

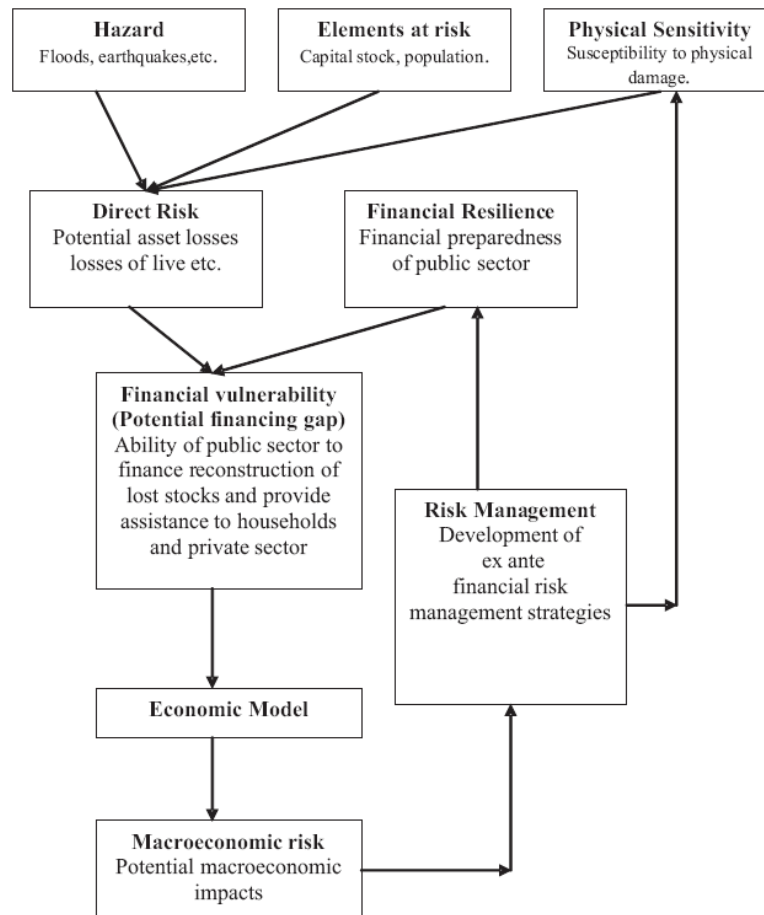
User Interface of the CatSim Model

Some Practical Guidelines

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A) Overview:

The CatSim Model is designed to illustrate the tradeoffs and choices a country must make in managing the economic risks due to natural disasters. Budgetary resources allocated to ex-ante disaster risk management strategies, including loss mitigation measures, excess of loss insurance, reserve fund and contingent credit arrangements for public assets, reduce the probability of financing gaps - the inability of governments to meet their full obligations in providing relief to private victims and restoring public infrastructure – or prevent the deterioration of the ability to undertake additional borrowing without incurring a debt crisis. The next figure shows the risk management approach of CatSim:



Hazard, exposure and physical sensitivity are determining the direct risk of potential asset losses by the use of loss distributions, also represented as exceedance probability loss curves. Financial vulnerability is measured through the financing gap concept and describes the ability of the public sector to finance reconstruction of lost stocks and provide assistance to the business sector (as an insurer of last resort) and households. The financial vulnerability is determined by the direct risk and the financial resilience of the government, which also determines their macroeconomic risk (e.g. indebtedness, growth and growth stability) of negative long term impacts in the future (e.g. 10 years). Due to risk management options, the financial resilience can be strengthened which as a consequence lessens the financial vulnerability and therefore macroeconomic risk. The user interfaces guide the user through each step of the above figure

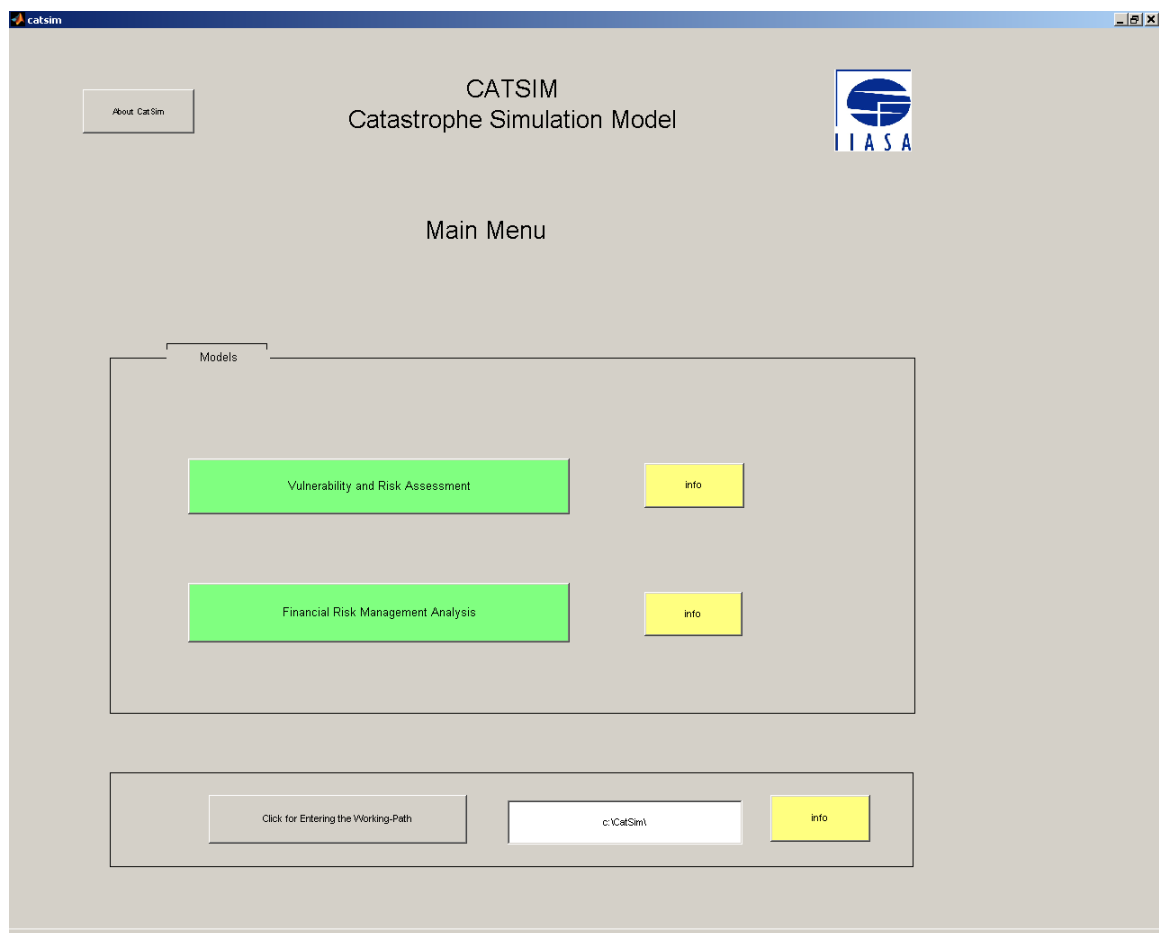
We view the problem of disaster risk management for developing countries as a two stage decision problem under uncertainty. The first stage is the ex ante stage, where budget allocation can be made to undertake mitigation measures, buy insurance or other financial protection instruments for public assets. The second stage is the ex-post stage, the decision stage after a disaster, where repair, budget reallocation and other financial decisions (tax increase, loans etc.) are made. We look at this problem from an integrative view: The scope of possible actions at stage two influences the decision at stage one.

