**Carbon dioxide atmospheric concentration**

**and hydrometeorological disasters**

**Andrés Fortunato, Helmut Herwartz, Ramón E. López, Eugenio Figueroa B.**

**Online Appendix**

**Appendix A Cointegration analysis Robustness tests**

This appendix provides some alternative results for the cointegration exercise in section 5.1.

**A.1 Significance tests for equation (9)** using **non-standard critical ratios**

Equation (9) in the main text allows for error correcting mechanisms:

 (9)

Where stands for the GPOD and for l*og(CO2).* Noting under the null hypothesis of no cointegration testing the significance of requires non-standard critical values, we check if sampled estimates of are less than zero for a significant fraction of the 1000 performed regressions. Moreover, we evaluate how often single equation *t*-ratios for are below a non-standard 5% critical value of -3.3. Confirming the strong evidence against the hypothesis of `no cointegration', 15.6% of the *t*-ratios of are smaller than a 5% critical value of -3.3.

**A.2 Cointegration analysis using global temperature and World GDP per capita**

Following López et al. (2020), in analogy to Table 4 in the main text, Tables A1 and A2 below show cointegration parameter estimates using alternative Climate Change related variables, namely *log(Global temperature)* and *log(World GDP pc)* instead of *log(CO2)*, respectively, as potential (weekly exogenous) determinants () of the GPOD () in equations (7), (8) and (9) (see Section 5.1 in the main text).

Both trending variables (*log*) world GDP per capita and global temperature exhibit a long-term relation with the GPOD ( is positive and significant for both sets of regressions). For both variables, *log(global temp)* and *log(World GDP pc)*, however, positivity of parameter estimates for in regression (9) implies that these variables adjust to deviations of (the GPOD) from the long-term equilibrium. Hence, these variables cannot be regarded as weakly exogenous, and are prone to obtain biased GPOD projections if used as conditional information.

**Table A1** Estimated parameters for cointegration analysis using global temperature

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Mean | SD | Q2.5% | Q50% | Q97.5% |
| Regression (7) |  |  |  |  |  |
|  | -10.814 | 1.817 | -7.582 | -10.664 | -14.749 |
|  | 4.129 | 0.693 | 5.639 | 4.072 | 2.896 |
|   | 0.768 | 0.030 | 0.819 | 0.771 | 0.700 |
| Regression (8) |  |  |  |  |  |
|  | -1.502 | 0.879 | 0.013 | -1.449 | -3.378 |
|  | -0.172 | 0.067 | -0.050 | -0.167 | -0.304 |
|  | 0.578 | 0.335 | 1.292 | 0.557 | 0.001 |
| Regression (9) |  |  |  |  |  |
|  | 1.259 | 0.164 | 1.583 | 1.251 | 0.944 |
|  | 0.092 | 0.020 | 0.139 | 0.090 | 0.060 |
|  | -0.478 | 0.062 | -0.358 | -0.476 | -0.601 |

Note: SD indicates standard deviations. Q2.5%, Q50% and Q97.5% stand for posterior MCMC quantiles. We regard a parameter as significant if the zero is not included in the Q2.5% - Q97.5% interval.

**Table A2** Estimated parameters for cointegration analysis using World GDP per capita

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Mean | SD | Q2.5% | Q50% | Q97.5% |
| Regression (7) |  |  |  |  |  |
|  | -3.355 | 0.563 | -2.322 | -3.314 | -4.579 |
|  | 0.398 | 0.066 | 0.544 | 0.393 | 0.276 |
|   | 0.858 | 0.027 | 0.905 | 0.860 | 0.794 |
| Regression (8) |  |  |  |  |  |
|  | -1.117 | 0.387 | -0.434 | -1.088 | -1.980 |
|  | -0.351 | 0.095 | -0.179 | -0.352 | -0.541 |
|  | 0.133 | 0.046 | 0.236 | 0.130 | 0.053 |
| Regression (9) |  |  |  |  |  |
|  | 0.365 | 0.113 | 0.594 | 0.359 | 0.156 |
|  | 0.089 | 0.036 | 0.167 | 0.085 | 0.025 |
|  | -0.041 | 0.013 | -0.016 | -0.040 | -0.068 |

Note: See Table A1.

