

DGE–CRED Practical Session 2: Implementation of storms, land loss and labour productivity losses

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On behalf of:



of the Federal Republic of Germany

Task 1: Calibration workbook and the Baseline scenario.

- Create folder named ExcelFiles
- Use the CreateRawExcelInputFileRobust.m in the function folder to create the excel file.
- Sectors and subsectors are: Agriculture, forestry and fishing; Industry; Services
- Region: Vietnam
- Climate variables regional: surface temperature (tas), storms (storms)
- Climate variables national: sea level (SL)
- Use the Calibration.xlsx file in data folder and copy the Sheet Data and the Baseline sheet into the ModelSimulationandCalibration3Sectorsand1Region.xlsx.
- Update parameters and run the Baseline scenario.

Task 1: Calibration workbook and the Baseline scenario.

- First modify line 12 to 15 in the CreateRawExcelInputFileRobust.m

```
%% Define sectors
casSectors = {'Agriculture, forestry and fishery'; 'Industry'; 'Services'};
inbsectors_p = length(casSectors);
%% Define subsectors
casSubSectors = {'Agriculture, forestry and fishery'; 'Industry'; 'Services'};
inbsubsectors_p = length(casSubSectors);
%% Define regions
casRegions = {'Vietnam'};
inbregions_p = length(casRegions);

%% Define regional climate variables
casClimateVarsRegionalName = {'surface temperature (Celsius)', 'storms (storms)'};
casClimateVarsRegional = {'tas', 'storms'};

%% Define national climate variables
casClimateVarsNationalName = {'Sea level'};
casClimateVarsNational = {'SL'};
casClimateVars = [casClimateVarsRegional casClimateVarsNational];
```

Task 1: Calibration workbook and the Baseline scenario.

- Copy from Calibration.xlsx file the data into the ModelSimulationandCalibration3Sectorsand1Region.xlsx Sheet Data.

The image shows two Excel windows side-by-side. The left window is titled 'Calibration' and the right window is titled 'ModelSimulationandCalibration3Sectorsand1Region'. Both windows have their ribbon menus open, showing the Home tab selected. The data being transferred is a table with columns: Region, Initial Value Added Shares (phi), Initial Employment Shares (phi), Labour Cost Shares (phi), Sector, export share (phi), import share (phi). The data is as follows:

| Region | Initial Value Added Shares (phi) | Initial Employment Shares (phi) | Labour Cost Shares (phi) | Sector | export share (phi) | import share (phi) |
|----------------|----------------------------------|---------------------------------|--------------------------|-------------------------------------|--------------------|--------------------|
| China, Vietnam | 0.158321065 | 0.376176494 | 0.6575 | Agriculture, forestry and fisheries | 0.130530763 | 0.0 |
| Vietnam | 0.422561374 | 0.193657296 | 0.475 | Industry | 0.466348874 | 0.7 |
| Vietnam | 0.419117561 | 0.43016626 | 0.8655 | Services | 0.10251019 | 0. |

Task 1: Copy the Baseline scenario.

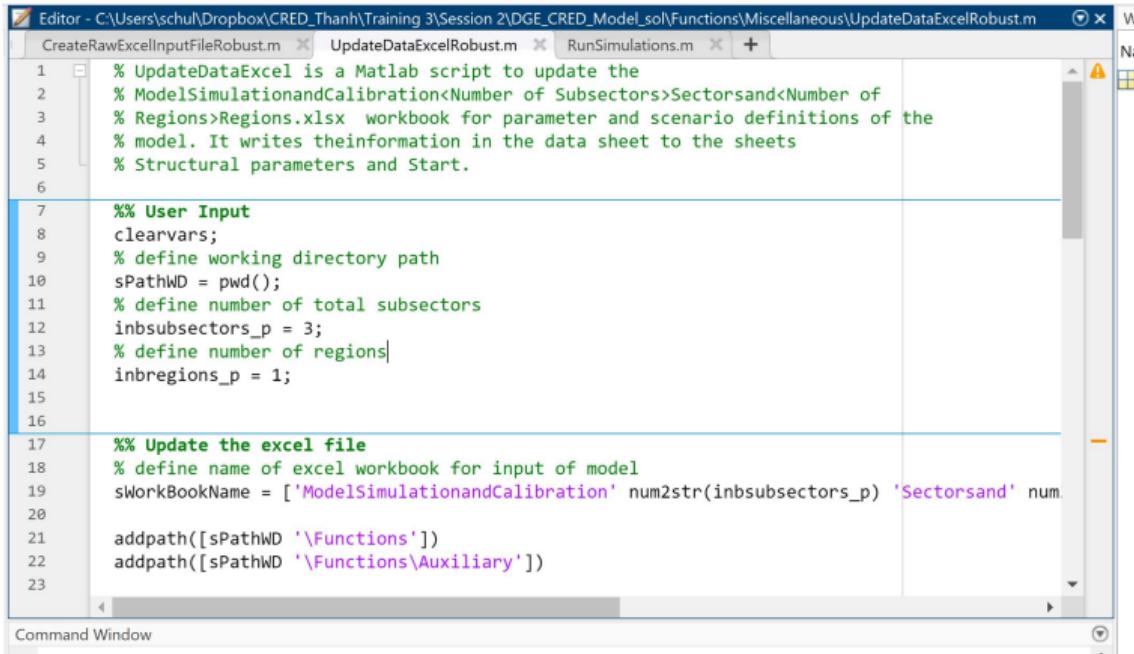
- Copy from Calibration.xlsx file the Baseline scenario into the ModelSimulationandCalibration3Sectorsand1Region.xlsx Baseline sheet.

The image shows two Microsoft Excel windows side-by-side. Both windows have the same title bar: 'Calibration' and 'ModelSimulationandCalibration3Sectorsand1Region.xlsx' respectively. The 'Home' tab is selected in both. The data is organized into two main sections: 'Time' and 'Sectors'. The 'Time' section contains columns for 'Time' and 'exp_PoP'. The 'Sectors' section contains columns for 'S' and 'g1', 'g2', 'g3', and 'g4'. The data is identical in both workbooks, with values such as 0.103533 for exp_PoP at Time 1, and various growth rates for each sector over time steps 1 through 36.

| | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R |
|----|------|---------|----------|-----------|-----------|-----------|----------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | Time | exp_PoP | g1'_1_1 | g1'_2_1 | g1'_3_1 | g1'_4_1 | g1'_N_1 | g2'_1_1 | g2'_2_1 | g2'_3_1 | g2'_4_1 | g2'_N_1 | g3'_1_1 | g3'_2_1 | g3'_3_1 | g3'_4_1 | g3'_N_1 |
| 1 | | | | | | | | | | | | | | | | | |
| 2 | 1 | 0 | 1.028 | 1.074 | 1.069 | 0.948 | 1.057 | 1.027 | | | | | | | | | |
| 3 | 2 | 0 | 1.028 | 1.074 | 1.069 | 0.948 | 1.057 | 1.027 | | | | | | | | | |
| 4 | 3 | 0 | 1.02327 | 1.066785 | 1.0740666 | 0.95307 | 1.051443 | 1.034368 | | | | | | | | | |
| 5 | 4 | 0 | 1.02327 | 1.066785 | 1.071162 | 0.953417 | 1.04887 | 1.023148 | | | | | | | | | |
| 6 | 5 | 0 | 1.023207 | 1.0634446 | 1.071162 | 0.953417 | 1.04887 | 1.023148 | | | | | | | | | |
| 7 | 6 | 0 | 1.023206 | 1.0602273 | 1.067694 | 0.9579466 | 1.049427 | 1.021392 | | | | | | | | | |
| 8 | 7 | 0 | 1.021666 | 1.05726 | 1.064224 | 0.959763 | 1.041106 | 1.026892 | | | | | | | | | |
| 9 | 8 | 0 | 1.020583 | 1.054397 | 1.060103 | 0.961775 | 1.0419 | 1.019847 | | | | | | | | | |
| 10 | 9 | 0 | 1.019533 | 1.051877 | 1.057962 | 0.963886 | 1.039805 | 1.018855 | | | | | | | | | |
| 11 | 10 | 0 | 1.019536 | 1.051877 | 1.057962 | 0.963886 | 1.039805 | 1.018855 | | | | | | | | | |
| 12 | 11 | 0 | 1.019539 | 1.0544197 | 1.052311 | 0.963886 | 1.039794 | 1.01797 | | | | | | | | | |
| 13 | 12 | 0 | 1.019526 | 1.043293 | 1.047422 | 0.970422 | 1.013422 | 1.015358 | | | | | | | | | |
| 14 | 13 | 0 | 1.015313 | 1.035987 | 1.04485 | 0.971901 | 1.039801 | 1.03459 | | | | | | | | | |
| 15 | 14 | 0 | 1.014374 | 1.037987 | 1.040367 | 0.975306 | 1.025296 | 1.013388 | | | | | | | | | |
| 16 | 15 | 0 | 1.013855 | 1.038624 | 1.040477 | 0.974941 | 1.027797 | 1.013187 | | | | | | | | | |
| 17 | 16 | 0 | 1.012972 | 1.034234 | 1.03845 | 0.975209 | 1.028408 | 1.012589 | | | | | | | | | |
| 18 | 17 | 0 | 1.011824 | 1.030941 | 1.03588 | 0.975529 | 1.030236 | 1.011381 | | | | | | | | | |
| 19 | 18 | 0 | 1.011813 | 1.030941 | 1.03588 | 0.975529 | 1.030236 | 1.011381 | | | | | | | | | |
| 20 | 19 | 0 | 1.011123 | 1.029394 | 1.032968 | 0.975948 | 1.032941 | 1.017723 | | | | | | | | | |
| 21 | 20 | 0 | 1.010599 | 1.027334 | 1.031132 | 0.983076 | 1.021209 | 1.012185 | | | | | | | | | |
| 22 | 21 | 0 | 1.010598 | 1.026538 | 1.029754 | 0.981359 | 1.023044 | 1.009679 | | | | | | | | | |
| 23 | 22 | 0 | 1.009536 | 1.025302 | 1.026267 | 0.982291 | 1.020412 | 1.009335 | | | | | | | | | |
| 24 | 23 | 0 | 1.009299 | 1.023941 | 1.02698 | 0.983176 | 1.020481 | 1.008735 | | | | | | | | | |
| 25 | 24 | 0 | 1.008084 | 1.022744 | 1.02595 | 0.984017 | 1.021519 | 1.008299 | | | | | | | | | |
| 26 | 25 | 0 | 1.00776 | 1.022476 | 1.025629 | 0.984841 | 1.021879 | 1.008044 | | | | | | | | | |
| 27 | 26 | 0 | 1.007767 | 1.020537 | 1.020203 | 0.985576 | 1.023811 | 1.007394 | | | | | | | | | |
| 28 | 27 | 0 | 1.007719 | 1.019385 | 1.021872 | 0.986297 | 1.020521 | 1.007115 | | | | | | | | | |
| 29 | 28 | 0 | 1.007701 | 1.018325 | 1.020779 | 0.986982 | 1.024027 | 1.006759 | | | | | | | | | |
| 30 | 29 | 0 | 1.006659 | 1.017399 | 1.019176 | 0.987033 | 1.021556 | 1.006421 | | | | | | | | | |
| 31 | 30 | 0 | 1.006526 | 1.016719 | 1.018753 | 0.988251 | 1.012878 | 1.00661 | | | | | | | | | |
| 32 | 31 | 0 | 1.006001 | 1.015383 | 1.017615 | 0.988339 | 1.012334 | 1.005795 | | | | | | | | | |
| 33 | 32 | 0 | 1.005709 | 1.015389 | 1.019024 | 0.989397 | 1.016233 | 1.005505 | | | | | | | | | |
| 34 | 33 | 0 | 1.005424 | 1.014343 | 1.016078 | 0.989927 | 1.016042 | 1.00523 | | | | | | | | | |
| 35 | 34 | 0 | 1.005153 | 1.013468 | 1.015274 | 0.990431 | 1.016049 | 1.004969 | | | | | | | | | |
| 36 | 35 | 0 | 1.004605 | 1.013737 | 1.016051 | 0.990606 | 1.016086 | 1.004771 | | | | | | | | | |

Task 1: Update the parameters.

