

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

Andrej Drygalla, Katja Heinisch and Christoph Schult* | October 2022
Halle Institute for Economic Research

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

IWH
Leibniz-Institut für
Wirtschaftsforschung Halle

On behalf of:



Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

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 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 on wards.
- Run the scenarios.

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

Sub-sector	Description	Physical intensity (W)	Productivity reduction ($D_s^{N,Heat}$ in $\frac{\%}{^{\circ}C}$)
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 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 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.

C3 143.445800000001

	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 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 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 $2634 \frac{\text{billion VND}}{\text{km}^2}$.
- $D_2^K = \text{Landloss} \left(\frac{2643}{\text{GDP in billion VND}} \right)$

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
$$D^H = 10^8 \times \left(\frac{exo_storms}{100} \right) \times (Pop^{SSP} + Pop_0) \times (1.3 \times 10^{-10})$$
- Run all previous scenarios and new scenarios: SSP119LabLLAgri, SSP245LabLLAgri, SSP585LabLLAgri
- Is housing destruction due to storms important for GDP reduction?

Task 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 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?

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