Monte-Carlo-Simulation is used to generate the scenarios for a given time horizon, e.g. for a time horizon of 11 years, more than 3200 scenarios for losses caused by catastrophic events within the time period are generated.

In the following the user interfaces, some guidelines for the use of CatSim, important variables and their presentation within CatSim are shown.

B) User Interfaces:

1) Main Menu: In the main menu one can chose between two sorts of analysis: Vulnerability and Risk Assessment and Financial Risk Management Analysis. While the former one is a more static analysis for the next year, the later one uses probability based approaches for longer time horizons. At the bottom there is also the directory path where the files should be saved and loaded from.

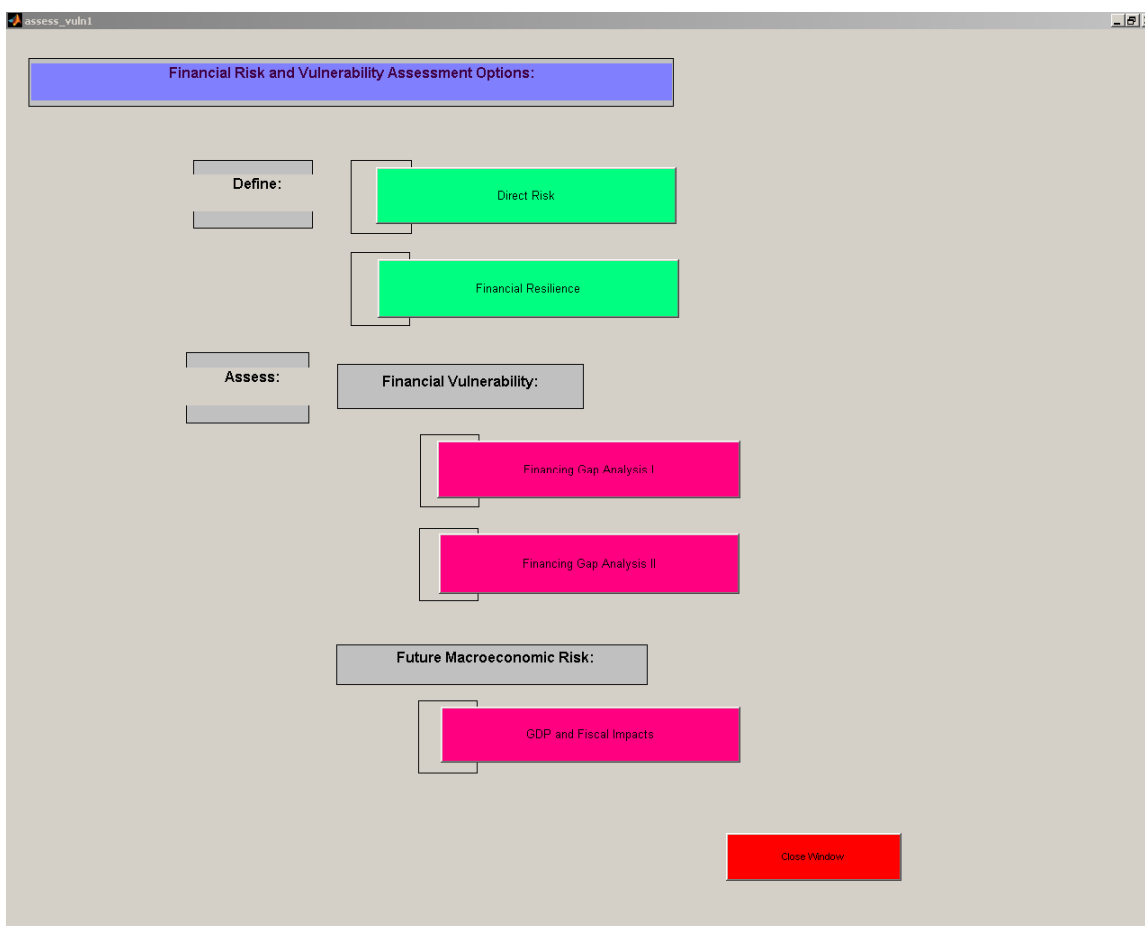


Note: To keep it simple the directory should be the work directory, e.g. c:\catsim\. This directory can be changed by writing a new directory in the text window below and push

the button on the lower left hand side (the directory c:\catsim\ will be used as the standard work directory at the beginning).

Note: Double clicking at the top edge of the window will increase the window to its maximum size.

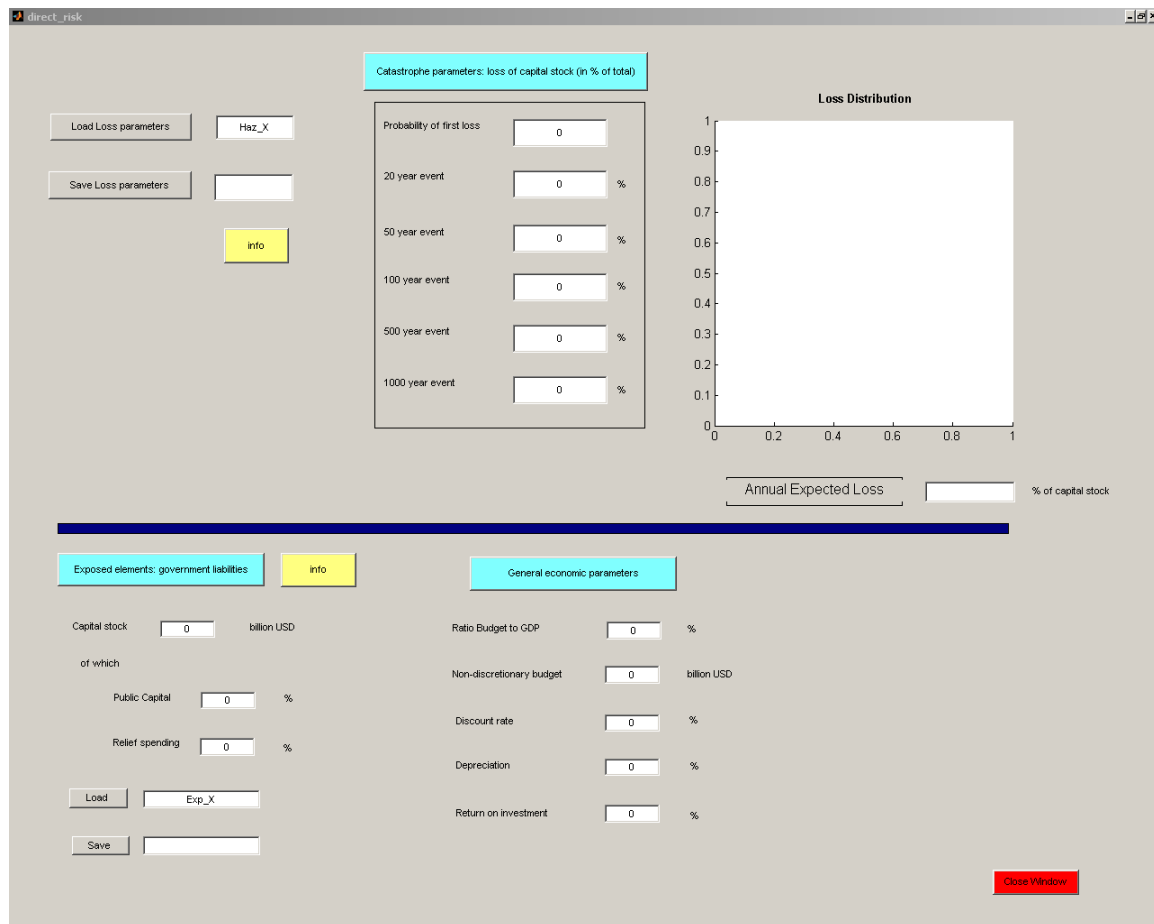
2) Vulnerability and Risk Assessment: The following window appears if you push in the main menu (1) on the ‘Vulnerability and Risk Assessment’ button.