- Run UpdateDataExcelRobust.m.



The screenshot shows a Matlab editor window with the file `UpdateDataExcelRobust.m` open. The code is a script designed to update an Excel workbook with parameter and scenario definitions for a model. It includes sections for user input, defining working directory, and updating an Excel file. The code uses standard Matlab syntax with comments explaining its purpose.

```
% UpdateDataExcel is a Matlab script to update the
% ModelSimulationandCalibration<Number of Subsectors>Sectorsand<Number of
% Regions>Regions.xlsx workbook for parameter and scenario definitions of the
% model. It writes the information in the data sheet to the sheets
% Structural parameters and Start.

%% User Input
clearvars;
% define working directory path
sPathWD = pwd();
% define number of total subsectors
inbsubsectors_p = 3;
% define number of regions
inbregions_p = 1;

%% Update the excel file
% define name of excel workbook for input of model
sWorkBookName = [ 'ModelSimulationandCalibration' num2str(inbsubsectors_p) 'Sectorsand' num2str(inbregions_p) 'Regions.xlsx' ];
addpath([sPathWD '\Functions'])
addpath([sPathWD '\Functions\Auxiliary'])
```

Task 1: Run the Baseline scenario.

- Execute RunSimulation.m
- makes sure that you add the right dynare version, have the right scenarios specified and the correct vector for sSubsecstart and sSubsecend.

The screenshot shows the MATLAB Editor window with the file `RunSimulations.m` open. The code defines a scenario named 'Baseline' with specific sector and region configurations. The workspace browser on the right lists various variables used in the script.

```
% RunSimulations is a Matlab script to run different scenarios stored in
% ModelSimulationandCalibration<Number of Subsectors>Sectorsand<Number of
% Regions>Regions.xlsx workbook. The DGE_CRED_Model.mod file is changed
% in the script.

addpath('C:\dynare\4.6.4\matlab')
%% Specify scenario names
casScenarioNames = {...
    'Baseline'
};

%% Define sector structure
sSubsecstart = '[1, 2, 3]';
sSubsecend = '[1, 2, 3]';

%% Define number of regions
sRegions = '1';

%% Define additional specification of the version of the model for sensitivity analysis.
sSensitivity = '';

%% Execute dynare to run the model
```

Workspace variables:

- caData
- caHeal
- casDat
- casShe
- caValu
- dat_rar
- icorow
- icoshe
- inbcoll
- inbregr
- inbrov
- inbsub
- iparam
- iposco
- iposro
- itempl
- ivaluec
- sExcelF
- sPathW
- sSearch
- sSheet
- sWork
- temp
- templc

Task 2: Define SSP 119, 245 and 585 scenario.

- Create three scenarios called SSP119, SSP245 and SSP585.
- Use the ClimateVariables.xlsx file.
- Copy temperature, storms and sea level to the respective sheet and place them in column C-E.
- Delete empty rows from row 84 onwards.
- Run the scenarios.

Task 2: Create the SSP 119, 245 and 585 scenario.

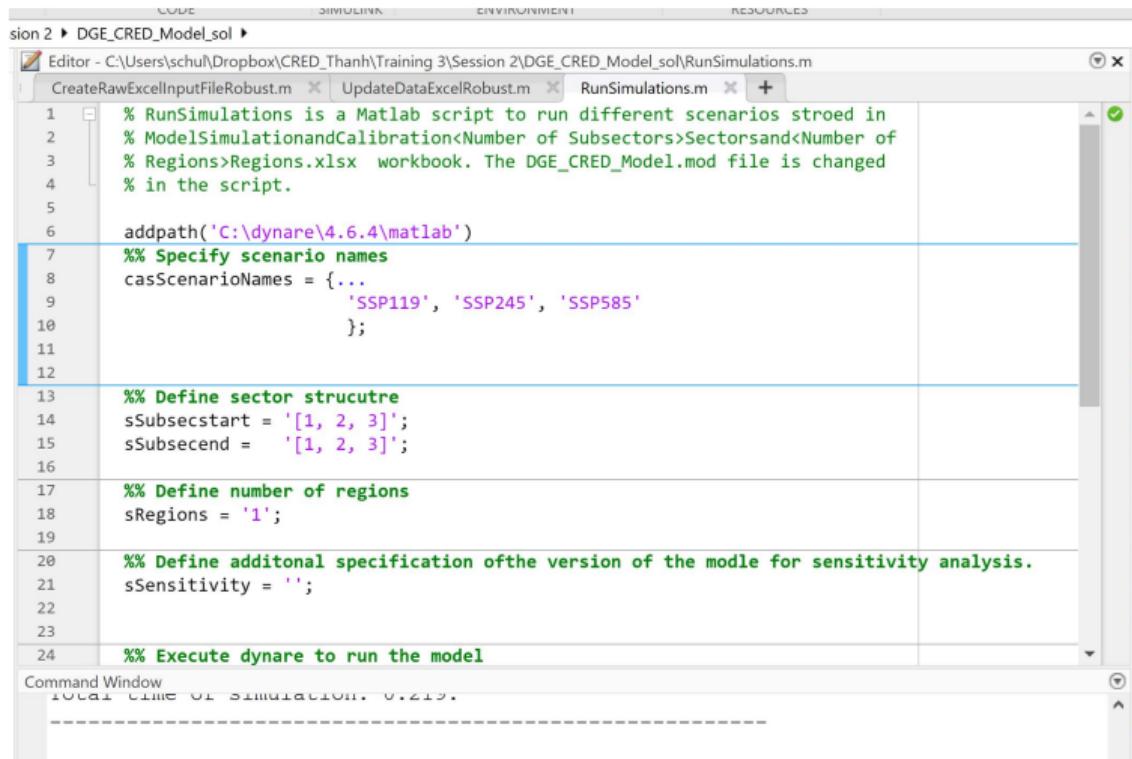
- Make sure that the last values for the climate variables are not zero.
- Copy the data from the ClimateVariables.xlsx file into the sheets.

| | A | B | C | D | E | F | G | H |
|----|------|----------|----------|-----------|---|---|---|---|
| 1 | | tas | storms | sea level | | | | |
| 69 | 2086 | 2.956706 | 9.836575 | 45.118 | | | | |
| 70 | 2087 | 2.943672 | 12.88506 | 46.236 | | | | |
| 71 | 2088 | 3.162891 | 13.38739 | 47.354 | | | | |
| 72 | 2089 | 2.938407 | 7.426616 | 48.472 | | | | |
| 73 | 2090 | 2.920138 | 9.823825 | 49.59 | | | | |
| 74 | 2091 | 2.883892 | 12.1342 | 50.862 | | | | |
| 75 | 2092 | 2.999779 | 10.03919 | 52.134 | | | | |
| 76 | 2093 | 2.943652 | 7.802605 | 53.406 | | | | |
| 77 | 2094 | 3.336882 | 12.64604 | 54.678 | | | | |
| 78 | 2095 | 3.255781 | 10.35442 | 55.95 | | | | |
| 79 | 2096 | 3.203051 | 9.82283 | 57.222 | | | | |
| 80 | 2097 | 1.982708 | 7.176881 | 58.494 | | | | |
| 81 | 2098 | 3.189576 | 11.37649 | 59.766 | | | | |
| 82 | 2099 | 3.943957 | 11.17556 | 61.038 | | | | |

| | A | B | C | D | E |
|----|------|---------|-----------|--------------|-----------|
| 1 | Time | exo_PoP | exo_tas_1 | exo_storms_1 | exo_SL e: |
| 2 | 2 | 0 | 0.422842 | 4.656261068 | 1.008 |
| 3 | 3 | 0 | 0.826634 | 5.944776264 | 1.21 |
| 4 | 4 | 0 | 0.53996 | 4.77154533 | 1.556 |
| 5 | 5 | 0 | 0.782261 | 5.836549163 | 1.902 |
| 6 | 6 | 0 | 0.849398 | 6.639448291 | 2.248 |
| 7 | 7 | 0 | 1.603274 | 7.268377551 | 2.594 |
| 8 | 8 | 0 | 0.718275 | 4.868098029 | 2.94 |
| 9 | 9 | 0 | 0.864823 | 5.472237539 | 3.286 |
| 10 | 10 | 0 | 0.1058044 | 7.708920578 | 3.632 |
| 11 | 11 | 0 | 0.726702 | 6.403596354 | 3.978 |
| 12 | 12 | 0 | 1.315699 | 5.2511215 | 4.324 |
| 13 | 13 | 0 | 1.354474 | 6.984867678 | 4.67 |
| 14 | 14 | 0 | 2.054011 | 7.368681989 | 5.118 |
| 15 | 15 | 0 | 1.092368 | 6.70493788 | 5.566 |
| 16 | 16 | 0 | 1.055174 | 4.646971775 | 6.014 |
| 17 | 17 | 0 | 1.512201 | 7.637803308 | 6.462 |
| 18 | 18 | 0 | 1.111818 | 9.478776365 | 6.91 |
| 19 | 19 | 0 | 1.987544 | 7.528889887 | 7.358 |
| 20 | 20 | 0 | 1.503945 | 4.983721355 | 7.806 |
| 21 | 21 | 0 | 2.397046 | 8.310909054 | 8.254 |
| 22 | 22 | 0 | 1.633332 | 6.079644093 | 8.702 |

Task 2: Execute the RunSimulation.m file.

- Rename the casScenarioNames object.
- Each scenario is one character string.



