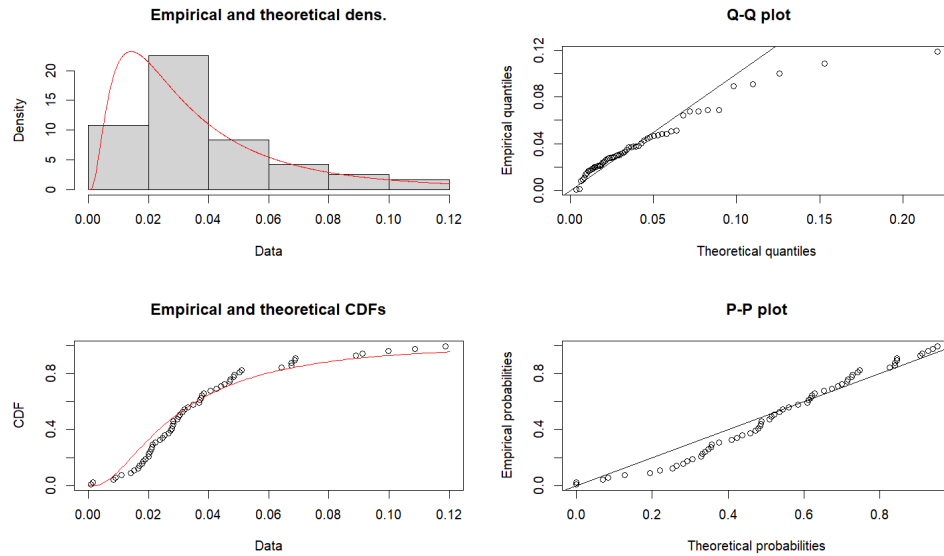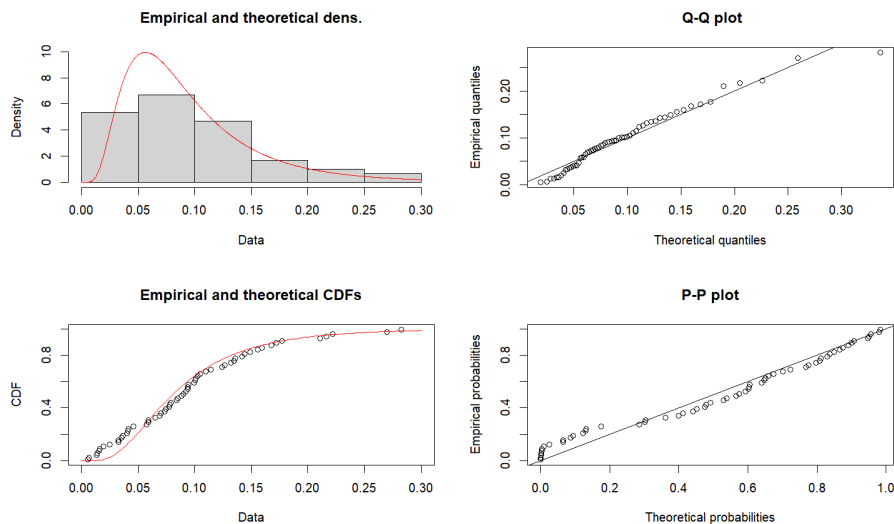# Appendices

Appendix 1: The fitted and simulated results of the inflation and one-year risk free rate.

Appendix 1A: Log-normal distribution fitted to historical inflation rate

Appendix 1B: Log-normal distribution fitted historical to one-year risk free rate