**Appendix B Diagnostics of the predictive properties of *log(CO2)* for the GPOD**

In this section we implement a series of out-of-sample forecast exercises to inspect the potential of *log(CO2)* as a predictor for the GPOD. The specification used for all pseudo predictive analysis is based on the static regression model (7) and stated in equation (10) in the main text.

**Fig. B1** CUSUM statistics for the parameters in equation (10)



The static regression model would be unsuitable for a conditional predictive analysis if it suffers from structural instability. Therefore, we first investigate parameter stability by means of CUSUM statistics. Figure B1 displays the outcomes from the set of 1000 CUSUM profiles joint with the corresponding critical values. As a result, we cannot reject the null hypothesis of parameter stability with 5% significance.

**Fig. B2** Forecast exercises results (left: leave one out; right: recursive analysis starting in 2000)

Since the parameters in equation (10) are stable, we can use it for predicting GPOD trends conditional on information about *log(CO2),* i.e., . We perform two exercises to assess the accuracy of such predictions in a pseudo out-of-sample context. On the one hand, we adopt so-called `leave one out’ regressions for parameter estimation and subsequent prediction of the left-out observation conditional on the left-out information about . On the other hand, we perform sequential one-step ahead predictions in a recursive manner starting with initial samples covering the period from 1970 until 1999. For both exercises, we consider a forecasted probability curve as a good fit, if the mean of the original probabilities is covered by the 90% confidence interval of the forecasted one. Respective results are displayed in Figure B2. As can be seen in both panels of Figure B2, our criteria for acceptable forecasts are met throughout.

**Appendix C Results for a more stringent codification of hydrometeorological disasters**

The EM-DAT criterion for coding a natural event as a disaster is that it fulfills at least one of the following conditions: 10 or more people dead, 100 or more people affected, declaration of state of emergency or a call for international assistance was given. Thomas et al. (2013) have suggested more demanding conditions, i.e., 100 or more people dead or 1000 or more people affected (see also Thomas et al., 2014 and Lopez el al. 2015), since such a more exigent criterion is less likely to suffer from underreporting bias. In this appendix we redo the analysis described in Sections 4 and 5.1 adopting this more stringent classification. Tables C1, C2, C3 and C4 show statistics and results for this second category of disasters, which are analogous to the results and statistics in Tables 1, 2, 3 and 4 in the main text, respectively. As it can be seen, all results are qualitatively similar to those reported in the main text in terms of order of magnitude and effect directions

**Table C1** Summary statistics of hydrometeorological disasters (more demanding coding)

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Statistic | Complete sample | Decade |
| 1970 | 1980 | 1990 | 2000 | 2010 |
| *Dependent Variable* |   |   |   |   |   |   |
| Hydrometeorological disasters (more demanding coding) | Total number of | 3185 | 178 | 353 | 624 | 1204 | 826 |
| Mean per year/country | 0.424 | 0.158 | 0.252 | 0.361 | 0.624 | 0.621 |
| Standard deviation | 1.068 | 0.486 | 0.714 | 0.846 | 1.375 | 1.359 |

Note: Data source is EM-DAT

**Table C2** Included explanatory variables in the model with minimal DIC

|  |  |  |
| --- | --- | --- |
| Parameter  | Linear Covariates | Random Effects |
|  |   | trend |   | year  |
|  trend2 |
| *Δlog(CO2)* |  decade |
|  | Temperature deviation |
| Precipitation deviation |  | country  |
| GDP per capita growth | isosubregion |
| Population density growth |   |
|  |   | trend |   | decade |
|  *Δlog(CO2)* |
|   | Precipitation deviation |   | isoregion |
|  isosubregion |

Note: Parameters and symbols refer to the model in (2) and (3) in section 4 of the main text.