The screenshot shows a MATLAB IDE interface with the following details:

- Tab Bar:** CODE, SIMULINK, ENVIRONMENT, RESOURCES
- Project Explorer:** session 2 > DGE_CRED_Model_sol >
- Editor:** C:\Users\schul\Dropbox\CRED_Thanh\Training 3\Session 2\session 2>DGE_CRED_Model_sol>RunSimulations.m
- Script Content:**

```
1 % RunSimulations is a Matlab script to run different scenarios stored in
2 % ModelSimulationandCalibration<Number of Subsectors>Sectorsand<Number of
3 % Regions>Regions.xlsx workbook. The DGE_CRED_Model.mod file is changed
4 % in the script.
5
6 addpath('C:\dynare\4.6.4\matlab')
7 %% Specify scenario names
8 casScenarioNames = {...
9             'SSP119', 'SSP245', 'SSP585'
10            };
11
12
13 %% Define sector structure
14 sSubsecstart = '[1, 2, 3]';
15 sSubsecend = '[1, 2, 3]';
16
17 %% Define number of regions
18 sRegions = '1';
19
20 %% Define additional specification of the version of the module for sensitivity analysis.
21 sSensitivity = '';
22
23
24 %% Execute dynare to run the model
```
- Command Window:** TOTAL TIME OF SIMULATION: 0.219.
- giz logo:** Bundesministerium für
Wirtschaft und Klimaschutz
Zentrale Einrichtung für
Klimawandel und
Emissionshandel (ZEKE)

Task 3: Include damages to labour productivity in all scenarios.

| Sub-sector | Description | Physical intensity (W) | Productivity reduction ($D_s^{N,Heat}$ in % °C) |
|-----------------------------------|---|------------------------|---|
| Agriculture, forestry and fishery | Heavy physical work ^a | 400 | 5.71 |
| Industry | Moderate physical work ^b | 300 | 2.38 |
| Services | Clerical/light physical work ^c | 200 | 0.35 |

Source: Kjellstrom et al. 2019 Table 6.43 and own computation.

^aexo_D_N_1_1

^bexo_D_N_2_1

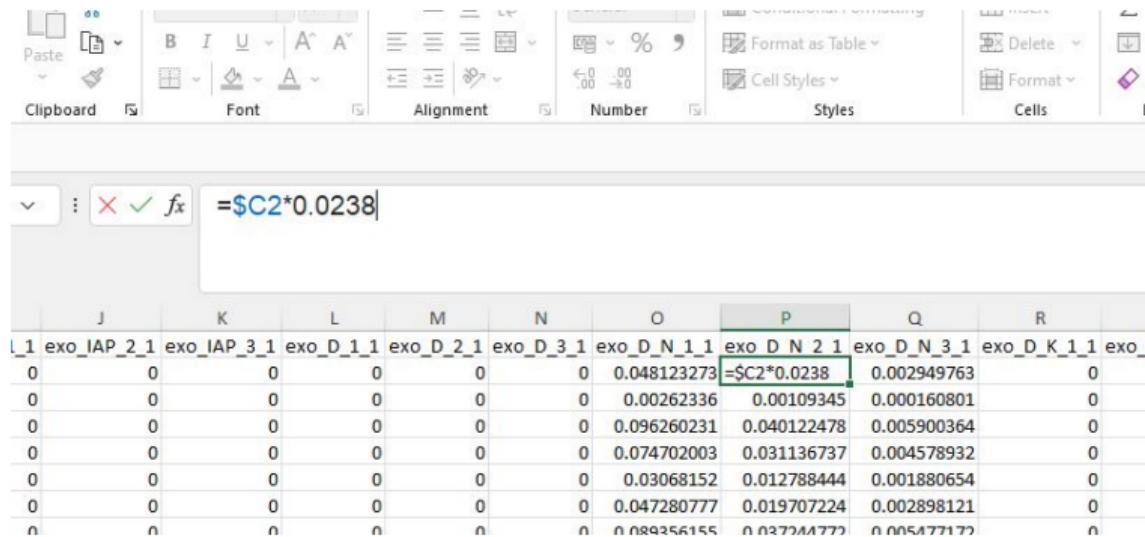
^cexo_D_N_3_1

Task 3: Agriculture, forestry and fishery

= $\$C2*0.0571$

| K | L | M | N | O | P |
|---------|-----------|-----------|-----------|-----------------|-------------|
| IAP_3_1 | exo_D_1_1 | exo_D_2_1 | exo_D_3_1 | exo_D_N_1_1 | exo_D_N_1_2 |
| 0 | 0 | 0 | 0 | = $\$C2*0.0571$ | 0.020058 |
| 0 | 0 | 0 | 0 | 0.00262336 | 0.00109 |
| 0 | 0 | 0 | 0 | 0.096260231 | 0.040122 |
| 0 | 0 | 0 | 0 | 0.074702003 | 0.031136 |
| ~ | ~ | ~ | ~ | ~ | ~ |

Task 3: Industry



The screenshot shows a Microsoft Excel spreadsheet with a formula bar at the top containing the formula $=\$C2*0.0238$. The formula is being typed into cell P1. The formula bar also includes standard icons for cancel, accept, and formula entry. Below the formula bar is a ribbon with tabs for Home, Insert, Page Layout, Formulas, Data, Page Break Preview, and Sort & Filter. The Home tab is selected. On the far left of the ribbon, there is a small icon labeled 'E'.

| J | K | L | M | N | O | P | Q | R |
|-------------|-------------|-----------|-----------|-----------|-------------|----------------|-------------|-------------|
| exo_IAP_2_1 | exo_IAP_3_1 | exo_D_1_1 | exo_D_2_1 | exo_D_3_1 | exo_D_N_1_1 | exo_D_N_2_1 | exo_D_N_3_1 | exo_D_K_1_1 |
| 0 | 0 | 0 | 0 | 0 | 0.048123273 | $=\$C2*0.0238$ | 0.002949763 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0.00262336 | 0.00109345 | 0.000160801 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0.096260231 | 0.040122478 | 0.005900364 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0.074702003 | 0.031136737 | 0.004578932 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0.03068152 | 0.012788444 | 0.001880654 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0.047280777 | 0.019707224 | 0.002898121 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0.089256155 | 0.037244772 | 0.005477172 | 0 |

Task 3: Services

The screenshot shows a Microsoft Excel spreadsheet with a formula editor open. The formula `=$C2*0.0035` is being typed into cell Q1. The formula bar at the top also displays this formula. Below the formula bar is a preview area showing the result of the formula in cell Q1, which is `=$C2*0.0035`. The main worksheet area contains a table with columns labeled K through Q. The table has 7 rows of data. The data in the table is as follows:

| K | L | M | N | O | P | Q |
|-------------|-----------|-----------|-----------|-------------|-------------|---------------------------|
| exo_IAP_3_1 | exo_D_1_1 | exo_D_2_1 | exo_D_3_1 | exo_D_N_1_1 | exo_D_N_2_1 | exo_D_N_3_1 |
| 0 | 0 | 0 | 0 | 0.048123273 | 0.020058387 | <code>=\$C2*0.0035</code> |
| 0 | 0 | 0 | 0 | 0.00262336 | 0.00109345 | 0.000160801 |
| 0 | 0 | 0 | 0 | 0.096260231 | 0.040122478 | 0.005900364 |
| 0 | 0 | 0 | 0 | 0.074702003 | 0.031136737 | 0.004578932 |

Task 4: Illustrate the impact of labour productivity on GDP and its components.

- What is the impact on GDP, consumption and investment in the SSP 119, 245 and 585 scenario?
- Use the Figures.xlsx file to create the graph.

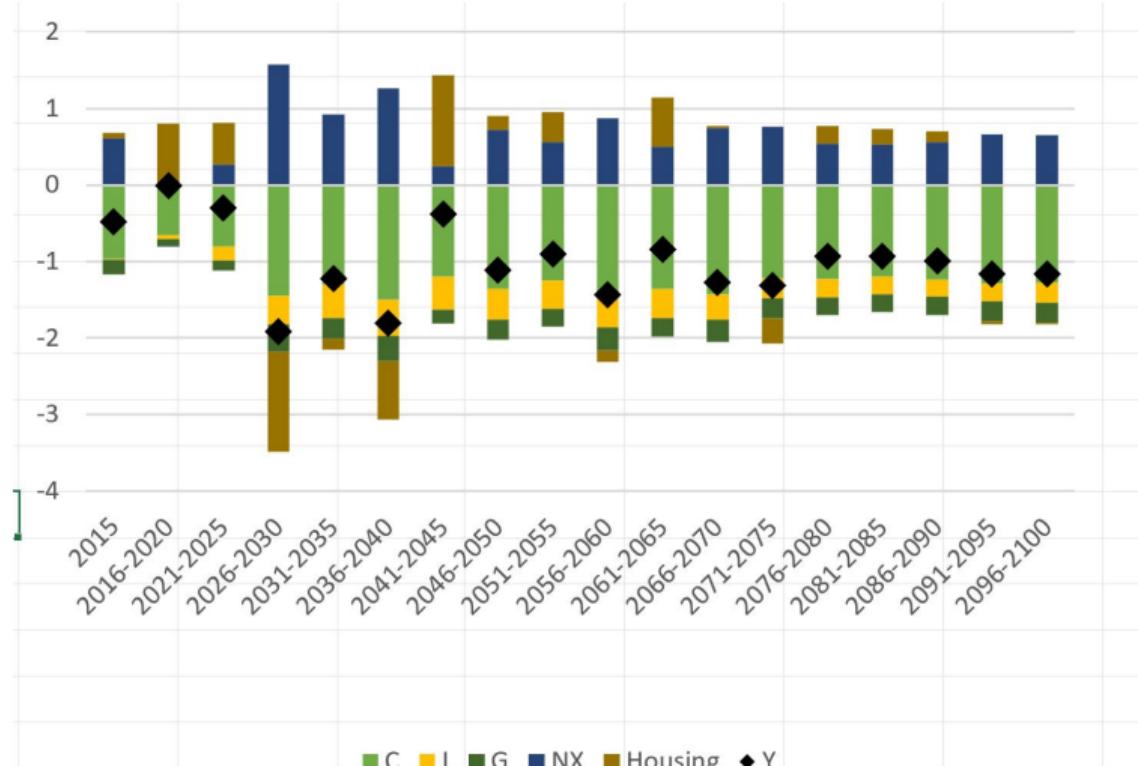
Task 4: Rename the workbook you refer to in the Excel sheet.