Usually one starts with defining the direct risk the country is exposed to. This is the first button at the top. It combines the information about the hazard, the physical sensitivity and the elements at risk via a loss distribution. The second button defines the financial resilience of the government (see also the figure in section A, first page).

Afterwards, financial vulnerability via the financing gap can be analyzed. We start by explaining the direct risk button.

2.1) Direct Risk: The following window appears if you push the direct risk button in window (2).



To load up a file, type in the file name (e.g. Haz_X) in the upper left corner and push the **Load Loss parameters** button. The following numbers are loaded then from the file,

- Probability of first loss
- Percentage of capital stock destroyed in the 20 year event
- Percentage of capital stock destroyed in the 50 year event
- Percentage of capital stock destroyed in the 100 year event
- Percentage of capital stock destroyed in the 500 year event
- Percentage of capital stock destroyed in the 1000 year event

Example: Honduras

- Probability of first loss = 0.1
- Percentage of capital stock destroyed in the 20 year event = 0.77
- Percentage of capital stock destroyed in the 50 year event = 5
- Percentage of capital stock destroyed in the 100 year event = 12.31
- Percentage of capital stock destroyed in the 500 year event = 30.77
- Percentage of capital stock destroyed in the 1000 year event = 30.78

You can also change the parameters and save the changes afterwards. Just change the numbers and type in the file name, afterwards push the **Save Loss parameters**. The file (called Hazard file here) is then saved under the file-name in the directory you have selected in the main menu (1).

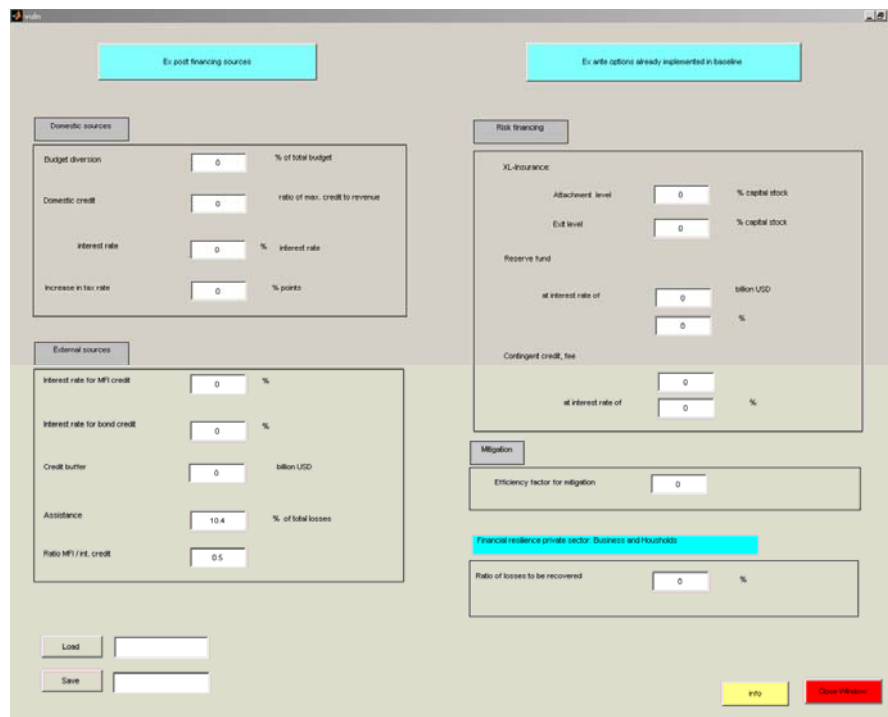
Note: If you do not have any loading file yet, just put in the parameters by hand and save the file, you then have a file in the correct order to be used afterward for loading and changing parameters in the analysis.

Note: The window also shows the loss distribution function, where the x-axis shows the percentage of capital stock destroyed for different year event, and below the annual expected loss is calculated and presented.

Under the blue line there are also some parameters you have to define to describe the direct risk in more detail. On the lower left corner you can again load (e.g. Exp_X) and save the parameter settings (called the exposure file her). The parameters include the total capital stock at risk in dollar terms, the percentage of the losses which the government is responsible for and some economic parameters.

2.2) Financial Resilience: Saving and loading files (e.g. Res_X) is done in the same manner as in the direct risk window (2.1)