	Sim 1	Sim 2	Sim 3	Sim 4	Sim 5	Sim 6	Sim 7	Sim 8	Sim 9	Sim 10	Sim 11	Sim 12
2021	0.012375819	0.033235928	0.018514777	0.015515193	0.015681423	0.013430958	0.020034584	0.05146634	0.118910686	0.012062697	0.026781104	0.016544989
2022	0.017331143	0.073188936	0.0133001	0.076546775	0.020787718	0.007026106	0.010652646	0.020885454	0.014866933	0.068543432	0.056263767	0.022640948
2023	0.075052138	0.016959125	0.031618753	0.022449766	0.04529497	0.091550133	0.059543705	0.017245016	0.119112559	0.029551785	0.030757997	0.044483554
2024	0.015536385	0.009537774	0.120442132	0.011523774	0.04135346	0.032424078	0.032262543	0.020056575	0.029554873	0.081176118	0.085443887	0.048002112
2025	0.020742727	0.013335178	0.029731943	0.031908854	0.025853145	0.025678303	0.052652123	0.009273861	0.009716101	0.01686837	0.06024531	0.032561243
2026	0.017377225	0.036558816	0.004143108	0.01148759	0.005359529	0.012870495	0.017916807	0.019180996	0.019280186	0.030957276	0.019368048	0.022704619
2027	0.022480519	0.023668717	0.016520691	0.031967407	0.022284238	0.031477835	0.012928912	0.074036132	0.018758976	0.008239353	0.050403185	0.017234754
2028	0.016202269	0.043581732	0.037728633	0.010895256	0.028674676	0.016081008	0.076287947	0.010192534	0.014302281	0.031010951	0.057767249	0.012651406
2029	0.01876767	0.017020124	0.039664878	0.020945576	0.148709444	0.063162682	0.045257498	0.040602659	0.044954153	0.006671683	0.055430742	0.103177901
2030	0.045411648	0.004705355	0.174276994	0.035543047	0.031667146	0.039564565	0.030711622	0.01388024	0.010496211	0.018741574	0.009392859	0.085311342
2031	0.053939699	0.03511703	0.011763884	0.015449618	0.045287792	0.053832675	0.006610864	0.006342436	0.060969459	0.012714399	0.111132393	0.024116081
2032	0.031580473	0.028495423	0.016747564	0.01836675	0.006940684	0.054344068	0.038722895	0.002152073	0.051819209	0.005816431	0.034289872	0.023913102
2033	0.045593464	0.00508139	0.029522381	0.01741123	0.065863259	0.028123927	0.031943663	0.088213476	0.053581843	0.029829699	0.019233789	0.005176981
2034	0.043165061	0.030653488	0.055069485	0.014908007	0.014659925	0.008061034	0.038616445	0.06093163	0.027433085	0.045103603	0.040491751	0.037478088
2035	0.030941309	0.046830331	0.101717552	0.031235189	0.004277542	0.041227556	0.025382199	0.043797582	0.019599636	0.006166654	0.016065357	0.025507767
2036	0.016845113	0.003096641	0.041039376	0.036162454	0.047570845	0.008581017	0.067758049	0.002838842	0.037318831	0.019912658	0.061001664	0.116663154
2037	0.041388405	0.025016153	0.031409713	0.044772201	0.012098617	0.015409254	0.060124449	0.098381975	0.020854189	0.013003909	0.04307381	0.02391765
2038	0.131278786	0.011159624	0.034674439	0.137328715	0.040981167	0.007185019	0.019593713	0.054923171	0.060468422	0.121356131	0.015873958	0.026005227
2039	0.024373195	0.058697913	0.137815525	0.03253873	0.044851468	0.028187008	0.058737996	0.00719139	0.04008731	0.028970672	0.099114254	0.056381295
2040	0.036317378	0.020250613	0.022249417	0.061657116	0.016131891	0.03580639	0.004855932	0.077762135	0.066536773	0.022630781	0.00494659	0.063958329
2041	0.050464601	0.055118504	0.114127184	0.058493784	0.040589463	0.037107385	0.028464352	0.020757278	0.0100107	0.056697838	0.009773868	0.049282976
2042	0.013234788	0.044374798	0.1249841	0.020289699	0.053719475	0.044719669	0.023155208	0.02365143	0.058585657	0.040740192	0.010426685	0.058805483
2043	0.019987142	0.093216551	0.016792567	0.030857283	0.014316133	0.012543399	0.009434472	0.033641817	0.060628004	0.023301219	0.024438984	0.023574864
2044	0.017559622	0.058088886	0.036301496	0.014273424	0.016528817	0.154148665	0.021426328	0.007986342	0.010060363	0.041655338	0.008919605	0.088176106
2045	0.017824351	0.036449518	0.020566287	0.020951846	0.025536882	0.029287707	0.014896817	0.060817205	0.008564504	0.138582185	0.03869956	0.012780758
2046	0.009801606	0.015922736	0.061966074	0.020756293	0.031707977	0.01095191	0.016842612	0.015690834	0.068052967	0.136764443	0.025319853	0.156266133
2047	0.024930422	0.080291969	0.010255774	0.054786	0.037030501	0.02983885	0.026837514	0.028288012	0.016008923	0.026420857	0.194064127	0.093562705
2048	0.047544669	0.011871835	0.020823857	0.009011563	0.016075574	0.024593458	0.077907549	0.082365322	0.029025367	0.07913384	0.053261989	0.004646111

*Appendix 1C: Header of 130 years * 100 simulations on inflation rate according to log-normal*