**Table C3** Estimated marginal effects over second category of disaster probabilities and distribution parameters

|  |  |  |  |
| --- | --- | --- | --- |
|   |  |  |  |
| Variable | MEAN | SD | Q2.5% | Q50% | Q97.5% | MEAN | SD | MEAN | SD |
| *Country level* |   |   |   |   |   |   |   |   |   |
| temperature deviation | 0.000 | 0.004 | -0.008 | 0.000 | 0.008 | 0.000 | 0.015 | - | - |
| precipitation deviation | 0.043 | 0.003 | 0.036 | 0.043 | 0.049 | 0.124 | 0.015 | -0.040 | 0.013 |
| GDP p.c. growth | 0.004 | 0.004 | -0.004 | 0.003 | 0.011 | 0.013 | 0.013 | - | - |
| population density growth | 0.004 | 0.007 | -0.010 | 0.004 | 0.018 | 0.014 | 0.024 | - | - |
| *Global* |   |   |   |   |   |   |   |   |   |
| trend | 0.113 | 0.031 | 0.046 | 0.113 | 0.172 | 0.304 | 0.117 | -0.135 | 0.031 |
| trend2 | -0.031 | 0.030 | -0.090 | -0.031 | 0.030 | -0.108 | 0.105 | - | - |
| *Δlog(CO2)* | 0.008 | 0.005 | 0.000 | 0.008 | 0.016 | 0.005 | 0.016 | -0.033 | 0.012 |

Note: See note in Table A1.

**Table C4** Estimated parameters for cointegration analysis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Mean | SD | Q2.5% | Q50% | Q97.5% |
| Regression (7) |  |  |  |  |  |
|  | -5.106 | 1.728 | -2.466 | -4.866 | -9.531 |
|  | 0.887 | 0.299 | 1.649 | 0.846 | 0.431 |
|   | 0.893 | 0.031 | 0.945 | 0.896 | 0.824 |
| Regression (8) |  |  |  |  |  |
|  | -1.773 | 0.857 | -0.487 | -1.654 | -3.782 |
|  | -0.365 | 0.137 | -0.123 | -0.356 | -0.648 |
|  | 0.309 | 0.149 | 0.659 | 0.288 | 0.086 |
| Regression (9) |  |  |  |  |  |
|  | -0.049 | 0.029 | 0.014 | -0.050 | -0.104 |
|  | 0.003 | 0.007 | 0.019 | 0.003 | -0.008 |
|  | 0.009 | 0.005 | 0.019 | 0.009 | -0.002 |

Note: See Table A1.

**Appendix D Results displayed in Figure 1 and Figure 3**

This Appendix documents estimates and projections of disaster probabilities by country as displayed in Figure 1 and Figure 3 in the main text.

**Table D1 (part 1 of 5).**  Probability of at least on disaster to happen estimated for years 1990 and 2010 and projected to 2040 for the four top tier SSPs