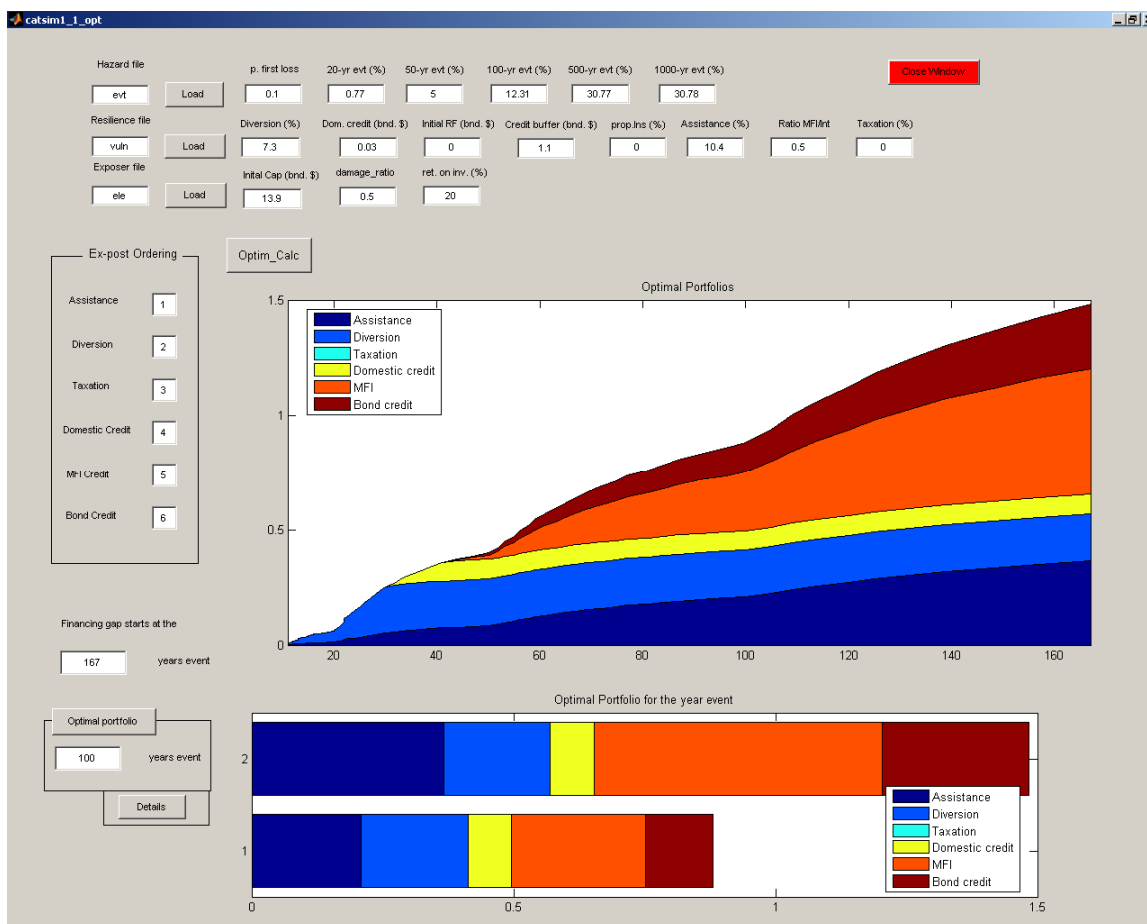
E.g., to save a file (called the resilience file), type in the file name and press the save button. If you do not have any loading file yet, just put in the parameters by hand and save the file, you than have a file in the correct order and you can use it afterward for loading and changing parameters.



2.3) Financing gap analysis I: After the direct risk and the financial resilience are defined one can push the financing gap analysis I button in (2).

Note: It is recommended to close all windows before (e.g. 2.1, 2.2).

Here you can look at the loss financing schemes till the critical year event (the year event when for the first time a financing gap would start). Again the files have to be loaded first (e.g. Haz_X, Exp_X, Res_X). Afterwards, it is possible to change the ordering of the ex-post measures which are used first, second, etc. in the loss financing process and compare the results in the figures after pushing button **Optim_Calc**.

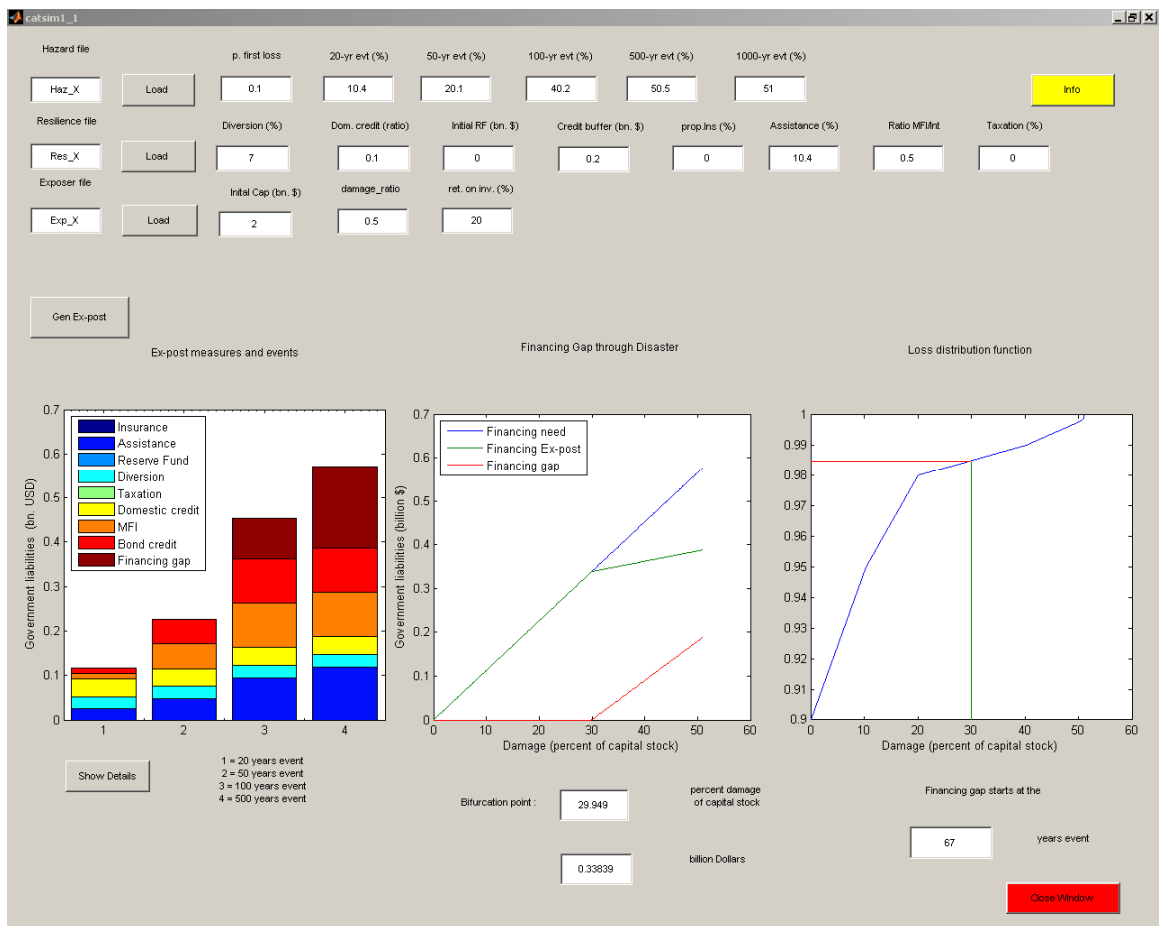


The upper figure shows on the x- axes the year events and on the y-axes the loss financing schema. One then can change the ex-post ordering on the left hand side and by pushing again the **Optim_Calc** button the new results are shown.