	Sim 1	Sim 2	Sim 3	Sim 4	Sim 5	Sim 6	Sim 7	Sim 8	Sim 9	Sim 10	Sim 11	Sim 12
2021	0.011007576	0.013522324	0.012460888	0.020315523	0.04805087	0.116223445	0.015658738	0.06054918	0.022616516	0.013450431	0.021613741	0.039167649
2022	0.020284982	0.040898902	0.009860055	0.071002731	0.052471961	0.093381046	0.040145959	0.016698353	0.103362183	0.006456972	0.021227247	0.042432706
2023	0.015387107	0.012070655	0.009171427	0.005983068	0.042711427	0.015744449	0.006225968	0.059448437	0.05897862	0.170195266	0.070766588	0.022261626
2024	0.055938938	0.021032601	0.007015473	0.060151727	0.04775807	0.037680816	0.035809976	0.005867329	0.130731798	0.058260481	0.010502882	0.025546705
2025	0.069919262	0.004713505	0.101340012	0.012663277	0.008334029	0.03000677	0.013198461	0.127915717	0.031307944	0.02530465	0.024123421	0.024344467
2026	0.028685172	0.017670054	0.033168494	0.075455422	0.042041063	0.033742075	0.026333009	0.049427056	0.054131618	0.097555074	0.006948784	0.018821863
2027	0.055795724	0.003639188	0.029516774	0.032003813	0.007532472	0.006825389	0.028779171	0.030803942	0.022766367	0.06239964	0.04228912	0.030184693
2028	0.008171631	0.017007234	0.130870074	0.02318506	0.013095125	0.058151532	0.012684922	0.040140071	0.033413329	0.029314718	0.142684418	0.005387487
2029	0.075593994	0.030431648	0.015187014	0.05266631	0.021919076	0.044995663	0.031294042	0.029269496	0.015338374	0.027124317	0.011021417	0.060790603
2030	0.030647893	0.072029199	0.00595292	0.017509724	0.057293112	0.031787014	0.008799861	0.033503781	0.01836092	0.017215326	0.029670863	0.020880474
2031	0.042341577	0.036299252	0.120452932	0.041110259	0.061382817	0.126798919	0.02291884	0.03890657	0.042815564	0.036446151	0.023023473	0.029815521
2032	0.10956937	0.036985695	0.031388706	0.049720054	0.030422701	0.125345386	0.041310621	0.021646188	0.030575331	0.013077087	0.028564903	0.021255686
2033	0.060826675	0.06954431	0.032956609	0.044872474	0.012881615	0.016088969	0.022966249	0.061296584	0.060452595	0.133960044	0.013484173	0.044842166
2034	0.02191486	0.051691715	0.063528877	0.076666748	0.059882515	0.086345728	0.029425485	0.008413682	0.055685024	0.055868099	0.032675708	0.00437156
2035	0.025591156	0.017686098	0.024185422	0.082429122	0.079503916	0.018424413	0.104255849	0.062402776	0.065908889	0.085562466	0.007324837	0.005852828
2036	0.031907286	0.03502737	0.014934103	0.044581526	0.016011239	0.023771073	0.041879638	0.02264412	0.014296306	0.034062649	0.008076754	0.030152822
2037	0.018768534	0.049849803	0.086474021	0.126534549	0.034180548	0.064773092	0.069580392	0.012430716	0.050155188	0.042285504	0.027327742	0.018520549
2038	0.030084579	0.02213723	0.062883291	0.065757406	0.124126559	0.03537121	0.026977675	0.007531163	0.080205988	0.011611446	0.171188367	0.033335419
2039	0.077370846	0.010865122	0.039729232	0.054581365	0.019641157	0.052854919	0.006901247	0.071754196	0.113142792	0.046851084	0.067752443	0.017715644
2040	0.005427823	0.014085057	0.088269813	0.011291531	0.017730186	0.03009652	0.041844913	0.055308849	0.086253699	0.016532582	0.0475325	0.009697355
2041	0.021777118	0.031325912	0.027546447	0.013520914	0.021590012	0.035868041	0.016123562	0.052838536	0.144445172	0.072397846	0.026101317
2042	0.009025816	0.038131299	0.007314408	0.116887799	0.030142183	0.009582874	0.049244865	0.019683285	0.063543891	0.063040604	0.014783349	0.022591413
2043	0.08489529	0.010135973	0.030361157	0.017570363	0.012712056	0.027725748	0.06514029	0.033087263	0.053368774	0.073581792	0.017883236	0.010922267
2044	0.00768169	0.047693655	0.056651148	0.012426326	0.066097856	0.040094438	0.017006261	0.019699076	0.003631071	0.051519772	0.035632424	0.056749757
2045	0.029692033	0.01345581	0.136868845	0.015631254	0.011607132	0.024916215	0.021619644	0.047443346	0.043135257	0.028246899	0.013218284	0.022150428
2046	0.023100612	0.004263982	0.028706524	0.017868831	0.014751969	0.022929235	0.030568078	0.03875599	0.073611949	0.031861851	0.024408193	0.018301732

Appendix 1D: Header of 130 years * 100 simulations on one year risk free rate according to log-normal

## Appendix 2: Projection of property damage in the short and long term

Method:

1. Convert all historical property damage value to 2020-dollar value using the historical one-year risk free rate
2. Categorise all the hazard damage into low, medium and high based on two benchmarks of ₱2,000,000 and ₱20,000,000.
3. Calculate the average property damage for low, medium high hazard level.

Average property damage – Average ₱

	low	median	high
Region 1	572140	6817447	121224652
Region 2	531119	7249437	317447523
Region 3	471149	6833204	161711513
Region 4	420108	6775572	193658178
Region 5	411788	6686161	159689228
Region 6	396383	6617369	132186332

4. In the short term from 2022 to 2026, the hazard frequencies is simulated through fitted negative binomial distribution on the historical frequency data.
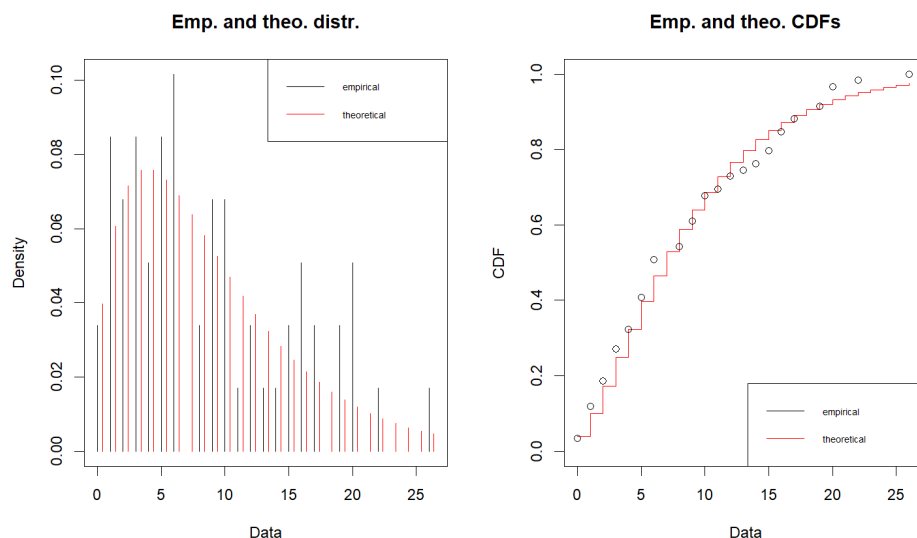
Fitted negative binomial distribution to the historical frequency data

