Countries with average HDI excl. Europe	6
Countries with low HDI excl. Europe	7

HDI stands for Human Development Index and is an index by level of development for each country. More information can be found in the publication ‘Sweden’s Future Population 2012-2060’ from Statistics Sweden

([http://www.scb.se/Pages/Product\\_14495.aspx](http://www.scb.se/Pages/Product_14495.aspx)).

The 21 status factors that describe the status groups are:

IS\_MARRIED, HAS\_PGII, HAS\_SAPGIS, HAS\_SAPGIA, HAS\_SAPGBS, HAS\_SAPGBA, HAS\_TRANSFER, HAS\_BPGB, HAS\_PGBSTUD, IS\_IN\_SWE, ABROAD, IS\_PARENT\_0\_1, IS\_PARENT\_0\_4, RETIREMENT\_EXTENT, IS\_RETIRED, HAS\_HIGH\_EDU, HAR\_BEHALLNING, DECEASED, IS\_ALIVE, NOT\_BORN, NOT\_IMMIGRATED

These are either 0 or 1 except for `retirement_extent` which may have five different values between 0 and 1.

Of the 21 status factors, it is possible to create 168 840 unique combinations. Using data from 2003-2009, it was possible to see that only 498 combinations described 95% of all data. This is the sample used for the calculations in the Pension Model.

Each gender, age and origin group contains 498 data points but since many of these are unreasonable, it was possible to reduce storage from 273 million to only 51288 cells.

The status factors describe:

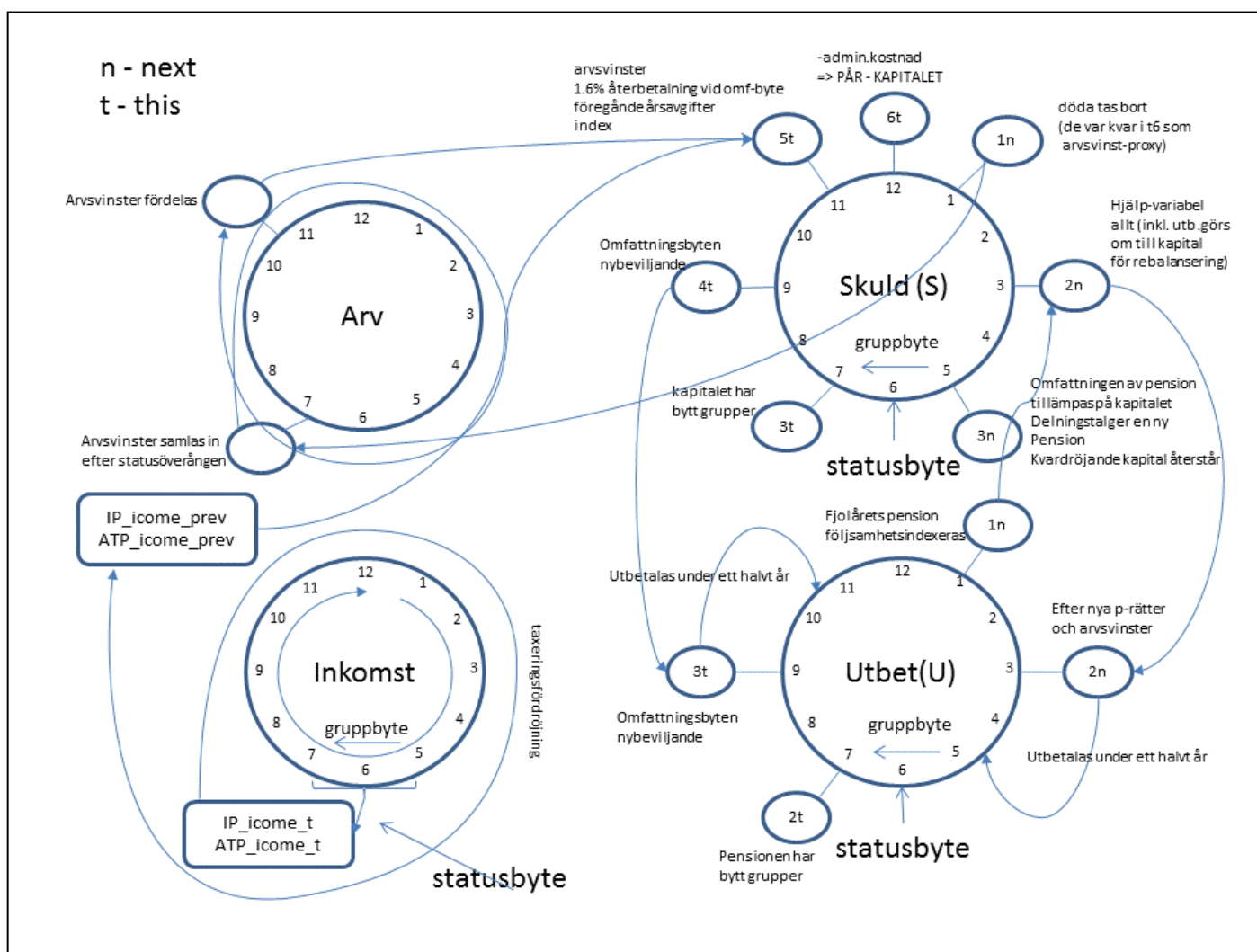
Has_PGII	Estimated earned income
Has_SAPGIS	Income from sickness compensation
Has_SAPGIA	Income from activity compensation
Has_SAPGBS	Pension-qualifying amounts from fictive income for those with sickness compensation
Has_SAPGBA	Activity compensation
Has_transfer	Transfers such as parental cash benefit, unemployment benefit, sickness and activity compensation, which count as pension-qualifying income
Has_PGBSTUD	Pension-qualifying amounts from studies