|  |  |  |  |
| --- | --- | --- | --- |
| Country | 1990 | 2010 | 2040 |
| SSP1\_26 | SSP2\_45 | SSP3\_70 | SSP5\_85 |
| Afghanistan |   | 0.992 | 1 | 1 | 1 | 1 |
| Albania | 0.118 | 0.562 | 0.578 | 0.625 | 0.673 | 0.691 |
| Algeria | 0.503 | 0.79 | 0.876 | 0.918 | 0.951 | 0.96 |
| Andorra | 0.302 | 0.773 | 0.777 | 0.817 | 0.854 | 0.867 |
| Angola | 0.01 | 0.049 | 0.297 | 0.344 | 0.392 | 0.409 |
| Antigua and Barbuda | 0.254 | 0.593 | 0.635 | 0.681 | 0.727 | 0.744 |
| Argentina | 0.71 | 0.857 | 0.939 | 0.955 | 0.968 | 0.972 |
| Armenia |  | 0.033 | 0.27 | 0.318 | 0.365 | 0.383 |
| Australia | 0.442 | 0.731 | 0.793 | 0.827 | 0.858 | 0.868 |
| Austria | 0.061 | 0.145 | 0.397 | 0.444 | 0.492 | 0.509 |
| Azerbaijan |  | 0.329 | 0.517 | 0.564 | 0.612 | 0.629 |
| Bahamas | 0.024 | 0.067 | 0.352 | 0.399 | 0.447 | 0.464 |
| Bahrain | 0.168 | 0.334 | 0.546 | 0.593 | 0.64 | 0.657 |
| Bangladesh | 0.562 | 0.618 | 0.788 | 0.824 | 0.857 | 0.868 |
| Barbados |  | 0.523 | 0.532 | 0.579 | 0.626 | 0.643 |
| Belarus |  | 0.174 | 0.376 | 0.424 | 0.471 | 0.489 |
| Belgium |  | 0.056 | 0.272 | 0.319 | 0.367 | 0.384 |
| Belize | 0.159 | 0.231 | 0.455 | 0.502 | 0.55 | 0.567 |
| Benin | 0.205 | 0.509 | 0.616 | 0.663 | 0.711 | 0.729 |
| Bermuda | 0.011 | 0.037 | 0.351 | 0.398 | 0.446 | 0.463 |
| Bhutan | 0.682 | 0.871 | 0.936 | 0.954 | 0.968 | 0.972 |
| Bolivarian Republic of Venezuela | 0.166 | 0.312 | 0.487 | 0.534 | 0.582 | 0.599 |
| Bosnia and Herzegovina |  | 0.378 | 0.496 | 0.543 | 0.59 | 0.607 |
| Botswana | 0.447 | 0.809 | 0.859 | 0.889 | 0.915 | 0.923 |
| Brazil | 0.228 | 0.397 | 0.603 | 0.65 | 0.695 | 0.712 |
| Brunei Darussalam | 0.026 | 0.943 | 0.728 | 0.773 | 0.815 | 0.83 |
| Bulgaria | 0.225 | 0.654 | 0.726 | 0.77 | 0.811 | 0.826 |
| Burkina Faso | 0.021 | 0.116 | 0.367 | 0.415 | 0.462 | 0.48 |
| Cambodia |  | 0.412 | 0.735 | 0.782 | 0.829 | 0.845 |
| Cameroon | 0.116 | 0.512 | 0.563 | 0.61 | 0.658 | 0.675 |
| Canada | 0.446 | 0.713 | 0.82 | 0.866 | 0.908 | 0.921 |
| Cape Verde | 0.016 | 0.083 | 0.331 | 0.378 | 0.426 | 0.444 |
| Central African Republic | 0.127 | 0.474 | 0.554 | 0.602 | 0.65 | 0.667 |
| Chad | 0.126 | 0.515 | 0.578 | 0.626 | 0.674 | 0.691 |
| Chile | 0.411 | 0.63 | 0.786 | 0.833 | 0.878 | 0.893 |
| China | 0.864 | 1 | 0.999 | 1 | 1 | 1 |
| Colombia | 0.804 | 0.985 | 1 | 1 | 1 | 1 |
| Comoros | 0.042 | 0.067 | 0.349 | 0.397 | 0.444 | 0.462 |
| Congo | 0.09 | 0.32 | 0.47 | 0.518 | 0.566 | 0.583 |