Further analysis can be performed by comparing the loss financing strategies for a specific year event with the loss financing in the case of the critical year event by selecting a year event (e.g. “100” for 100 year event) in the lower left hand cell and pushing the **optimal portfolio** button. For a detailed list of the numbers one can also push

afterwards the **Details** button. Afterwards you can close the window and push the button financing gap analysis II in window (2)

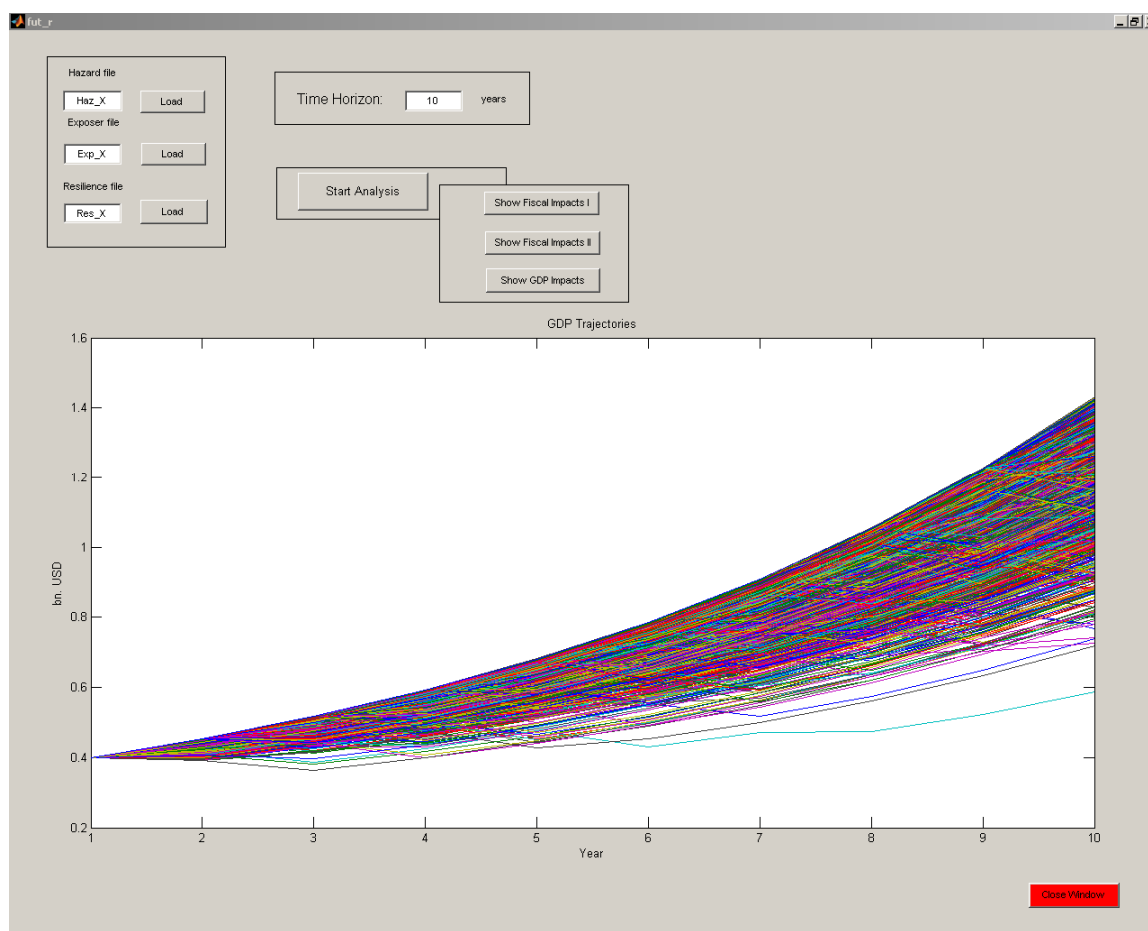
2.3) Financing gap analysis II: Again you have to load your files first, by typing in the file names (e.g. Haz_X, Res_X, Exp_X) and pushing then the load button. Then you can push the ‘Gen Ex-post’ button and the results are shown after some seconds.



On the upper left corner three file names defining the hazard (loss distribution in relative terms), the financial resilience and elements at risk (dollar terms) are entered and loaded by pushing the load buttons. Afterwards, by clicking the **Gen Ex-post** button various types of analysis are done. On the left hand side 4 year events and the loss financing of the damages are presented (for a closer look one can also push the Show details button, see end of script). The middle figure (and the lower two numbers which are shown) shows the bifurcation point where the losses exceeds the capability of the government to finance it. The figure on the right hand side shows the loss frequency function and the maximum loss amount the government is capable to finance, which can translates into the critical year event (e.g. the year event where for the first time a financing gap occurs) is

shown beneath. After this analysis one can close the window and push the ‘GDP and fiscal impacts’ button in window (2). While until now the current financial vulnerability was analyzed in the following the future vulnerability and risk (e.g. 10 year) is investigated

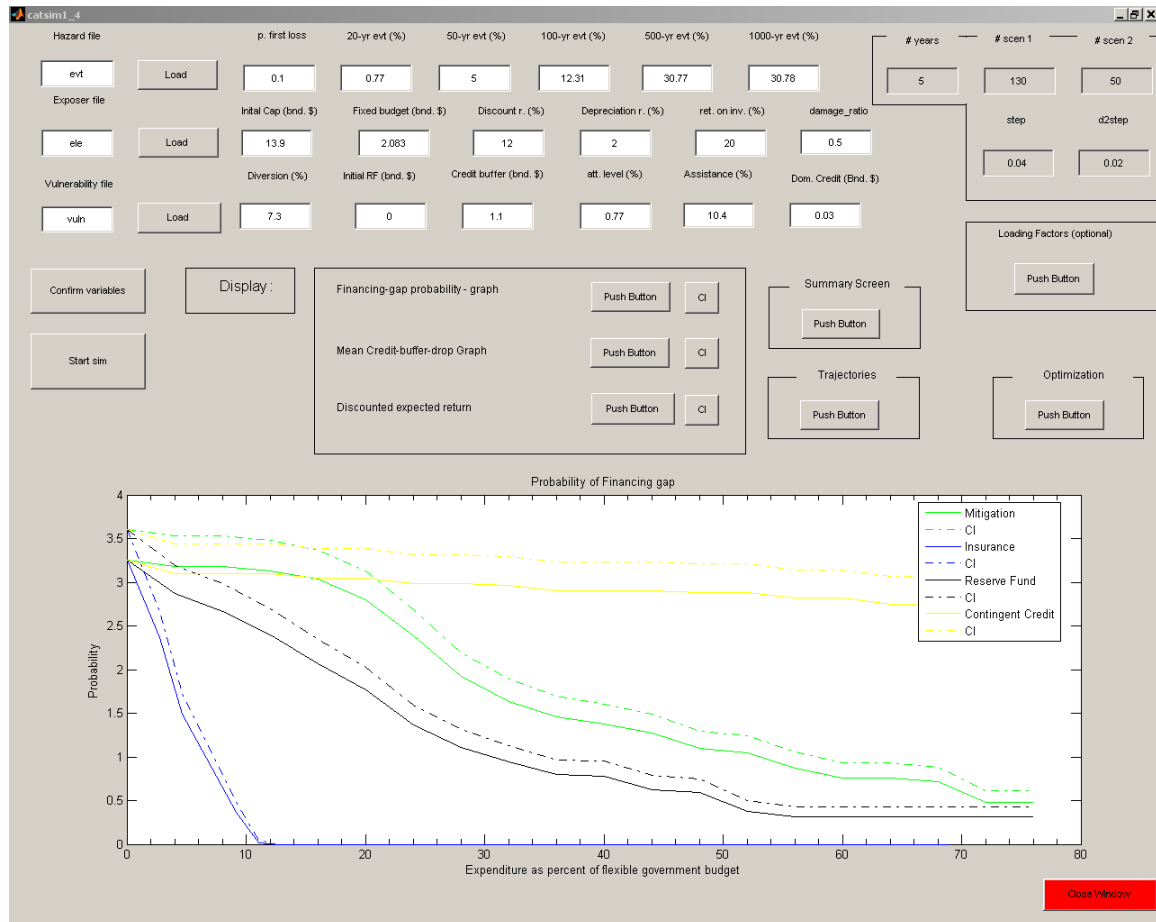
2.4) GDP and Fiscal Impacts: Again you have to load the files by typing in the names of the file and afterwards pushing the load button. Then one can chose the time horizon of interest (10 years as the standard case) and afterwards one can look at the different trajectories (or future paths) of various variables, including GDP and discretionary budget as well as the relation between the discretionary budget and revenue.