In the long term up to year 2150, use the average historical frequency and the SSP model to predict future hazard frequency under different emission assumptions

Frequency Projection Model of Minor, Medium, and Major Hazard Events Per Year, as a Function of SSP Scenario

One can view the values below either as the expected number of events per year, or as 1 divided by the "return period". An expectation of 0.25 implies a return period of 4 years (on average, an event occurs every 4 years). An expected value that exceeds 1.00 indicates a return period of less than one year. For example, an expectation of 3 events per year equates to a return period of 4 months.

	SSP1– 2.6 Low Emissions			SSP2–3.4 Medium Emissions			SSP3–6.0 High Emissions			SSP5–Baseline Very High Emissions			Risk Amplification Factor (RAF)			
Year	Minor	Medium	Major	Minor	Medium	Major	Minor	Medium	Major	Minor	Medium	Major	SSP1– 2.6	SSP2–3.4	SSP3–6.0	SSP5–Baseline
2020	8.695	1.237	0.322	8.695	1.237	0.322	8.695	1.237	0.322	8.695	1.237	0.322	1.00000	1.00000	1.00000	1.00000
2030	9.642	1.372	0.357	9.768	1.390	0.362	10.057	1.431	0.372	10.238	1.457	0.379	1.10890	1.12346	1.15665	1.17750
2040	10.350	1.472	0.383	10.854	1.544	0.402	11.547	1.643	0.428	12.470	1.774	0.462	1.19036	1.24834	1.32802	1.43414
2050	10.738	1.528	0.398	11.821	1.682	0.438	13.074	1.860	0.484	15.645	2.226	0.579	1.23499	1.35957	1.50368	1.79930
2060	10.842	1.542	0.401	12.529	1.782	0.464	14.736	2.096	0.546	20.188	2.872	0.748	1.24687	1.44094	1.69473	2.32185
2070	10.736	1.527	0.398	12.873	1.831	0.477	16.441	2.339	0.609	26.617	3.787	0.986	1.23472	1.48054	1.89081	3.06118
2080	10.422	1.483	0.386	12.899	1.835	0.478	17.992	2.560	0.666	35.368	5.032	1.310	1.19864	1.48348	2.06918	4.06758
2090	9.933	1.413	0.368	12.692	1.806	0.470	19.409	2.761	0.719	46.397	6.601	1.718	1.14243	1.45965	2.23223	5.33602
2100	9.450	1.344	0.350	12.361	1.759	0.458	20.799	2.959	0.770	59.225	8.426	2.193	1.08681	1.42166	2.39212	6.81144
2110	8.978	1.277	0.332	12.035	1.712	0.446	22.238	3.164	0.824	73.618	10.473	2.726	1.03259	1.38416	2.55753	8.46674
2120	8.519	1.212	0.315	11.714	1.666	0.434	23.724	3.375	0.879	89.575	12.743	3.317	0.97974	1.34717	2.72847	10.30191
2130	8.095	1.152	0.300	11.396	1.621	0.422	25.259	3.593	0.935	107.096	15.236	3.966	0.93104	1.31067	2.90495	12.31695
2140	8.095	1.152	0.300	11.083	1.577	0.410	26.841	3.819	0.994	126.181	17.951	4.673	0.93104	1.27468	3.08695	14.51185
2150	8.095	1.152	0.300	10.775	1.533	0.399	28.472	4.051	1.054	146.829	20.889	5.437	0.93104	1.23919	3.27448	16.88663

Example of projected region 1 hazard frequency

5. Calculate the projected property damage using the predicted frequencies and the average damage value for each hazard level.

Appendix 3: Detailed calculation of the variables used in calculating economic costs

Importance Index	Sign	Formula/Data
Given Index		
Housing Units	HU	Given
Owner-Occupied Housing Units	OHU	Given
Median Value of Owner-Occupied Housing Units	MVOOH	Given
Median Monthly Homeowner Housing Costs	MMHHC	Given
Temporary housing cost with disaster (per person per month)	THC	Given
Persons per Household, 2016-2020	PPH	Given
Sensitive Index		
Labor & Material cost index	ML_i	0.25
Replacing Household goods Cost index	RH_i	0.55
Temporary housing cost index	TH_i	0.9
Deductible discount	d	0.85
Incentive Cost per person	Ic	7500
Identify Index		
Property Value distribution index	PVD_i	$\sum_1^{13} \dfrac{probability}{mean\ property\ value}$
Risk Units	RU	$PD \times PVD\_i$
Risk Population	RP	$PU \times PPH$
Property damage	PD	-
Material and labor cost	ML	$ML\_i \times PD$
Replacing household goods cost	RH	$RH\_i \times MMHHC \times RU \times 12$
Temporary housing cost	TH	$TH\_i \times THC \times RU \times 3$
Incentive cost	IC	$Ic * RP$