Has_BPGB	Pension-qualifying amounts from the first 4 years with children
Is_parent_0_1	Parents with children between 0-1 years
Is_parent_0_4	Parents with children between 0-4 years

### Detailed view of inner workings of the pension system

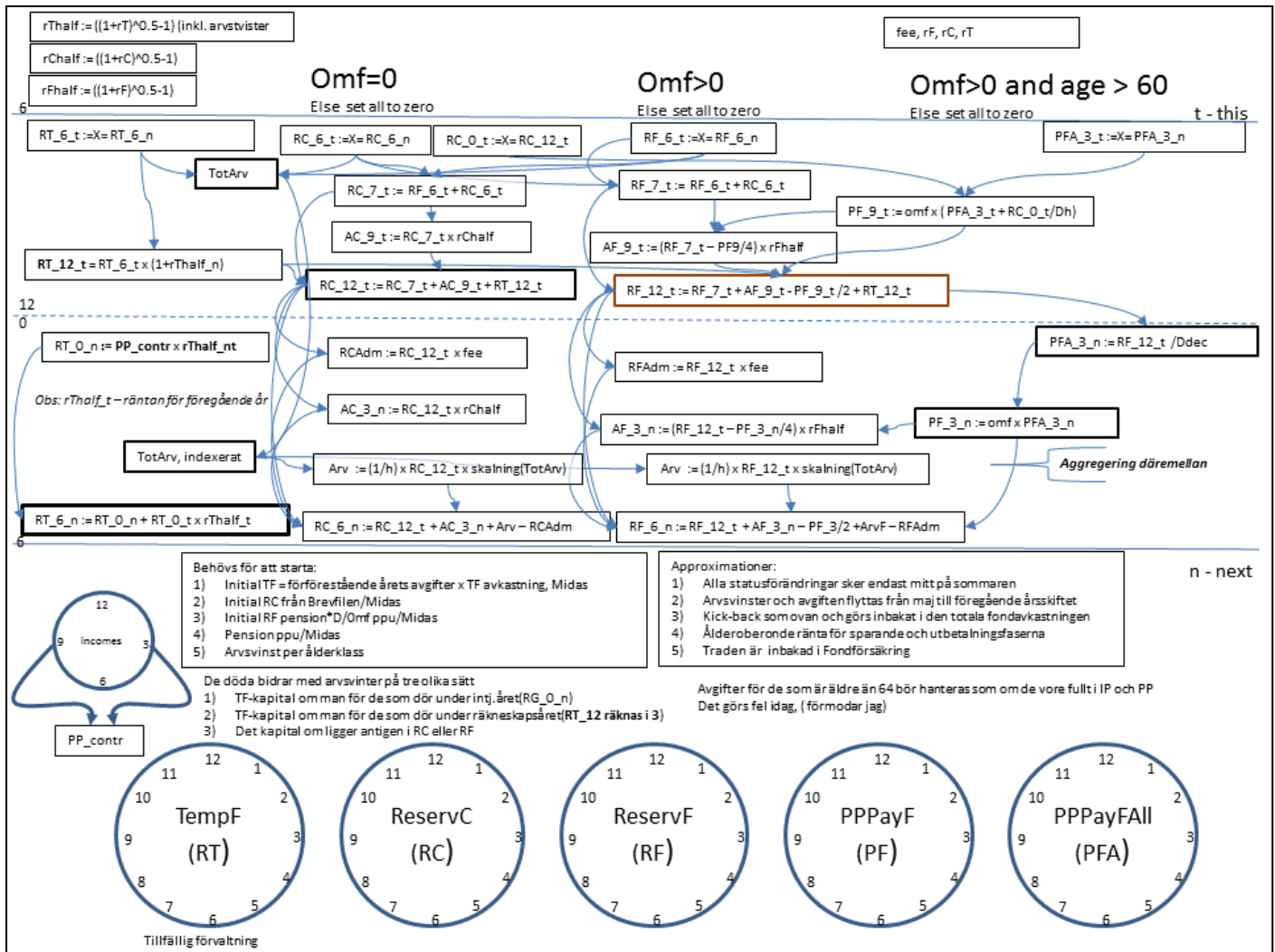
The pension system's inner workings are controlled by a complex regulatory system that includes a large number of variables. Figure 35 portrays the general principles upon which the system is based and the tables with their associated variables.