After this analysis one can go into the risk management model, by closing the other windows except for window (1) and pushing the ‘Financial Risk Management Analysis’.

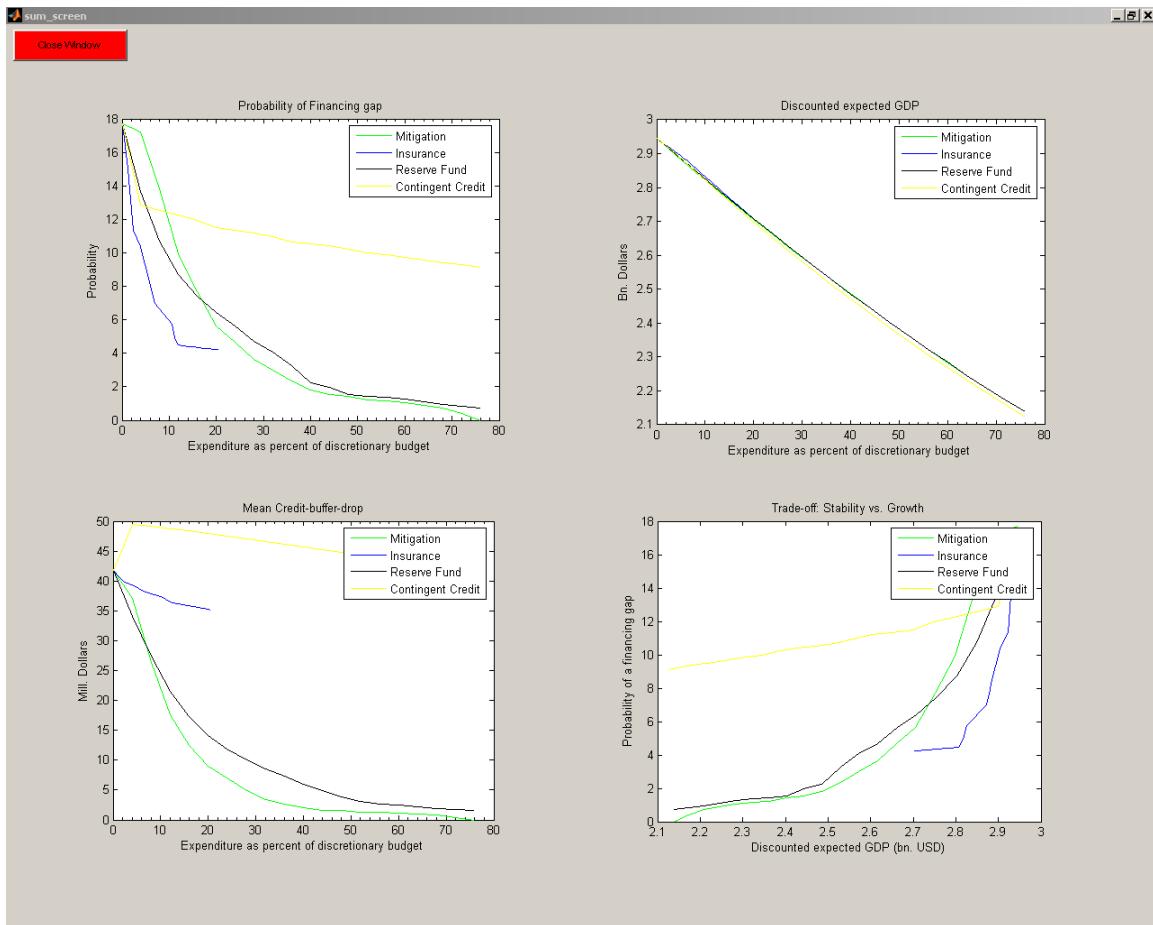
3) Financial Risk Management Analysis: The following window appears afterwards.

Note: Double clicking at the top edge of the window will increase the window to its maximum size.