G64

| A | B | C | D | E | F | I |
|----|-------------------------------------|----------|----------|----------|----------|----------|
| 1 | Y | Y | C | C | C | |
| 2 | Year | Baseline | SSP119 | Baseline | SSP119 | B |
| 3 | 2014 | 1.165338 | 1.1653 | 0.726204 | 0.726204 | |
| 4 | ResultsScenarios3Sectorsand1Regions | 2015 | 1.247481 | 1.239 | 0.778723 | 0.768764 |
| 5 | | 2020 | 1.679994 | 1.673 | 1.014928 | 0.998989 |
| 6 | | 2025 | 2.126184 | 2.1204 | 1.228267 | 1.205224 |
| 7 | | 2030 | 2.558817 | 2.5355 | 1.440145 | 1.408944 |
| 8 | | 2035 | 2.958148 | 2.9303 | 1.657551 | 1.621979 |
| 9 | | 2040 | 3.3127 | 3.2675 | 1.872029 | 1.825073 |
| 10 | | 2045 | 3.618043 | 3.5708 | 2.071791 | 2.018991 |
| 11 | | 2050 | 3.874811 | 3.8153 | 2.24923 | 2.185688 |
| 12 | | 2055 | 4.086752 | 4.035 | 2.401593 | 2.337262 |
| 13 | | 2060 | 4.259178 | 4.1738 | 2.52936 | 2.448366 |
| 14 | | 2065 | 4.397885 | 4.3432 | 2.634695 | 2.557329 |
| 15 | | 2070 | 4.508495 | 4.4521 | 2.720439 | 2.632806 |
| 16 | | 2075 | 4.596104 | 4.4926 | 2.789545 | 2.681187 |
| 17 | | 2080 | 4.66513 | 4.5616 | 2.844795 | 2.729059 |
| 18 | | 2085 | 4.719294 | 4.6188 | 2.888668 | 2.771214 |
| 19 | | 2090 | 4.761661 | 4.6544 | 2.923301 | 2.803347 |
| 20 | | 2095 | 4.794721 | 4.6797 | 2.950495 | 2.82429 |

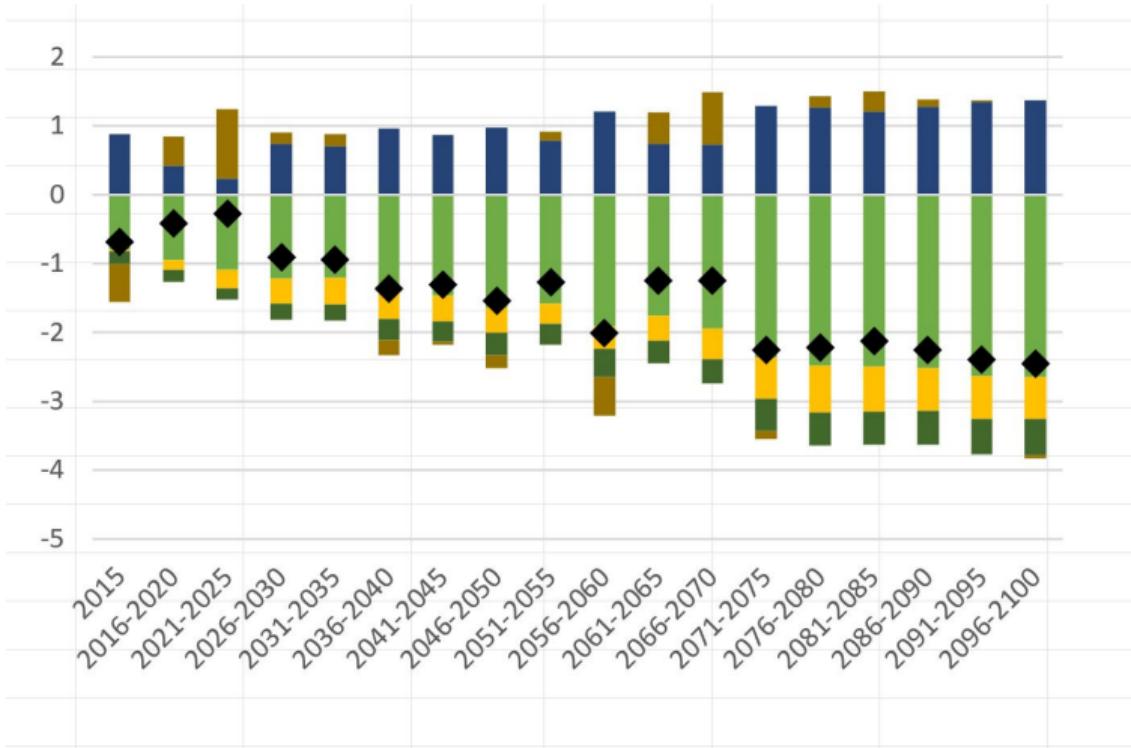
Task 4: SSP 119

- Copy the GDP sheet and rename it into SSP119.
- Make sure to replace all SSP scenarios in line 2 with SSP 119.



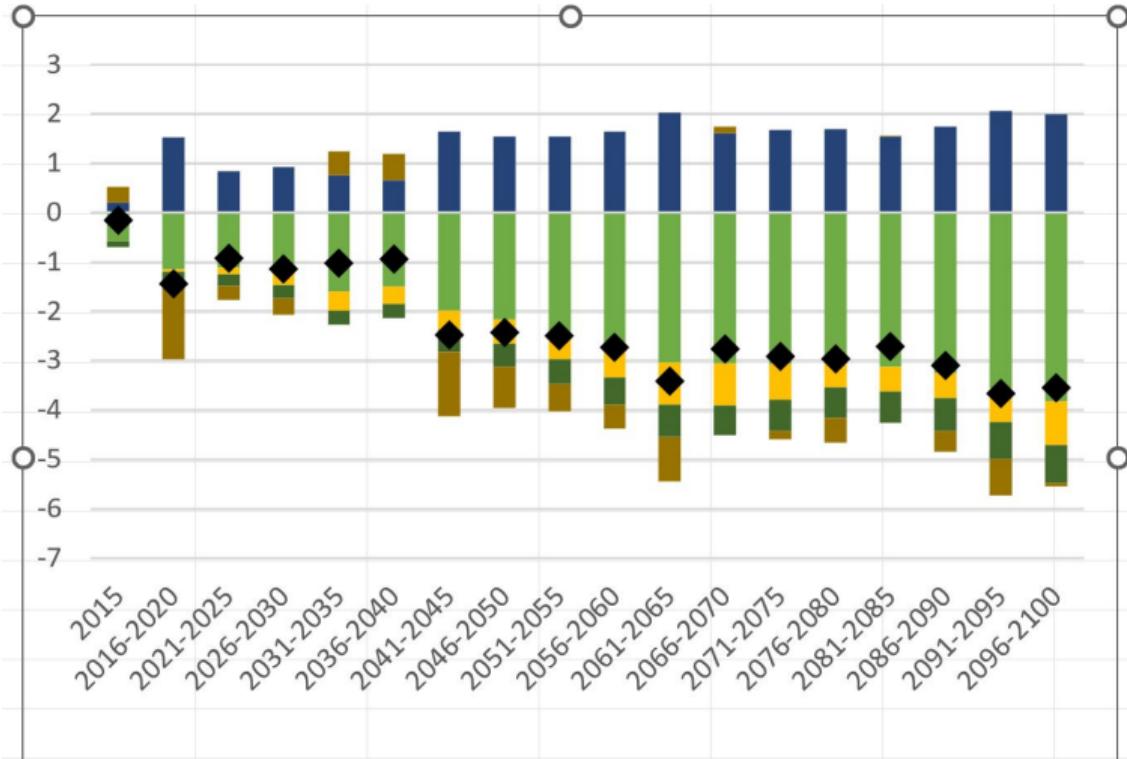
Task 4: SSP 245

- Copy the GDP sheet and rename it into SSP245.
- Make sure to replace all SSP scenarios in line 2 with SSP 245.



Task 4: SSP 585

- Copy the GDP sheet and rename it into SSP585.
- Make sure to replace all SSP scenarios in line 2 with SSP 585.



Task 5: Land loss due to sea level rise in Agriculture, forestry and fishery.

- First, copy the existing SSP scenarios and call them SSP119Lab, SSP245Lab and SSP585Lab.
- Include land loss in agriculture, forestry and fishery such that it reduces total factor productivity (exo_D_1_1) in the sector as a share of total land used in the sector.
- Use the VLOOKUP function to make the land loss conditional on the respective sea level rise.
- You can find the required data in the LandLossAgricultureForestryFishery.xlsx file.

| A | | B | C | D | E |
|---|---------------------|----|------------------------------|------------|--------|
| 1 | Sea level rise (cm) | | Vietnam (km ²) | Total land | 263939 |
| 2 | from | to | Land loss (km ²) | | |
| 3 | 0 | 5 | 143.4458 | | |
| 4 | 5 | 10 | 519.03 | | |
| 5 | 10 | 15 | 617.673 | | |

Task 5: Change damages to total factor productivity in the agriculture, forestry and fishery sector.

- Change the values for exo_D_1_1 in column L for all SSP scenarios.
- Use the VLOOKUP function to refer to the table in LandLossAgricultureForestryFishery.xlsx.

The screenshot shows a Microsoft Excel spreadsheet. The formula bar displays the formula: =VLOOKUP(\$E2;[LandLossAgricultureForestryFishery.xlsx]Sheet1!\$A\$3:\$C\$22;3;1) / [LandLossAgricultureForestry.xlsx]Sheet1!\$E\$1. The table below has columns labeled E through P. Row 1 contains labels for columns E through P. Row 2 contains numerical values: 1.283, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 2 is highlighted with a green border. Row 3 contains values: 1.54, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 4 contains values: 1.852, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 5 contains values: 2.164, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 6 contains values: 2.476, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 7 contains values: 2.788, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 8 contains values: 3.1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 9 contains values: 3.412, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 10 contains values: 3.724, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 11 contains values: 4.036, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 12 contains values: 4.348, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 13 contains values: 4.66, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 14 contains values: 4.886, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 15 contains values: 5.112, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 16 contains values: 5.338, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Row 17 contains values: 5.564, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0.

| E | F | G | H | I | J | K | L | M | N | O | P |
|--------|------------|------------|------------|-------------|-------------|-------------|---------------|-----------|-----------|-------------|-------------|
| exo_SL | exo_GA_1_1 | exo_GA_2_1 | exo_GA_3_1 | exo_IAP_1_1 | exo_IAP_2_1 | exo_IAP_3_1 | exo_D_1_1 | exo_D_2_1 | exo_D_3_1 | exo_D_N_1_1 | exo_D_N_2_1 |
| 1.283 | 0 | 0 | 0 | 0 | 0 | 0 | sheet1!\$E\$1 | 0 | 0 | 0.04692165 | 0.019557536 |
| 1.54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.081294302 | 0.03388449 |
| 1.852 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.006060994 | 0.002526299 |
| 2.164 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.045037357 | 0.018772138 |
| 2.476 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.035765173 | 0.014907375 |
| 2.788 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.023400606 | 0.009753667 |
| 3.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.065984809 | 0.0275033 |
| 3.412 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.043711282 | 0.018219414 |
| 3.724 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.098817882 | 0.041188539 |
| 4.036 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.011646388 | 0.004854361 |
| 4.348 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.039146284 | 0.016316665 |
| 4.66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.085353916 | 0.035576589 |
| 4.886 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.078529897 | 0.032732251 |
| 5.112 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.047596718 | 0.019838912 |
| 5.338 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.082251251 | 0.034283359 |
| 5.564 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.121298861 | 0.050558895 |

Task 6: How important are land losses for the GDP effect?

- Run the SSP scenarios with the land loss effect.
- Create a suitable graph in Figure.xlsx to investigate the additional GDP effect due to land losses.

Task 6: Run all scenarios.