Property value is divided into 13 ranges in the original dataset

Appendix 4: Economic costs comparison in the short term

Economic Cost in Ψ million in different region - Without Program; Short-term

Year	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total Cost
2022	191.58	461.58	2.61	11.54	10.79	10.14	688.22
2023	11.82	12.18	507.41	265.36	227.09	0.00	1023.86
2024	4.76	5.12	475.80	2.29	1.68	0.54	490.19
2025	179.75	14.37	9.78	265.36	227.09	9.60	705.95
2026	15.78	20.96	25.42	2.29	1.68	0.54	66.68

Economic Cost in Ψ million in different region - With Program; Short-term

Year	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total Cost
2022	174.57	419.96	2.41	10.70	10.01	9.46	627.11
2023	10.97	11.29	452.55	246.22	210.75	0.00	931.78
2024	4.41	4.75	432.44	2.13	1.56	0.51	445.80
2025	166.85	13.32	9.05	246.22	210.75	8.95	655.14
2026	14.65	19.42	23.54	2.13	1.56	0.51	61.81

Appendix 5: Economic costs comparison in the long term

Economic Cost in Ψ million in different region - Without Program; Long-term

Year	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total Cost
2030	81.61	275.12	75.41	64.49	48.47	24.06	569.16
2040	90.64	305.49	83.91	71.63	53.83	26.82	632.31
2050	98.75	332.94	90.36	78.00	58.62	29.32	687.99
2060	103.57	352.71	95.79	82.54	62.03	30.89	727.54
2070	106.46	362.35	98.49	85.09	63.96	31.86	748.20
2080	106.68	363.29	98.54	85.13	63.98	31.88	749.50
2090	104.92	357.51	97.01	83.66	62.87	31.38	737.34
2100	102.23	347.89	94.56	81.72	61.42	30.60	718.42
2110	99.54	338.74	92.13	79.49	59.74	29.83	699.47
2120	97.84	329.60	89.47	77.26	58.07	29.06	681.31
2130	95.15	320.90	87.06	75.34	56.63	28.11	663.20
2140	92.47	312.21	85.50	73.13	54.96	27.34	645.62
2150	89.97	303.54	83.29	71.22	53.53	26.58	628.13

Economic Cost in Ψ million in different region - With Program; Long-term

Year	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	total cost
2030	75.72	253.54	70.12	65.35	47.31	23.31	535.35
2040	84.09	281.53	78.03	72.57	52.55	25.97	594.75
2050	91.62	306.82	82.55	79.04	57.22	28.39	645.64
2060	94.39	325.05	87.51	83.64	60.55	29.92	681.06
2070	97.03	333.93	89.98	86.21	62.43	30.86	700.43
2080	97.23	334.80	90.02	86.26	62.45	30.88	701.63
2090	95.62	329.47	88.62	84.77	61.37	30.39	690.24
2100	93.17	320.61	86.39	82.80	59.95	29.64	672.56
2110	90.72	312.18	84.17	80.54	58.32	28.89	654.81
2120	90.78	303.75	81.74	78.29	56.68	28.15	639.38
2130	88.28	295.73	79.54	76.34	55.28	27.23	622.39
2140	85.80	287.73	79.51	74.10	53.65	26.48	607.26
2150	83.47	279.73	77.46	72.16	52.25	25.75	590.81

Appendix 6: Projected displacement and incentive costs in the short term

Incentive Cost in Ψ million in different region - With Program; Short-term

Year	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total incentives
2022	14.99	35.46	0.20	0.90	0.84	0.83	53.22
2023	0.92	0.94	38.50	20.66	17.72	0.00	78.75
2024	0.37	0.39	36.10	0.18	0.13	0.04	37.22
2025	14.06	1.10	0.74	20.66	17.72	0.79	55.08
2026	1.23	1.61	1.93	0.18	0.13	0.04	5.13

Displacement Cost in Ψ million in different region - With Program; Short-term

Year	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total displacement
2022	159.58	384.49	2.22	9.81	9.17	8.62	573.89
2023	10.05	10.35	414.05	225.56	193.02	0.00	853.03
2024	4.04	4.35	396.34	1.95	1.43	0.46	408.57
2025	152.79	12.22	8.31	225.56	193.02	8.16	600.06
2026	13.42	17.81	21.61	1.95	1.43	0.46	56.68

Appendix 7: Projected displacement and incentive costs in the long term

Incentive Cost in Ψ million in different region - With Program; Long-term

Year	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total incentives
2030	6.35	24.41	6.03	10.53	6.11	2.85	56.28
2040	7.05	27.11	6.71	11.69	6.79	3.18	62.53
2050	7.68	29.54	7.30	12.73	7.39	3.48	68.12
2060	8.14	31.30	7.74	13.48	7.82	3.66	72.13
2070	8.36	32.15	7.95	13.89	8.06	3.78	74.20
2080	8.38	32.24	7.96	13.90	8.07	3.78	74.32
2090	8.24	31.73	7.83	13.66	7.93	3.72	73.11
2100	8.03	30.87	7.64	13.34	7.74	3.63	71.25
2110	7.82	30.06	7.44	12.98	7.53	3.54	69.37
2120	7.61	29.25	7.23	12.61	7.32	3.45	67.46
2130	7.40	28.48	7.03	12.30	7.14	3.33	65.68
2140	7.19	27.71	6.84	11.94	6.93	3.24	63.84
2150	7.00	26.94	6.66	11.63	6.75	3.15	62.12