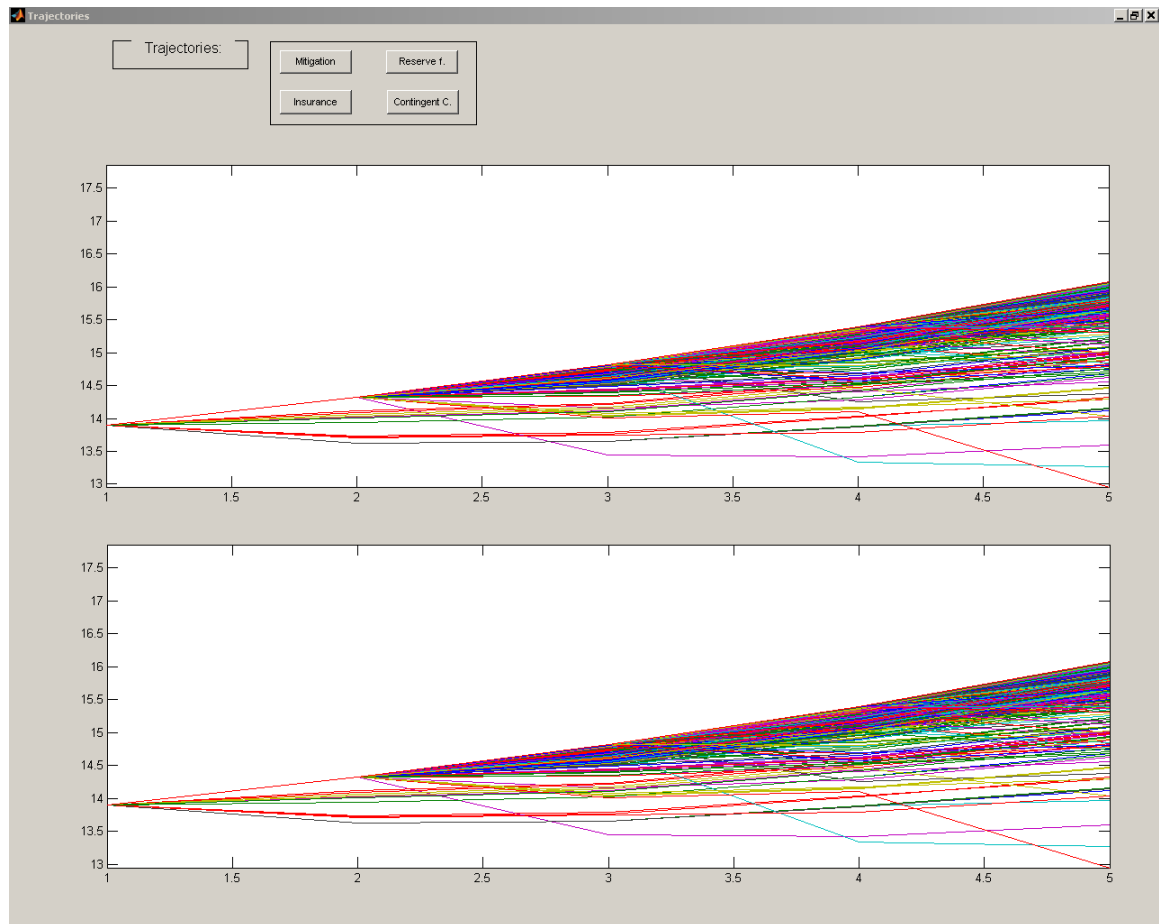


Again the files for the hazard, resilience and exposure are loaded by typing in the file name on the upper right hand side and pushing the load button. Various variables can be changed by typing in different numbers in the upper middle area of the window and by pushing the **confirm variables** button afterwards. Furthermore it is also possible to change the time horizon on the right hand side (the other variables there are for the stochastic trajectory estimations which can be ignored). By pushing the confirm variables button, the variables are saved for the analysis and trajectories for the time horizon are computed (usually a few thousands); they are needed for the simulation. Pushing the **start sim** button will start the stochastic macroeconomic analysis, dependent on the time horizon it takes 30 seconds till 2 minutes for the whole process (the program tells you when it is finished). You can then look at some of the results, including uncertainty analysis (by confidence intervals). One only has to push on the different buttons in the middle of the window, if also confidence intervals want to be seen, one has to push the **CI button**.

To have a complete picture of the whole analysis one can push the **summary screen** which shows the results in one window, including trade-off analysis, see the following window:



There is also the possibility to look at some of the **trajectories** (e.g. the path of the economic variables for different scenarios) with and without ex-ante measures, just push the button below. One example is shown in the next picture:

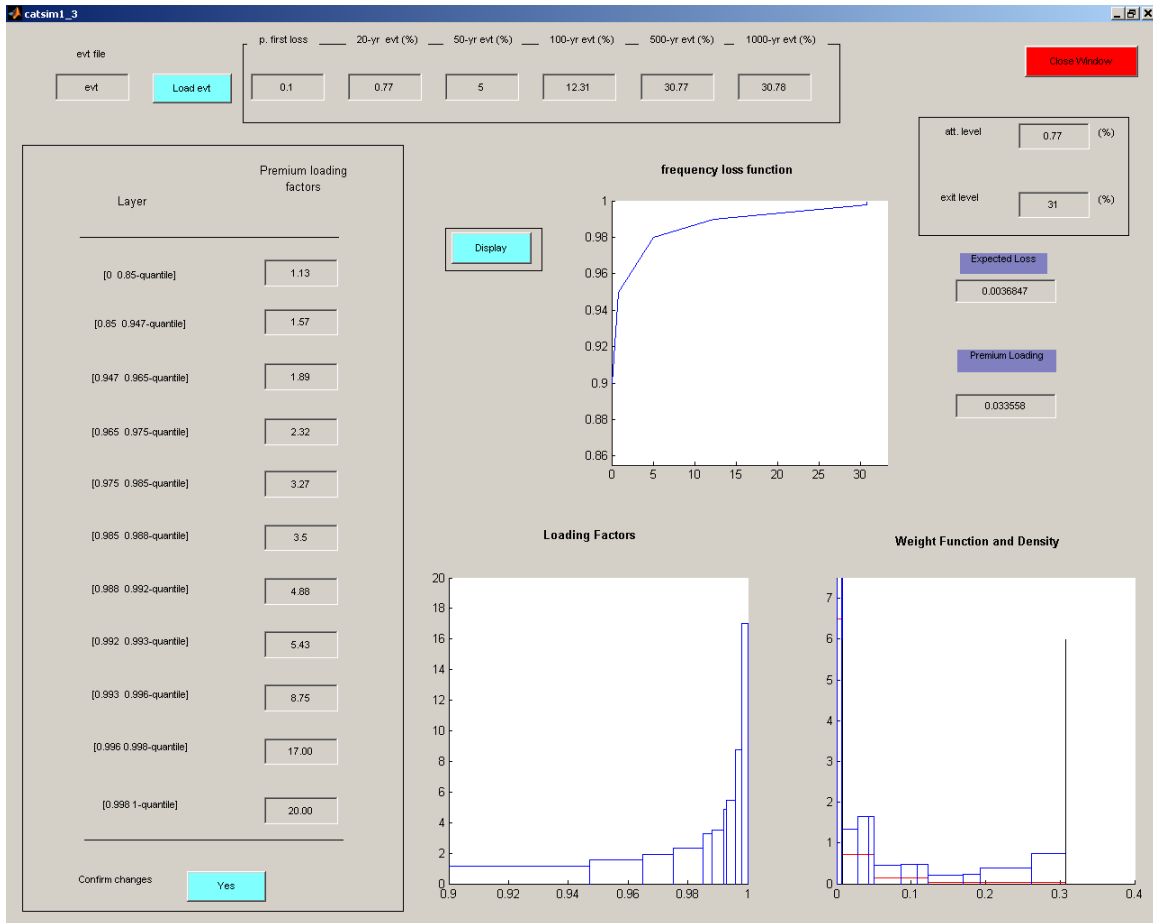


There is also the possibility to do a more detailed analysis of the insurance loading layers by pushing the loading factors button. However, this is only recommended for those with more interest in reinsurance XL-layer contract pricing (see figure at the end)

It is also possible to optimize the ex-ante portfolio by adaptive Monte Carlo algorithms however this takes a too long time for an interactive analysis and is therefore omitted here (see figure at the end)

Note: Usually in the first step, you first load up the files, then push the confirm variables button and afterwards the Start sim button. The figures appear after some seconds or minutes (depending on the time horizon) and after comparing and analyzing the results one usually wants to change some of the variables. After changing the variables one has to push again the confirm variables button and then the start sim button. Only pushing the start sim button would not change the results because the numbers for the variables are not recognized by the program.