- First run all SSP scenarios.

```
% READING/READING.mxa - NOT RECOMMENDED! THE DUE_CRED_PROCEDURE FILE IS CHANGED  
% in the script.  
  
addpath('C:\dynare\4.6.4\matlab')  
%% Specify scenario names  
casScenarioNames = {...  
    ['SSP119', 'SSP245', 'SSP585', ...  
     'SSP119Lab', 'SSP245Lab', 'SSP585Lab', ...  
    ];  
  
%% Define sector structure  
sSubsecstart = '[1, 2, 3]';  
sSubsecend = '[1, 2, 3]';
```

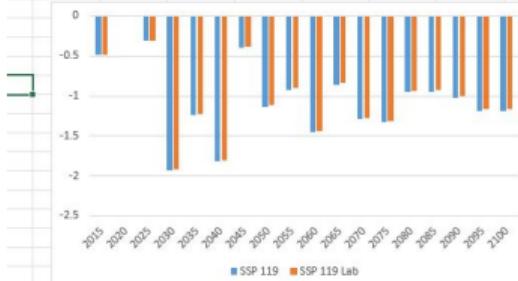
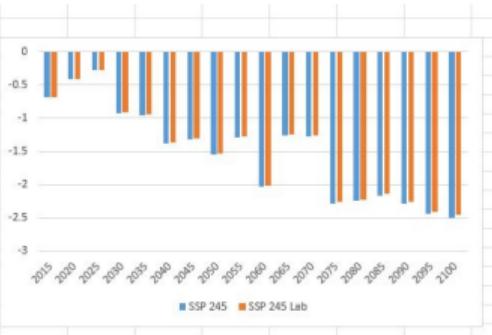
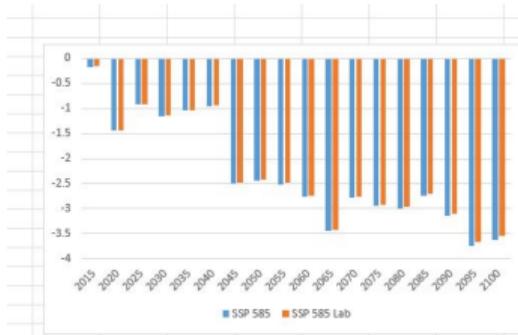
Task 6: Prepare Figures.xlsx file

- Copy the sheet in the Figures.xlsx file and change the references to the SSP scenarios such that you have the following excel workbook:

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
|----|------------|----------|----------|------------|-----------|------------|-----------|-------------|-----------|----------|----------|----------|-----------|----------|
| 1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | |
| 2 | Year | Baseline | SSP585 | Baseline | SSP585Lab | Baseline | SSP245 | Baseline | SSP245Lab | Baseline | SSP119 | Baseline | SSP119Lab | |
| 3 | | 2014 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | |
| 4 | ResultsSce | 2015 | 1.247481 | 1.245467 | 1.247481 | 1.245529 | 1.247481 | 1.238903 | 1.247481 | 1.238966 | 1.247481 | 1.241383 | 1.247481 | 1.241446 |
| 5 | | 2020 | 1.679994 | 1.655729 | 1.679994 | 1.655784 | 1.679994 | 1.67298 | 1.679994 | 1.673037 | 1.679994 | 1.679777 | 1.679994 | 1.679832 |
| 6 | | 2025 | 2.126184 | 2.106571 | 2.126184 | 2.106607 | 2.126184 | 2.120351 | 2.126184 | 2.120409 | 2.126184 | 2.119638 | 2.126184 | 2.119693 |
| 7 | | 2030 | 2.558817 | 2.529348 | 2.558817 | 2.529644 | 2.558817 | 2.535199 | 2.558817 | 2.535511 | 2.558817 | 2.509573 | 2.558817 | 2.509886 |
| 8 | | 2035 | 2.958148 | 2.927266 | 2.958148 | 2.927619 | 2.958148 | 2.929923 | 2.958148 | 2.930271 | 2.958148 | 2.921438 | 2.958148 | 2.921812 |
| 9 | | 2040 | 3.3127 | 3.281103 | 3.3127 | 3.281572 | 3.3127 | 3.267088 | 3.3127 | 3.267495 | 3.3127 | 3.252576 | 3.3127 | 3.253022 |
| 10 | | 2045 | 3.618043 | 3.527885 | 3.618043 | 3.528367 | 3.618043 | 3.57023 | 3.618043 | 3.570753 | 3.618043 | 3.603707 | 3.618043 | 3.604281 |
| 11 | | 2050 | 3.874811 | 3.780328 | 3.874811 | 3.781021 | 3.874811 | 3.814712 | 3.874811 | 3.815267 | 3.874811 | 3.830903 | 3.874811 | 3.831507 |
| 12 | | 2055 | 4.086752 | 3.98414 | 4.086752 | 3.985034 | 4.086752 | 4.034307 | 4.086752 | 4.035038 | 4.086752 | 4.049187 | 4.086752 | 4.049819 |
| 13 | | 2060 | 4.259178 | 4.141848 | 4.259178 | 4.142711 | 4.259178 | 4.173033 | 4.259178 | 4.173795 | 4.259178 | 4.197259 | 4.259178 | 4.19791 |
| 14 | | 2065 | 4.397885 | 4.246381 | 4.397885 | 4.247483 | 4.397885 | 4.342257 | 4.397885 | 4.343187 | 4.397885 | 4.360049 | 4.397885 | 4.360895 |
| 15 | | 2070 | 4.508495 | 4.382714 | 4.508495 | 4.38391 | 4.508495 | 4.451126 | 4.508495 | 4.45207 | 4.508495 | 4.450224 | 4.508495 | 4.451061 |
| 16 | | 2075 | 4.596104 | 4.460748 | 4.596104 | 4.462067 | 4.596104 | 4.491406 | 4.596104 | 4.492625 | 4.596104 | 4.534958 | 4.596104 | 4.535826 |
| 17 | | 2080 | 4.66513 | 4.525355 | 4.66513 | 4.526905 | 4.66513 | 4.560366 | 4.66513 | 4.561604 | 4.66513 | 4.620731 | 4.66513 | 4.621609 |
| 18 | | 2085 | 4.719294 | 4.58972 | 4.719294 | 4.59145 | 4.719294 | 4.617353 | 4.719294 | 4.61877 | 4.719294 | 4.674352 | 4.719294 | 4.675419 |
| 19 | | 2090 | 4.761661 | 4.612089 | 4.761661 | 4.614229 | 4.761661 | 4.652795 | 4.761661 | 4.65442 | 4.761661 | 4.713138 | 4.761661 | 4.714247 |
| 20 | | 2095 | 4.794721 | 4.615428 | 4.794721 | 4.619119 | 4.794721 | 4.677702 | 4.794721 | 4.679711 | 4.794721 | 4.737753 | 4.794721 | 4.738898 |
| 21 | | 2100 | 4.820468 | 4.645272 | 4.820468 | 4.649284 | 4.820468 | 4.700412 | 4.820468 | 4.702454 | 4.820468 | 4.76313 | 4.820468 | 4.7643 |
| 22 | | | SSP 585 | SSP 585 La | SSP 245 | SSP 245 La | SSP 119 | SSP 119 Lab | | | | | | |
| 23 | | | 2015 | -0.161513 | -0.156534 | -0.687699 | -0.682632 | -0.488842 | -0.483826 | | | | | |
| 24 | | | 2020 | -1.44435 | -1.441089 | -0.417496 | -0.414143 | -0.012943 | -0.009646 | | | | | |

Task 6: Prepare Figures.xlsx file

- Depict in bar charts the impact on GDP for the different SSP scenarios.
- We can see that land loss in the agriculture sector has only a small impact.



Task 7: Implement damages to the capital stock of the industry.

- Implement damages to the capital stock in the industry (exo_D_K_2_1) in Vietnam.
- The average value of capital in the manufacturing sector is 2634 $\frac{\text{billionVND}}{\text{km}^2}$.
- $D_2^K = \text{Landloss} \left(\frac{2643}{\text{GDPinbillionVND}} \right)$

Task 7: Use VLOOKUP to refer to LandLossIndustry.xlsx file

- First copy the existing SSP scenarios and rename them into SSPxxxLabLLAgri.
- Now, use the same procedure as for Task 5. Instead of the file LandLossAgricultureForestryFishery.xlsx use the LandLossIndustry.xlsx.

The screenshot shows an Excel spreadsheet with a formula bar at the top containing the formula =VLOOKUP(\$E2;[LandLossIndustry.xlsx]Sheet1!\$A\$3:\$C\$22;3;1)*2630 \[LandLossIndustry.xlsx]Sheet1!\$D\$1. Below the formula bar is a table with columns labeled P through X. The first column has values ranging from 0.019557536 to 0.016315655. The second column has values ranging from 0.002876108 to 0.002300500. The third column has values ranging from 0 to 0.00096888. The fourth column has values ranging from 0 to 0.0008695. The fifth column has values ranging from 0 to 0.0006167. The sixth column has values ranging from 0 to 0.000685. The seventh column has values ranging from 0 to 0.0007863. The eighth column has values ranging from 0 to 0.0007168. The ninth column has values ranging from 0 to 0.0005656. The tenth column has values ranging from 0 to 0.0008222. The eleventh column has values ranging from 0 to 0.0008148. The twelfth column has values ranging from 0 to 0.0006472. The thirteenth column has values ranging from 0 to 0.0006166. The fourteenth column has values ranging from 0 to 0.0006166.

| P | Q | R | S | T | U | V | W | X |
|-------------|-------------|-------------|-------------|-------------|--------|------------|-------------|---|
| exo_D_N_2_1 | exo_D_N_3_1 | exo_D_K_1_1 | exo_D_K_2_1 | exo_D_K_3_1 | exo_DH | exo_I_A_DH | exo_I_AP_DH | |
| 0.019557536 | 0.002876108 | | 0 | 0.0008058 | 0 | 0 | 0 | |
| 0.03388449 | 0.004983013 | | 0 | 0.00096888 | 0 | 0.0008695 | 0 | 0 |
| 0.002526299 | 0.000371514 | | 0 | 0.00096888 | 0 | 0.0006167 | 0 | 0 |
| 0.018772138 | 0.002760609 | | 0 | 0.00096888 | 0 | 0.000685 | 0 | 0 |
| 0.014907375 | 0.002192261 | | 0 | 0.00096888 | 0 | 0.0007863 | 0 | 0 |
| 0.009753667 | 0.001434363 | | 0 | 0.00096888 | 0 | 0.0007168 | 0 | 0 |
| 0.0275033 | 0.004044603 | | 0 | 0.00096888 | 0 | 0.0005656 | 0 | 0 |
| 0.018219414 | 0.002679326 | | 0 | 0.00096888 | 0 | 0.0008222 | 0 | 0 |
| 0.041188539 | 0.006057138 | | 0 | 0.00096888 | 0 | 0.0008148 | 0 | 0 |
| 0.004854361 | 0.000713877 | | 0 | 0.00096888 | 0 | 0.0006472 | 0 | 0 |
| 0.016315655 | 0.002300500 | | 0 | 0.00096888 | 0 | 0.0006166 | 0 | 0 |

Task 8: Implement damages caused by storms to housing.

- Implement damages to housing caused by storms.
- Damages caused per affected person in Vietnam by storms amounted to 890 Thousand VND per affected person.
- relative to GDP in 2018, this amounts to about 1.3×10^{-10} percentage points per year and affected person.
- Damages to houses exo_DH
$$D^H = 10^8 \times \left(\frac{\text{exo_storms}}{100} \right) \times (Pop^{SSP} + Pop_0) \times (1.3 \times 10^{-10})$$
- Run all previous scenarios and new scenarios: SSP119LabLLAgri, SSP245LabLLAgri, SSP585LabLLAgri
- Is housing destruction due to storms important for GDP reduction?