Displacement Cost in Ψ million in different region - With Program; Long-term

Year	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total displacement
2030	69.37	229.13	64.10	54.82	41.20	20.45	479.06
2040	77.04	254.42	71.32	60.88	45.76	22.79	532.22
2050	83.94	277.28	75.25	66.30	49.83	24.92	577.52
2060	86.26	293.75	79.77	70.16	52.73	26.26	608.93
2070	88.66	301.77	82.02	72.32	54.37	27.08	626.23
2080	88.85	302.56	82.06	72.36	54.38	27.10	627.31
2090	87.38	297.74	80.79	71.11	53.44	26.67	617.13
2100	85.14	289.74	78.75	69.46	52.21	26.01	601.31
2110	82.90	282.12	76.73	67.57	50.78	25.36	585.44
2120	83.16	274.50	74.52	65.67	49.36	24.70	571.92
2130	80.88	267.26	72.50	64.04	48.14	23.89	556.71
2140	78.60	260.02	72.68	62.16	46.72	23.24	543.42
2150	76.47	252.79	70.80	60.53	45.50	22.59	528.69

Appendix 8: Projected Storslysia GDP

Using the projected inflation and one-year interest rate above, the GDP from 2021 to 2150, under the 2020-dollar value is calculated based on the below formula:

$$Region\ i\ GDP\ (Year\ n) = 2020\ GDP * \frac{\prod_{2020}^{n}(1 + inflation_k)^{k-2020}}{\prod_{2020}^{n}[1 + (1\ yr\ rf)_k]^{k-2020}}$$

$$i = Region\ number\ 1\ to\ 6$$
$$n = Target\ GDP\ Year\ [2020, 2150]$$
$$k\ takes\ value\ [2020, n]$$
$$inflation = the\ projected\ inflation\ rate\ in\ that\ year$$
$$1\ yr\ rf = the\ projected\ one\ year\ risk\ free\ rate\ in\ that\ year$$

Then compute average GDP across 100 different simulated rate scenarios for each year.

			Region 1 GDP	531,771,287.00				
	Min	Max	Average	Sim 1	Sim 2	Sim 3	Sim 4	Sim 5	Sim 6
2021	454,478,747.44	581,845,262.65	529,280,981.49	532,490,957.52	542,114,550.77	534,950,949.97	529,269,435.92	515,347,330.05	482,800,721.64
2022	441,648,783.09	599,991,918.54	527,235,686.75	530,949,336.92	558,931,647.52	536,773,237.36	532,009,198.44	499,833,006.98	444,669,250.78
2023	426,093,182.74	632,544,817.03	528,068,121.82	562,148,382.72	561,631,380.75	548,712,857.98	540,717,530.84	501,071,451.39	477,855,212.87
2024	429,532,837.70	617,091,078.09	528,405,829.75	540,639,345.63	555,308,511.81	610,517,932.14	515,915,432.96	498,008,561.93	475,434,468.75
2025	427,912,675.00	625,945,240.52	526,079,050.73	515,790,022.39	560,073,739.47	570,822,642.84	525,720,360.43	506,661,121.18	473,436,518.48
2026	378,769,175.72	661,593,415.35	527,093,526.33	510,120,137.82	570,469,151.30	554,786,199.87	494,450,638.90	488,825,828.60	463,877,685.01
2027	402,458,634.95	658,465,614.29	527,722,816.28	494,023,504.27	581,853,948.35	547,782,868.14	494,433,195.99	495,982,961.96	475,235,880.69
2028	385,146,686.65	674,856,402.23	526,506,840.23	497,958,671.39	597,057,848.48	502,666,026.95	488,494,400.12	503,610,273.47	456,341,212.27
2029	385,581,743.35	704,886,814.76	524,097,422.35	471,650,268.10	589,286,876.21	514,786,149.25	473,774,254.93	566,093,627.75	464,274,603.60
2030	376,512,410.15	693,265,354.27	524,849,223.98	478,406,531.98	552,279,434.68	600,924,277.78	482,170,955.32	552,373,027.43	467,774,278.74
2031	393,721,084.43	693,709,837.77	524,414,713.14	483,729,755.78	551,649,388.26	542,631,880.40	470,286,704.12	543,996,730.68	437,483,397.38
2032	385,897,490.33	740,805,106.04	523,924,055.32	449,729,583.04	547,132,784.82	534,928,915.92	456,240,061.84	531,599,740.16	409,881,295.62
2033	377,896,973.62	761,979,516.27	526,715,123.57	443,271,576.52	514,156,332.50	533,150,459.89	444,249,201.90	559,406,571.33	414,736,091.33
2034	378,874,600.82	893,965,470.96	526,538,610.06	452,489,184.25	503,871,058.19	528,909,739.25	418,766,598.79	535,538,063.56	384,849,208.09
2035	356,042,918.81	895,207,011.54	523,690,250.81	454,849,663.43	518,300,788.00	568,948,874.43	398,960,859.28	498,218,526.31	393,466,216.24
2036	351,170,869.66	810,900,795.13	522,033,032.38	448,210,477.53	502,311,141.03	583,582,894.09	395,745,332.06	513,694,319.84	387,628,217.77
2037	341,305,201.29	805,403,723.44	521,868,834.79	458,162,162.13	490,429,232.81	554,005,943.54	367,022,673.19	502,725,865.28	369,657,425.17
2038	318,069,404.58	793,811,992.54	520,441,657.69	503,171,433.80	485,162,093.62	539,302,662.36	391,670,208.25	465,542,027.88	359,594,140.87
2039	301,185,791.09	814,489,713.45	521,102,532.93	478,419,600.17	508,119,317.85	590,179,561.01	383,483,601.14	477,052,409.81	351,169,013.88
2040	305,717,209.85	838,517,923.61	523,701,129.24	493,117,988.67	511,208,642.73	554,376,042.72	402,582,323.36	476,303,222.67	353,115,559.07
2041	304,894,374.06	836,271,812.88	523,838,718.75	506,962,802.54	523,002,178.27	601,087,591.83	420,446,071.59	485,161,472.57	353,538,037.12
2042	302,949,676.61	825,971,726.02	531,624,669.20	509,077,507.91	526,147,602.86	671,303,793.47	384,082,265.06	496,265,564.86	365,842,320.39
2043	322,333,197.43	813,967,040.98	531,756,406.04	478,619,934.23	569,421,625.28	680,493,609.76	389,097,417.50	497,051,620.70	360,437,818.53
2044	319,309,350.63	817,597,942.90	533,655,857.33	483,311,668.72	575,071,434.40	667,388,235.88	389,807,297.20	473,940,823.56	399,962,553.17
2045	341,288,273.06	838,692,762.04	530,595,425.88	477,741,275.77	588,118,895.10	599,113,905.36	391,849,382.50	480,466,951.16	401,668,480.84
2046	356,215,920.33	880,268,443.29	533,331,652.69	471,531,246.97	594,946,515.76	618,484,113.00	392,960,969.86	488,495,318.40	396,965,404.92