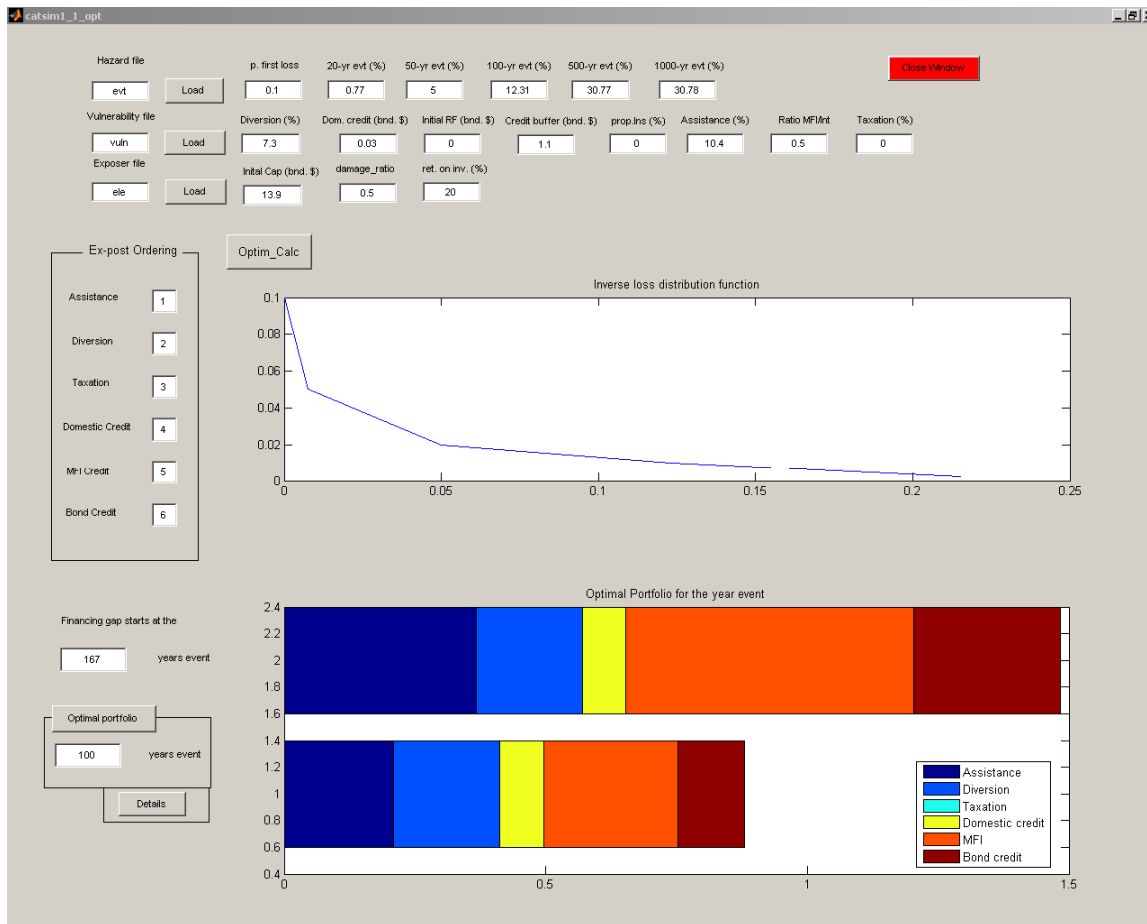
4) Additional Interfaces:



XL-Insurance: Loading factors

	20 year event	50 year event	100 year event	500 year event	
Capital need:	0.063032	0.4093	1.0077	2.5188	in bnd. USD
Capital get:					
Proportional Insurance	0	0	0	0	in bnd. USD
Assistance	0.013111	0.085134	0.2096	0.52392	in bnd. USD
Reserve Fund	0	0	0	0	in bnd. USD
Diversion	0.049922	0.20294	0.20294	0.20294	in bnd. USD
Taxation	0	0	0	0	in bnd. USD
Domestic Credit	0	0.0834	0.0834	0.0834	in bnd. USD
MFI borrowing	0	0.018913	0.25588	0.55	in bnd. USD
International borrowing	0	0.018913	0.25588	0.55	in bnd. USD
Financing Gap	0	0	0	0.60858	in bnd. USD

Loss financing for different year events



Optimal financing scheme for loss financing below critical year event.

C) Guidelines for a typical CatSim model run

Here, a typical example how an analysis could start and which things one has to pay attention to are given. The number in brackets refers to the windows in section B).

- Usually, one starts with window (1) and goes afterwards to window (2) (Vulnerability and Risk Assessment).
- In this window one defines the direct risk and financial resilience and afterwards assesses the financial vulnerability and macroeconomic risk. There one defines the direct risk by pushing the direct risk button to open window (2.1).
 - Window (2.1) opens if the direct risk button is pushed in window (2). Here, above the blue line, he puts in the file name, e.g. let's call the name of the file "Haz_X" and pushes the load button. Below the blue line he can also load and save a file, e.g. let's call the name of the file "Exp_X". Afterwards one can close the file by pushing the close button (red button). Hence, he looks now again at window (2) where he should now push the Financial Resilience button to open window (2.2).
 - Again in window (2.2) the user can load or save a file, e.g. let's call the name of the file "Res_X". He should again afterwards close the window by pushing the close window button (red button). He comes back again to window (2). There, he can now push the Financing gap analysis I or Financing gap analysis II button
 - Usually, the user has now three file names, which he puts into the upper right hand side. By pushing the load button the variables are uploaded into the Interface. Then one can push the **Optim_Calc** button to see the results. Afterwards one can change the ordering (left hand side) or the values of the variables in the upper middle side and pushing afterwards the **Optim_Calc** button again to look at the new situation. One can look at a specific financing scenario, e.g. 100 year event by putting this value in the lower left hand side and pushing the optimal portfolio button. If the analysis is finished one should again close the window and comes back to window (2) where he can take a closer look at some financing gap issues by pushing the Financing gap analysis II button.
 - Here again, one has first to put in the file names, Hazard, Resilience, Exposure and push the load button. Afterwards, one pushes the **Gen Ex-post** button and looks and interpreted the results. (Note: First the files have to be loaded, afterwards the Gen Ex-post button has to be pushed.) Afterwards the user can change some of the numbers on the upper middle side and by pushing the **Gen Ex-post** button the new results with this

setting are calculated. (Note: Only push the button once, because otherwise the calculation is performed several times or the system crashes due to calculation issues, you will know when the analysis is finished by a small window which appears afterwards). If the analysis is finished one should again close the window and also window (2), because in window (1) the 'Financial Risk Management Analysis' button to open window (3).

- ➔ Here, one again should type in first the file names, loading it by pushing the loading button and afterwards pushing the **Confirm variables** button, waiting till the calculation is finished (showed by a window) and then pushing the **Start sim** button. (Note: This analysis takes some time from 30 second to 3 minutes, so be patient, most of the time thousands of scenarios and their future consequences are calculated.) Afterwards, just push the buttons on the middle to look at the results. Note: You can also push also the other buttons, e.g. trajectories button to look at the development paths of the analysis: when doing that, be sure to close the window again (except of (3)). When you want to change some of the values of the variable, just put in the new number in the upper middle side and push than the **Confirm variables** and afterwards the **Start Sim** button. If you have finished your analysis you can discuss the results again by looking at the other windows, e.g. 2.3., 2.4. etc.