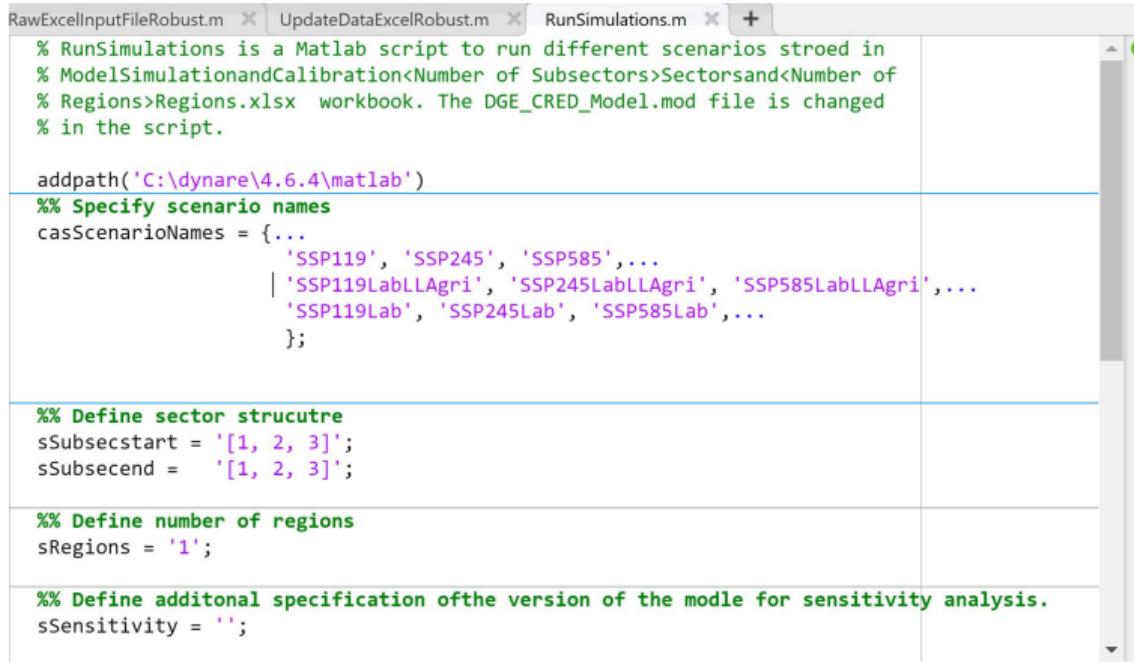
Task 8: Destruction of housing stock due to storms

- Here, we need to keep track of the current population development ($SUM(B\$2:B2) + Data!$R\$2$)).
 - Further, we multiply the current population by the share of affected persons ($\$D2/100$).

| D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|--|------------|------------|------------|-------------|-------------|-------------|-----------|-----------|-----------|-------------|--------------|-------------|-------------|-------------|-------------|-------------|---|-------------|
| =1.3*10^(-10)*(B2+Data!\$R\$2)*10^8*\$D2/100 | | | | | | | | | | | | | | | | | | |
| exp_storm_1 | exo_GA_1_1 | exo_GA_2_1 | exo_GA_3_1 | exo_IAP_1_1 | exo_IAP_2_1 | exo_IAP_3_1 | exo_D_1_1 | exo_D_2_1 | exo_D_3_1 | exo_N_1_1 | exo_N_2_1 | exo_N_3_1 | exo_D_K_1_1 | exo_D_K_2_1 | exo_D_K_3_1 | exp_DH_1 | | |
| 6.35612063 | 1.2833 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.04692165 | 0.019557536 | 0.002876108 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 6.870159302 | 1.54 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.081294032 | 0.03388449 | 0.004983013 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 4.871463535 | 1.852 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.00606904 | 0.000526299 | 0.000371514 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 5.426303827 | 2.164 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.040573757 | 0.018772138 | 0.002760095 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 6.22238226 | 2.476 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.03577491 | 0.014907375 | 0.002192261 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 5.659740052 | 2.788 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.023400606 | 0.009753067 | 0.001434363 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 4.66072816 | 3.1 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.065984605 | 0.02750303 | 0.004044603 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 6.507096593 | 3.412 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.04371128 | 0.0182194914 | 0.002679326 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 6.44332083 | 3.724 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.09817882 | 0.041188593 | 0.006057138 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 5.138424825 | 4.036 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.01040388 | 0.004545361 | 0.000713877 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 4.868101030 | 4.348 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.039146284 | 0.016316663 | 0.002399509 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 7.275198682 | 4.66 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.085353914 | 0.035570589 | 0.005213851 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 6.623146337 | 4.886 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.07852987 | 0.032732525 | 0.004813566 | 0 | 0.000970354 | 0 | 0.000970354 | 0 | 0.000970354 |
| 5.49250238 | 5.112 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.04797017 | 0.019638912 | 0.002917487 | 0 | 0.002309693 | 0 | 0.002309693 | 0 | 0.002309693 |
| 4.407619851 | 5.338 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.08251251 | 0.032483285 | 0.00504617 | 0 | 0.002309693 | 0 | 0.002309693 | 0 | 0.002309693 |
| 5.390721035 | 5.564 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.121289801 | 0.05058895 | 0.007435132 | 0 | 0.002309693 | 0 | 0.002309693 | 0 | 0.002309693 |
| 6.116417134 | 5.79 | 0 | 0 | 0 | 0 | 0 | 0.0005435 | 0 | 0 | 0.07105785 | 0.029617487 | 0.00435513 | 0 | 0.002309693 | 0 | 0.002309693 | 0 | 0.002309693 |

Task 8: Execute the RunSimulation.m file

- Change the scenarios you want to run with the casScenarioNames.



The screenshot shows a MATLAB editor window with three tabs at the top: 'RawExcelInputFileRobust.m', 'UpdateDataExcelRobust.m', and 'RunSimulations.m'. The 'RunSimulations.m' tab is active. The code in the editor is as follows:

```
% RunSimulations is a Matlab script to run different scenarios stored in
% ModelSimulationandCalibration<Number of Subsectors>Sectorsand<Number of
% Regions>Regions.xlsx  workbook. The DGE_CRED_Model.mod file is changed
% in the script.

addpath('C:\dynare\4.6.4\matlab')
%% Specify scenario names
casScenarioNames = {...%
    'SSP119', 'SSP245', 'SSP585',...
    | 'SSP119LabLLAgri', 'SSP245LabLLAgri', 'SSP585LabLLAgri',...
    'SSP119Lab', 'SSP245Lab', 'SSP585Lab',...
};

%% Define sector structure
sSubsecstart = '[1, 2, 3]';
sSubsecend = '[1, 2, 3]';

%% Define number of regions
sRegions = '1';

%% Define additional specification of the version of the module for sensitivity analysis.
sSensitivity = '';
```

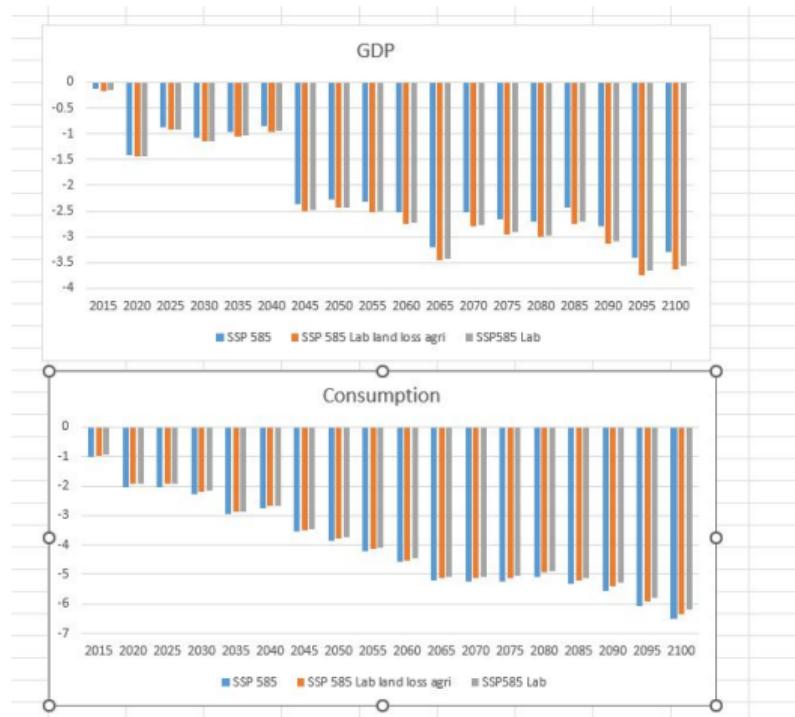
Task 8: Depict the results

- Create a sheet in Figure.xlsx and plot Consumption and GDP relative to the Baseline for the SSP 585 scenario.