*Header of 130 years * 100 simulations on GDP according to the simulated rates.*

10% GDP LT						
Year	Region 1 Average	Region 2 Average	Region 3 Average	Region 4 Average	Region 5 Average	Region 6 Average	Total
2030	52,484,922,397.84	21,926,202,064.69	41,227,121,317.07	4,521,957,101.70	6,873,689,875.09	971,774,980.82	128,005,667,737.20
2040	52,370,112,923.58	21,878,239,038.04	41,136,938,005.23	4,512,065,431.98	6,858,653,847.89	969,649,247.00	127,725,658,493.72
2050	53,954,470,203.94	22,540,123,180.85	42,381,457,132.30	4,648,569,314.01	7,066,149,259.88	998,984,124.44	131,589,753,215.41
2060	53,833,859,843.97	22,489,736,765.04	42,286,717,201.00	4,638,177,855.88	7,050,353,519.46	996,750,985.38	131,295,596,170.72
2070	55,322,123,090.25	23,111,476,479.47	43,455,754,071.07	4,766,402,539.24	7,245,263,972.60	1,024,306,651.30	134,925,326,803.93
2080	54,700,375,321.09	22,851,733,936.33	42,967,368,654.15	4,712,834,455.08	7,163,836,752.16	1,012,794,794.20	133,408,943,913.02
2090	54,569,820,681.78	22,797,193,179.27	42,864,817,450.73	4,701,586,225.08	7,146,738,658.82	1,010,377,533.66	133,090,533,729.34
2100	55,129,485,221.29	23,030,999,713.05	43,304,436,236.71	4,749,805,388.29	7,220,035,146.70	1,020,739,900.07	134,455,501,606.12
2110	56,044,551,445.49	23,413,279,537.76	44,023,224,500.36	4,828,644,986.83	7,339,876,829.85	1,037,682,641.37	136,687,259,941.67
2120	57,394,399,680.67	23,977,194,731.10	45,083,535,812.81	4,944,944,212.10	7,516,659,755.75	1,062,675,509.48	139,979,409,701.90
2130	57,156,741,900.77	23,877,910,360.16	44,896,854,654.18	4,924,468,268.98	7,485,534,895.49	1,058,275,200.32	139,399,785,279.90
2140	57,480,064,608.33	24,012,982,275.94	45,150,825,964.04	4,952,324,867.54	7,527,878,866.29	1,064,261,622.78	140,188,338,204.92
2150	56,251,728,463.90	23,499,830,207.20	44,185,962,896.11	4,846,494,791.05	7,367,009,776.02	1,041,518,589.56	137,192,544,723.84

10% GDP ST						
Year	Region 1 Average	Region 2 Average	Region 3 Average	Region 4 Average	Region 5 Average	Region 6 Average	Total
2023	52,806,812,181.56	22,060,675,359.45	41,479,967,059.40	4,549,690,243.46	6,915,846,182.96	977,734,872.24	128,790,725,899.07
2024	52,840,582,975.49	22,074,783,511.24	41,506,494,156.22	4,552,599,842.53	6,920,268,976.28	978,360,149.19	128,873,089,610.96
2025	52,607,905,072.78	21,977,579,543.36	41,323,724,711.50	4,532,552,951.99	6,889,796,305.83	974,052,044.04	128,305,610,629.50
2026	52,709,352,633.08	22,019,960,471.15	41,403,412,185.25	4,541,293,395.81	6,903,082,389.45	975,930,377.79	128,553,031,452.54

10% GDP for comparison in both long- and short-term.