#### Inkomstpension



gure 17

Premium pension



Figur 36

IP_U1_n	PP_U1_n		Sum of disbursements carried over to next year. Index-adjusted.
IP_U2_n	PP_U2_n	ATP_U2_n	Sum of disbursements due next year
IP_U2_t	PP_U2_t	ATP_U2_t	After status transition
IP_U3_t	PP_U3_t	ATP_U3_t	Ongoing annual disbursement amount at year-end
IP_S1_n			Total balance continuing to next year - conceptually prior to pension recalculation. Corresponds to S6_t from before year-end but without balances from deceased.
IP_S2_n	PP_S2_n		Value of total balance after fictive withdrawal of pension. Functions as basis for annual recalculation of pension (and balance)
IP_S3_n	PP_S3_n	ATP_S3_n	Total balance directly after annual recalculation. Valid until the next change of status (i.e. next spring half-year)
	PP_S2_t		Help for rebalancing
IP_S3_t	PP_S3_t	ATP_S3_t	As S3_n but after status transition
IP_S4_t	PP_S4_t	ATP_S4_t	Balance directly after the mid-year
IP_S5_t	PP_S5_t	ATP_S5_t	Balance after indexation but before payment of administration fees
IP_S6_t	PP_S6_t	ATP_S6_t	Balance at year-end, including balances of those deceased during the year

In the workbook **Result**, after a run of the Pension System, you can see the aggregated values of the variables, for example, AY\_IP\_S6\_t (= Age vs Year for IP\_S6\_t).

Other variables from which you can read results are: (Osay = Origin Sex Age Year)

x_OSAY_IP_empirical_inheritance_gain_retired	Empirical inheritance gains for inkomstpension for <= 60 years
x_OSAY_IP_demographic_inheritance_gain_retired	Forecast inheritance gains for inkomstpension for >= 60 years
x_OSAY_ATP_empirical_inheritance_gain_retired	Empirical inheritance gains for ATP for <= 60 years
x_OSAY_ATP_demographic_inheritance_gain_retired	Forecast inheritance gains for ATP for >= 60 years
x_OSAY_PP_empirical_inheritance_gain_retired	Empirical inheritance gains for premium pension
x_OSAY_PP_empirical_inheritance_gain_active	Empirical inheritance gains for persons not claiming premium pension at start of year
x_OSAY_IP_admin_fee	Administration fees paid, inkomstpension
x_OSAY_ATP_admin_fee	Administration fees paid, ATP
x_OSAY_PP_admin_fee_retired	Administration fees paid, premium pension
x_OSAY_PP_admin_fee_active	Administration fees paid for persons not claiming PP at start of year
x_OSAY_PP_fund_return_spring_retired	Change in market value in premium pension funds during spring

x_OSAY_PP_fund_return_spring_active	Same as above but for persons not claiming premium pension
x_OSAY_PP_fund_return_autumn_retired	Same as above but for persons claiming premium pension
x_OSAY_PP_RGK_return	Change in market value in premium pension funds during autumn
x_OSAY_IP_indexation	Value of return on pension rights in Swedish National Debt Office
x_OSAY_IP_indexation_adjustment	How much balance changes due to indexation, inkomstpension
x_OSAY_ATP_indexation	Adjustment of index on changed amount during year due to norm reducing disbursement index, inkomstpension
ATP_index_d	How much balance changes due to indexation, ATP
PP_index	Adjustment of index on changed amount during year due to norm reducing disbursement index, inkomstpension, ATP
PP_index	How much balance changes due to indexation, premium pension
PP_index_d	Adjustment of index on changed amount during year due to norm reducing disbursement index, inkomstpension, premium pension
x_OSAY_IP_contribution_prev	Previous year's pension credit, inkomstpension
x_OSAY_ATP_contribution_prev	Previous year's pension credit, ATP
x_OSAY_PP_contribution_prev	Previous year's pension credit, premium pension
x_OSAY_IP_contribution_t	Current year's pension credit, inkomstpension
x_OSAY_ATP_contribution_t	Current year's pension credit, ATP
x_OSAY_PP_contribution_t	Current year's pension credit, premium pension
x_AY_cnt_IP_income	Number of persons with pension credit, inkomstpension
x_AY_cnt_ATP_income	Number of persons with pension credit, ATP
x_AY_cnt_PP_income	Number of persons with pension credit, premium pension
x_AY_cnt_TP_active_liability	Number of persons with active pension liability, ATP
x_AY_cnt_IP_active_liability	Number of persons with active inkomstpension liability
x_AY_cnt_total_pensions	Number of persons with pension disbursements
x_AY_cnt_IP_pensions	Number of persons with disbursement from inkomstpension