| Year | C | C | C | SSP585Lab Baseline | | | | |
|------|----------|----------|----------|--------------------|----------|----------|--------------------|----------|----------|--------------------|----------|----------|--------------------|----------|----------|--------------------|----------|----------|--------------------|----------|----------|--------------------|----------|----------|--------------------|----------|----------|----------|----------|
| | Baseline | SSP585 | Baseline | C | C | Y | T | Y | Baseline | Y | Baseline | T | Y | Baseline | Y | Baseline | Y | Baseline | Y | Baseline | Y | Baseline | Y | Baseline | Y | Baseline | Y | Baseline | |
| 2014 | 0.776304 | 0.776304 | | 0.776304 | 0.776304 | 0.776304 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | 1.165338 | |
| 2015 | 0.778723 | 0.779094 | | 0.778723 | 0.779094 | 0.778723 | 0.779373 | 0.779373 | 0.779373 | 1.247481 | 1.247481 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 | 1.245467 |
| 2020 | 1.049528 | 0.994403 | | 1.049528 | 0.994403 | 1.049528 | 0.995407 | 1.049528 | 0.995407 | 1.679994 | 1.679994 | 1.659264 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 | 1.679994 |
| 2025 | 1.228287 | 1.203355 | | 1.228287 | 1.203355 | 1.228287 | 1.204529 | 1.228287 | 1.204657 | 2.128534 | 2.107729 | 2.126184 | 2.106807 | 2.126184 | 2.106807 | 2.126184 | 2.106807 | 2.126184 | 2.106807 | 2.126184 | 2.106807 | 2.126184 | 2.106807 | 2.126184 | 2.106807 | 2.126184 | 2.106807 | 2.126184 | 2.106807 |
| 2030 | 1.440545 | 1.407213 | | 1.440545 | 1.407213 | 1.440545 | 1.408615 | 1.440545 | 1.408615 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | 2.535817 | |
| 2035 | 1.637531 | 1.600389 | | 1.637531 | 1.600389 | 1.637531 | 1.600389 | 1.637531 | 1.600389 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | 2.958148 | |
| 2040 | 1.872029 | 1.808388 | | 1.872029 | 1.808388 | 1.872029 | 1.821774 | 1.872029 | 1.821774 | 3.1327 | 3.282572 | 3.1327 | 3.282572 | 3.1327 | 3.282572 | 3.1327 | 3.282572 | 3.1327 | 3.282572 | 3.1327 | 3.282572 | 3.1327 | 3.282572 | 3.1327 | 3.282572 | 3.1327 | 3.282572 | 3.1327 | 3.282572 |
| 2045 | 2.168466 | 1.959341 | | 2.168466 | 1.959341 | 2.168466 | 1.960341 | 2.168466 | 1.960341 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | 3.608252 | |
| 2050 | 2.489323 | 2.162065 | | 2.489323 | 2.162065 | 2.489323 | 2.164049 | 2.489323 | 2.164049 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | 4.087501 | | |
| 2055 | 2.491559 | 2.300396 | | 2.491559 | 2.300396 | 2.491559 | 2.302392 | 2.491559 | 2.302392 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | 3.801599 | | |
| 2060 | 2.523518 | 2.419379 | | 2.523518 | 2.419379 | 2.523518 | 2.421387 | 2.523518 | 2.421387 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | 4.239178 | | |
| 2065 | 2.634955 | 2.497433 | | 2.634955 | 2.497433 | 2.634955 | 2.509365 | 2.634955 | 2.509365 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | 4.371882 | | |
| 2070 | 2.770439 | 2.578266 | | 2.770439 | 2.578266 | 2.770439 | 2.581118 | 2.770439 | 2.581118 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | 5.252686 | | |
| 2075 | 2.785545 | 2.643435 | | 2.785545 | 2.643435 | 2.785545 | 2.704059 | 2.785545 | 2.704059 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | 5.648873 | | |
| 2080 | 2.844795 | 2.700508 | | 2.844795 | 2.700508 | 2.844795 | 2.704448 | 2.844795 | 2.704448 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | 4.66513 | | |
| 2085 | 2.888668 | 2.735982 | | 2.888668 | 2.735982 | 2.888668 | 2.741212 | 2.888668 | 2.741212 | 4.715254 | 4.609413 | 4.715254 | 4.591455 | 4.715254 | 4.609413 | 4.591455 | 4.715254 | 4.609413 | 4.591455 | 4.715254 | 4.609413 | 4.591455 | 4.715254 | 4.609413 | 4.591455 | 4.715254 | 4.609413 | 4.591455 | |
| 2090 | 2.923101 | 2.761645 | | 2.923101 | 2.761645 | 2.923101 | 2.763997 | 2.923101 | 2.763997 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | 4.786857 | | |
| 2095 | 2.950695 | 2.771113 | | 2.950695 | 2.771113 | 2.950695 | 2.775933 | 2.950695 | 2.775933 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | 4.779781 | | |
| 2100 | 2.971758 | 2.777339 | | 2.971758 | 2.777339 | 2.971758 | 2.781323 | 2.971758 | 2.781323 | 4.787466 | 4.830468 | 4.787466 | 4.830468 | 4.787466 | 4.830468 | 4.787466 | 4.830468 | 4.787466 | 4.830468 | 4.787466 | 4.830468 | 4.787466 | 4.830468 | 4.787466 | 4.830468 | 4.787466 | 4.830468 | | |

Task 8: Consumption vs. GDP effect

- Destruction of the housing stock leads to lower consumption but not to lower GDP.



Task 9: Conduct sensitivity analysis for damages caused by storms to housing.

- Define the scenarios SSP119stormhigh, SSP245stormhigh, SSP585stormhigh.
- Replace the storm variable in the respective scenario sheets with the 95 percent value in the sheet Storms in column D in the ClimateVariables.xlsx file.
- Run simulation.

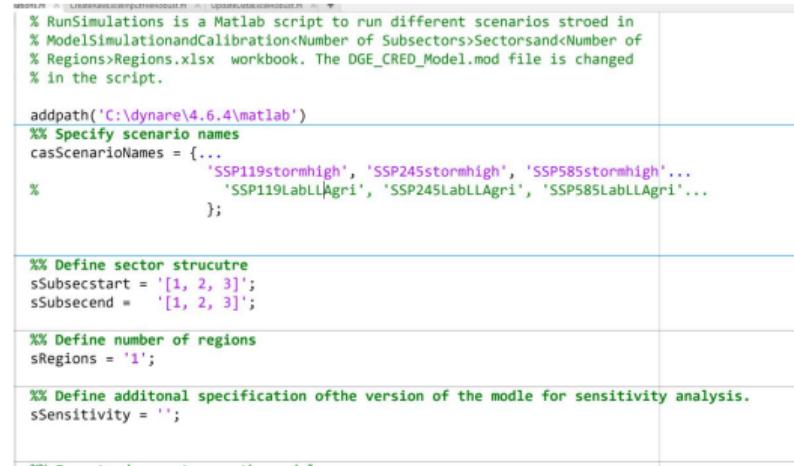
Task 9: Create the sheets for SSP585stormhigh, SSP245stormhigh and SSP119stormhigh

- Copy the affected persons for the 95 percent interval from the sheet storms in the ClimateVariables.xlsx file.

| A | B | C | D | E | F | G | H | I |
|----|----|---|------------|-------------|--------|---|---|---|
| 43 | 43 | 0 | 1.8691061 | 41.00311468 | 20.89 | 0 | 0 | 0 |
| 44 | 44 | 0 | 2.4300643 | 31.2328937 | 21.702 | 0 | 0 | 0 |
| 45 | 45 | 0 | 2.1328232 | 34.29799253 | 22.514 | 0 | 0 | 0 |
| 46 | 46 | 0 | 2.9910023 | 37.85197402 | 23.326 | 0 | 0 | 0 |
| 47 | 47 | 0 | 3.1000792 | 37.25128747 | 24.138 | 0 | 0 | 0 |
| 48 | 48 | 0 | 2.8766968 | 31.20137922 | 24.95 | 0 | 0 | 0 |
| 49 | 49 | 0 | 2.42741391 | 37.65918547 | 25.762 | 0 | 0 | 0 |
| 50 | 50 | 0 | 3.4324178 | 43.05118872 | 26.574 | 0 | 0 | 0 |
| 51 | 51 | 0 | 2.5326493 | 44.18750937 | 27.386 | 0 | 0 | 0 |
| 52 | 52 | 0 | 3.6754953 | 35.48919742 | 28.198 | 0 | 0 | 0 |
| 53 | 53 | 0 | 3.4296377 | 37.60085438 | 29.01 | 0 | 0 | 0 |
| 54 | 54 | 0 | 2.8111601 | 44.87878523 | 29.95 | 0 | 0 | 0 |
| 55 | 55 | 0 | 3.1925128 | 41.03416827 | 30.89 | 0 | 0 | 0 |
| 56 | 56 | 0 | 2.8917653 | 35.61644669 | 31.82 | 0 | 0 | 0 |

Task 9: Execute the RunSimulation.m file

- Make sure to rename the scenario names.



The screenshot shows a MATLAB code editor window with the following content:

```
% RunSimulations is a Matlab script to run different scenarios stored in
% ModelSimulationandCalibration<Number of Subsectors>Sectorsand<Number of
% Regions>Regions.xlsx workbook. The DGE_CRED_Model.mod file is changed
% in the script.

addpath('C:\dynare\4.6.4\matlab')
%% Specify scenario names
casScenarioNames = {...%
    'SSP119stormhigh', 'SSP245stormhigh', 'SSP585stormhigh',...
    'SSP119LabLLAgri', 'SSP245LabLLAgri', 'SSP585LabLLAgri',...
};

%% Define sector structure
sSubsecstart = '[1, 2, 3]';
sSubsecend = '[1, 2, 3]';

%% Define number of regions
sRegions = '1';

%% Define additional specification of the version of the module for sensitivity analysis.
sSensitivity = '';
```

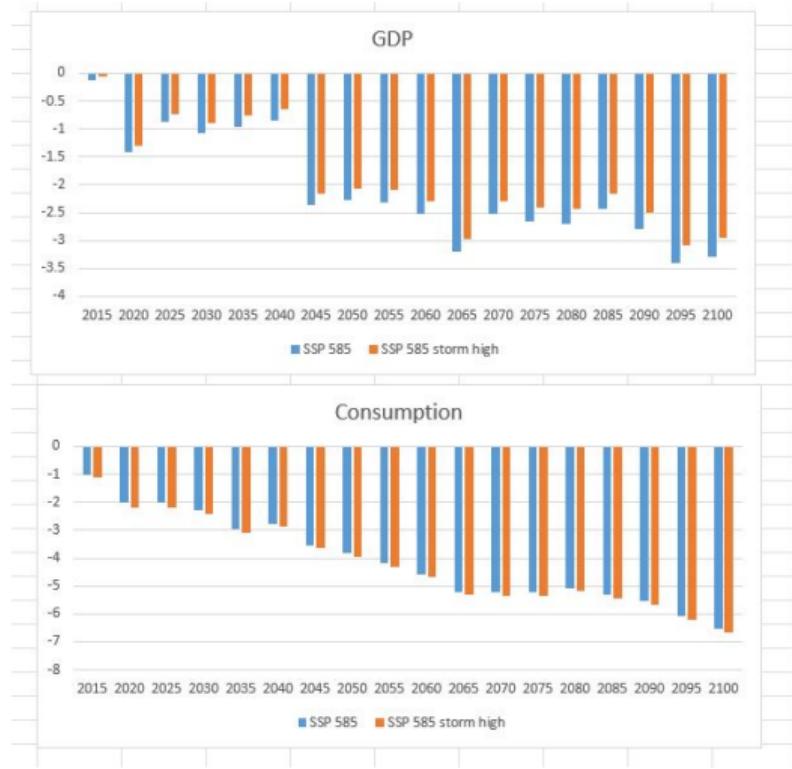
Task 9: Create a Figure comparing GDP and consumption losses for 50 percentile and 95 percentile storms.