Appendix 9: 5 percentile and 95 percentiles of the historical property damage

Average property damage - 95% Percentile Ᵽ

	low	median	high
Region 1	1699405	16868364	363665297
Region 2	1690528	17181550	953769548
Region 3	1618582	16778225	531807174
Region 4	1566775	16501257	586737467
Region 5	1566776	16506560	490713571
Region 6	1533462	16181774	421738435

Average property damage - 5% Percentile Ᵽ

	low	median	high
Region 1	19493	2187993	21462514
Region 2	10324	2212023	21937994
Region 3	8005	2187057	21295643
Region 4	5121	2187693	21660494
Region 5	4715	2176928	21433290
Region 6	4641	2173086	21170816

Appendix 10: Projected economic capital for the program

Economic Capital in Ᵽ million

Year	With	Without	Difference
2022	1575.07	1764.24	189.17
2023	2523.96	2831.49	307.52
2024	1271.10	1424.93	153.83
2025	1689.42	1857.11	167.69
2026	143.78	158.28	14.51
2030	385.84	448.75	62.91
2040	625.65	724.81	99.16
2050	1088.20	1226.74	138.54
2060	1746.03	2041.79	295.77
2070	2806.78	3309.75	502.97
2080	4371.20	5126.93	755.74
2090	5919.60	7400.54	1480.94
2100	7590.93	9981.88	2390.95
2110	9480.43	12881.30	3400.87
2120	11184.64	15895.43	4710.79
2130	13121.82	19222.00	6100.18
2140	15841.67	23058.82	7217.15
2150	18200.70	27029.91	8829.20

The critical values leading to indifference in costs between with and without program, under different SSP assumptions.

Incentives Ᵽ	SSP	Temporary relocation %	Replacing house goods	Labor & materials
9185	SSP1-2.6	0.8	0.4	0
14450	SSP5-Basline	1	0.75	0.5

The comparison of costs at the highest incentive. When the incentive exceeds 14400, the policy cost in 2030 will exceed the no-policy cost under SSP5-Baseline. For the other SSP cases, the future policy costs will be greater than the no-policy costs when the incentive is 14400.

Property damage -short term

Incentives: 14400

Year	Without	With	Difference
2022	2,454,425,452	2,350,642,129	103,783,323
2023	3,858,142,827	3,687,574,316	170,568,510
2024	1,916,553,535	1,830,662,191	85,891,345
2025	2,564,944,318	2,501,029,368	63,914,950
2026	225,160,250	219,151,869	6,008,381

Property damage -long term

Incentives: 14400

Year	Without	With	Difference
2030	720,049,531	720,046,471	3,061
2040	875,047,066	871,269,361	3,777,705
2050	1,097,413,082	1,092,702,889	4,710,192
2060	1,407,478,869	1,370,503,132	36,975,737
2070	1,849,033,535	1,776,639,253	72,394,283
2080	2,453,283,793	2,343,865,313	109,418,480
2090	3,195,594,651	2,905,971,313	289,623,338
2100	4,032,460,893	3,508,265,749	524,195,144
2110	4,975,718,584	4,195,303,714	780,414,870
2120	5,956,463,758	4,828,289,125	1,128,174,633
2130	7,042,328,887	5,548,430,506	1,493,898,382
2140	8,297,615,983	6,537,469,888	1,760,146,095
2150	9,598,025,051	7,416,426,743	2,181,598,308

The comparison of costs at the lowest incentive. When the incentive exceeds 9185, the policy cost in 2150 will exceed the no-policy cost under SSP1-2.6. For the same incentive, the policy cost in other SSP cases will be much lower than the no-policy cost.

Property damage -short term

Incentives: 9185

Year	Without	With	Difference
2022	1,635,126,506	1,556,039,947	79,086,558
2023	2,570,085,408	2,440,941,863	129,143,545
2024	1,276,570,925	1,211,762,221	64,808,704
2025	1,708,866,908	1,655,778,007	53,088,901
2026	149,993,273	145,083,602	4,909,670

Property damage -long term

Incentives: 9185

Year	Without	With	Difference
2030	1,361,675,679	1,351,519,499	10,156,180
2040	1,461,767,927	1,450,801,798	10,966,129
2050	1,516,557,950	1,505,211,415	11,346,535
2060	1,530,602,018	1,519,186,341	11,415,677
2070	1,516,494,096	1,505,148,696	11,345,400
2080	1,471,768,190	1,460,703,493	11,064,698
2090	1,402,570,140	1,392,100,329	10,469,811
2100	1,333,898,680	1,323,880,082	10,018,597
2110	1,274,411,140	1,274,393,332	17,808
2120	1,209,287,724	1,209,263,423	24,301
2130	1,148,406,595	1,148,334,810	71,785
2140	1,148,406,595	1,148,334,810	71,785
2150	1,148,406,595	1,148,334,810	71,785