- You need to create a sheet in Figures.xlsx as previously.

| Year | Y | Y | Y | Y | C | C | C | C |
|-------------------|-----------|--------------------|----------|-------------|--------------------|---------|----------|---------|
| | Baseline | SSP585 | Baseline | SSP585 | Baseline | SSP585 | Baseline | SSP585 |
| ResultsSce | | | | | | | | |
| 2014 | 1.16534 | 1.16534 | | 1.165337639 | 1.16534 | 0.7262 | 0.7262 | 0.7262 |
| 2015 | 1.24748 | 1.2458 | | 1.24748146 | 1.24675 | 0.77872 | 0.77096 | 0.77872 |
| 2020 | 1.67999 | 1.65626 | | 1.679994099 | 1.65806 | 1.01493 | 0.9944 | 1.01493 |
| 2025 | 2.12618 | 2.10773 | | 2.12618437 | 2.11064 | 1.22827 | 1.20336 | 1.22827 |
| 2030 | 2.55882 | 2.53131 | | 2.558816725 | 2.53565 | 1.44014 | 1.40721 | 1.44014 |
| 2035 | 2.95815 | 2.92996 | | 2.958147834 | 2.93541 | 1.65755 | 1.60839 | 1.65755 |
| 2040 | 3.3127 | 3.28489 | | 3.312699892 | 3.29155 | 1.87203 | 1.82039 | 1.87203 |
| 2045 | 3.61804 | 3.53267 | | 3.618042767 | 3.53997 | 2.07179 | 1.99841 | 2.07179 |
| 2050 | 3.87481 | 3.78635 | | 3.874810724 | 3.79443 | 2.24923 | 2.16287 | 2.24923 |
| 2055 | 4.08675 | 3.99218 | | 4.086755223 | 4.00115 | 2.40159 | 2.3009 | 2.40159 |
| 2060 | 4.25918 | 4.15141 | | 4.259177837 | 4.161 | 2.52936 | 2.41368 | 2.52936 |
| 2065 | 4.39788 | 4.25696 | | 4.397884603 | 4.26743 | 2.63469 | 2.49744 | 2.63469 |
| 2070 | 4.5085 | 4.39431 | | 4.508495013 | 4.40509 | 2.72044 | 2.57827 | 2.72044 |
| 2075 | 4.5961 | 4.4737 | | 4.596103793 | 4.48515 | 2.78955 | 2.6435 | 2.78955 |
| 2080 | 4.66513 | 4.53955 | | 4.665130031 | 4.5518 | 2.84479 | 2.70051 | 2.84479 |
| 2085 | 4.71929 | 4.60491 | | 4.7192939 | 4.61757 | 2.88867 | 2.73508 | 2.88867 |
| 2090 | 4.76166 | 4.62841 | | 4.761661412 | 4.64222 | 2.9233 | 2.76144 | 2.9233 |
| 2095 | 4.79472 | 4.63201 | | 4.794720692 | 4.64616 | 2.9505 | 2.77113 | 2.9505 |
| 2100 | 4.82047 | 4.66233 | | 4.820467938 | 4.67789 | 2.97176 | 2.77794 | 2.97176 |
| GDP | | | | | | | | |
| | SSP 585 | SSP 585 storm high | | SSP 585 | SSP 585 storm high | | | |
| 2015 | -0.13485 | -0.058469237 | -0.9974 | -1.12378 | | | | |
| 2020 | -1.41254 | -1.305747056 | -2.02234 | -2.1771 | | | | |
| 2025 | -0.86801 | -0.731143018 | -2.02822 | -2.17367 | | | | |
| 2030 | -1.07491 | -0.9053444369 | -2.28656 | -2.42758 | | | | |
| 2035 | -0.95302 | -0.768523258 | -2.96592 | -3.08734 | | | | |
| 2040 | -0.83962 | -0.638363448 | -2.75853 | -2.87775 | | | | |
| 2045 | -2.35973 | -2.157812122 | -3.54192 | -3.64758 | | | | |
| 2050 | -2.28295 | -2.074340462 | -3.83977 | -3.94174 | | | | |
| 2055 | -2.31402 | -2.094530324 | -4.19294 | -4.29992 | | | | |
| 2060 | -2.53017 | -2.305058587 | -4.57363 | -4.67704 | | | | |
| 2065 | -3.20441 | -2.966196528 | -5.2096 | -5.32617 | | | | |
| 2070 | -2.53273 | -2.293580198 | -5.22608 | -5.33271 | | | | |
| 2075 | -2.66326 | -2.414100851 | -5.23543 | -5.34647 | | | | |
| 2080 | -2.69195 | -2.429276285 | -5.07196 | -5.19193 | | | | |
| 2085 | -2.424369 | -2.155492642 | -5.31688 | -5.42826 | | | | |
| 2090 | -2.7984 | -2.508404399 | -5.53676 | -5.66608 | | | | |

Task 9: GDP effects vs. Consumption

- Consumption effects are higher, and GDP effects are lower.



Task 10: Conduct sensitivity analysis for low and high values for the elasticity of substitution between different domestic sectors.

- Copy excel file and rename it to
ModelSimulationandCalibration3Sectorsand1Regions_etaQhigh.xlsx.
- The degree of substitutability is given by $\frac{\eta^Q - 1}{\eta^Q}$.
- Estimation results suggest very low values of η^Q (etaQ_p).
- So far we assumed a value of $\eta^Q = 0.01$.
- Set the value to 10 and analyse the impact.
- What is your initial hypothesis about the GDP impact for high and low elasticity of substitution?

$$Q_t^D = \left(\sum_k^K \omega_k^{Q^A \frac{1}{\eta^Q}} Q_{k,t}^{A,D \frac{\eta^Q - 1}{\eta^Q}} \right)^{\frac{\eta^Q}{\eta^Q - 1}} \quad (1)$$

Task 10: Copy the ModelSimulationandCalibration3Sectorsand1Regions.xlsx file.

- Rename the copy to ModelSimulationandCalibration3Sectorsand1Regions_etaQhigh.xlsx of You need to create a sheet in Figures.xlsx as previously.



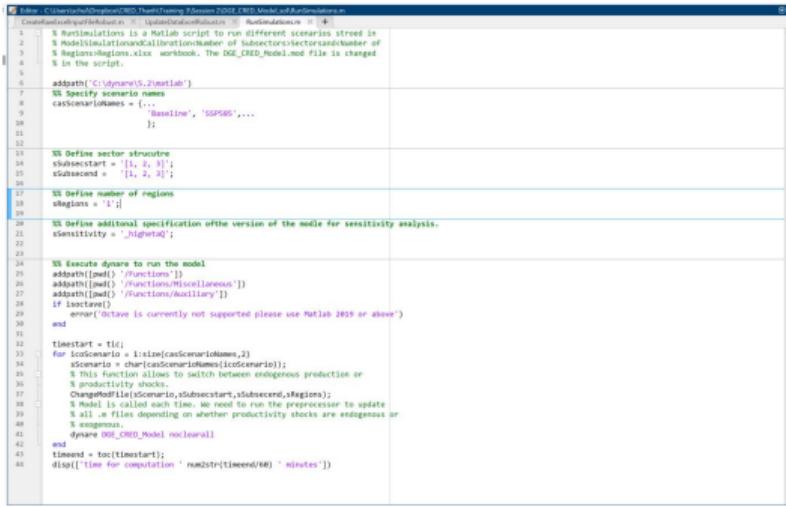
Task 10: Set the value for etaQ_p.

- Change the value of etaQ_p from 0.01 to 10 in the Structural Parameters sheet.

| A | B | C |
|---|--------|---|
| 1 Parameter | Value | Description |
| 2 beta_p | 0.9606 | discount factor |
| 3 delta_p | 0.045 | depreciation rate |
| 4 sh_p | 0.01 | share of investments in residential buildings relative to GDP |
| 5 phiB_p | 10 | foreign bond adjustment cost |
| 6 phiK_p | 10 | Investment adjustment cost |
| 7 sigmaL_p | 0.5 | Inverse Frisch elasticity |
| 8 sigmaC_p | 1 | intertemporal elasticity of substitution for consumption |
| 9 etaQ_p | 10 | elasticity of substitution between sectors |
| 10 etaF_p | 1.83 | elasticity of substitution between imports and domestic products |
| 11 etaX_p | 0.83 | supply price elasticity of exports |
| 12 tauC_p | 0.2 | consumption tax rate |
| 13 tauNH_p | 0 | tax rate on labour income |
| 14 tauKH_p | 0 | tax rate on capital income |
| 15 phiM_p | 0.3 | share of imports on total used domestic products |
| 16 iGAH_p | 0 | subsector to provide output for adaptation measures for housing sec |
| 17 iIAPH_p | 0 | subsector to provide output for private adaptation measures for hou |
| 18 Parameter values for subsector to provide output for adaptaiton measures in respective subsector | | 0 subsector to provide outout for adadoitaion measures in respective su |
| 19 iGA 1 o | | |

Task 10: Execute the RunSimulation.m file.

- Change the scenarios you want to simulate, and do not forget to include the Baseline scenario.



The screenshot shows a MATLAB code editor window titled "Editor: C:\Users\...\". The script "RunSimulation.m" contains the following code:

```
% Edit: C:\Users\...\RunSimulation.m; Last Saving: 3 January 2022, 09:16; Model: D:\DGF_OED\Baseline.m
% CreateModelForSubsector.m --> ModelForSubsector.m --> RunSimulation.m --> RunSimulation.m
% RunSimulations is a Matlab script to run different scenarios stored in
% ModelSimulations\Calibration\Number of Subsectors\sectors and Number of
% Regions\Regions.xlsx workbook. The DGF_OED_Model.mdl file is changed
% In the script.

addpath('C:\dynare5.5\matlab')

% Specify scenario names
casScenarioNames = {'Baseline', 'SSP585', ...
};

% Define sector structure
subsectorstart = [1, 2, 3];
subsectorend = [1, 2, 3];

% Define number of regions
regions = '1';

% Define additional specification of the version of the model for sensitivity analysis.
sensitivity = '_highref';

% Execute doeps to run the model
addpath([pwd]\'/functions\' );
addpath([pwd]\'/functions\miscellaneous\' );
addpath([pwd]\'/functions\auxiliary\' );

if isstacked()
    error('Octave is currently not supported please use Matlab 2019 or above')
end

TimeStart = tic;
for iocScenario = 1:size(casScenarioNames,2)
    s5Scenario = char(casScenarioNames(iocScenario));
    % This function allows to switch between endogenous production or
    % exogenous production
    % ChangeDGFFile(s5Scenario,subsectorstart,subsectorend,regions);
    % Model is called each time, we need to run the preprocessor to update
    % all .m files depending on whether productivity shocks are endogenous or
    % exogenous
    % dynare DGF_OED_Model noclearall
    % timeend = toc(TimeStart);
    % disp(['Time for computation: ' num2str(timeend/60) ' minutes']);
    % disp(['Time for computation: ' num2str((timeend - TimeStart)/60) ' minutes']);
end
```

Task 10: Compare the results for low and high etaQ_p.

- Create a new sheet in Figures.xlsx.
- List GDP for Baseline and SSP 585 scenario next to each other.
- Copy the range and change the reference to the ResultsScenarios3Sectorsand1Regions_etaQhigh.xlsx in E4 and change the formula accordingly (replace \$A\$4 by \$E\$4)

The screenshot shows an Excel spreadsheet with the following details:

- Formula Bar:** The formula `=VLOOKUP($B3;INDIRECT("'"&$E$4&".xlsx"&F$2&"!"&"A1:ECW1002")` is entered in the formula bar, with the range `=A1:ECW1002` highlighted.
- Table Structure:** The table has columns A through H. Columns A, C, D, and G are labeled "Year", "Baseline", and "SSP585". Column E is labeled "ResultsScenarios3Sectorsand1Regions_etaQhigh".
- Data:** The table displays GDP values for years 2014 to 2100. The "Baseline" column shows values starting at 1.165338 in 2014 and increasing to 4.671157 in 2100. The "SSP585" column shows values starting at 1.245799 in 2014 and increasing to 4.545312 in 2100. The "ResultsScenarios3Sectorsand1Regions_etaQhigh" column shows values starting at 1.208841 in 2014 and increasing to 4.671157 in 2100.
- Notes:** The formula in the formula bar uses the indirect function to refer to another Excel file named after the scenario (e.g., "ResultsScenarios3Sectorsand1Regions_etaQhigh.xlsx"). The range F\$2 is used as a column index for the lookup.

Task 10: GDP effects are lower for a higher elasticity of substitution between sectors.

- A higher substitutability implies that damages in more severely affected sectors can be compensated with production from other sectors.