**Table D1 (part 2 of 5)**

|  |  |  |  |
| --- | --- | --- | --- |
| Country | 1990 | 2010 | 2040 |
| SSP1\_26 | SSP2\_45 | SSP3\_70 | SSP5\_85 |
| Costa Rica | 0.377 | 0.772 | 0.71 | 0.757 | 0.804 | 0.822 |
| Cote d'Ivoire | 0.038 | 0.481 | 0.499 | 0.546 | 0.594 | 0.612 |
| Croatia |  | 0.506 | 0.592 | 0.639 | 0.687 | 0.705 |
| Cuba | 0.301 | 0.577 | 0.69 | 0.737 | 0.785 | 0.802 |
| Cyprus | 0.006 | 0.034 | 0.315 | 0.362 | 0.41 | 0.427 |
| Czech Republic |  | 0.517 | 0.627 | 0.674 | 0.722 | 0.739 |
| Denmark | 0.011 | 0.027 | 0.329 | 0.376 | 0.424 | 0.442 |
| Djibouti |  | 0.192 | 0.376 | 0.424 | 0.471 | 0.489 |
| Dominica | 0.008 | 0.047 | 0.315 | 0.362 | 0.41 | 0.427 |
| Dominican Republic | 0.306 | 0.705 | 0.704 | 0.752 | 0.799 | 0.817 |
| Ecuador | 0.401 | 0.707 | 0.844 | 0.889 | 0.928 | 0.94 |
| Egypt | 0.281 | 0.489 | 0.647 | 0.692 | 0.736 | 0.752 |
| El Salvador | 0.25 | 0.665 | 0.603 | 0.651 | 0.699 | 0.716 |
| Equatorial Guinea | 0.009 | 0.052 | 0.307 | 0.355 | 0.403 | 0.42 |
| Eritrea |  | 0.162 | 0.369 | 0.416 | 0.464 | 0.482 |
| Estonia |  | 0.04 | 0.264 | 0.311 | 0.359 | 0.377 |
| Ethiopia | 0.352 | 0.875 | 0.93 | 0.962 | 0.982 | 0.987 |
| Federated States of Micronesia |  | 0.028 | 0.292 | 0.339 | 0.387 | 0.405 |
| Fiji | 0.105 | 0.331 | 0.509 | 0.557 | 0.604 | 0.622 |
| Finland | 0.017 | 0.051 | 0.342 | 0.39 | 0.437 | 0.455 |
| France | 0.523 | 0.828 | 0.923 | 0.956 | 0.978 | 0.983 |
| Gabon | 0.033 | 0.118 | 0.365 | 0.413 | 0.46 | 0.478 |
| Gambia | 0.037 | 0.423 | 0.473 | 0.521 | 0.569 | 0.586 |
| Georgia | 0.063 | 0.445 | 0.531 | 0.579 | 0.627 | 0.644 |
| Germany | 0.217 | 0.466 | 0.595 | 0.643 | 0.69 | 0.708 |
| Ghana | 0.07 | 0.584 | 0.581 | 0.628 | 0.676 | 0.694 |
| Greece | 0.174 | 0.629 | 0.67 | 0.717 | 0.765 | 0.782 |
| Greenland | 0.016 | 0.039 | 0.337 | 0.384 | 0.432 | 0.45 |
| Grenada | 0.018 | 0.051 | 0.314 | 0.361 | 0.409 | 0.427 |
| Guam |  | 0.019 | 0.259 | 0.307 | 0.355 | 0.372 |
| Guatemala | 0.454 | 0.825 | 0.763 | 0.81 | 0.856 | 0.873 |
| Guinea | 0.077 | 0.286 | 0.569 | 0.617 | 0.665 | 0.682 |
| Guinea-Bissau | 0.01 | 0.163 | 0.396 | 0.444 | 0.492 | 0.509 |
| Guyana | 0.138 | 0.236 | 0.455 | 0.503 | 0.55 | 0.568 |
| Haiti |  | 0.904 | 0.99 | 0.997 | 0.999 | 0.999 |
| Honduras | 0.533 | 0.743 | 0.774 | 0.821 | 0.867 | 0.883 |
| Hong Kong | 0.165 | 0.487 | 0.689 | 0.736 | 0.784 | 0.801 |
| Hungary |  | 0.622 | 0.677 | 0.724 | 0.771 | 0.789 |
| Iceland | 0.073 | 0.122 | 0.408 | 0.455 | 0.503 | 0.521 |
| India | 0.986 | 1 | 1 | 1 | 1 | 1 |

**Table D1 (part 3 of 5)**

|  |  |  |  |
| --- | --- | --- | --- |
| country\_name | 1990 | 2010 | 2040 |
| SSP1\_26 | SSP2\_45 | SSP3\_70 | SSP5\_85 |
| Indonesia | 0.889 | 1 | 1 | 1 | 1 | 1 |
| Iraq | 0.044 | 0.324 | 0.465 | 0.513 | 0.56 | 0.578 |
| Ireland | 0.075 | 0.112 | 0.405 | 0.452 | 0.5 | 0.518 |
| Islamic Republic of Iran | 0.661 | 0.899 | 0.983 | 0.994 | 0.998 | 0.999 |
| Isle of Man | 0.289 | 0.636 | 0.803 | 0.849 | 0.892 | 0.907 |
| Israel | 0.052 | 0.125 | 0.394 | 0.442 | 0.489 | 0.507 |
| Italy | 0.499 | 0.874 | 0.894 | 0.933 | 0.963 | 0.971 |
| Jamaica | 0.086 | 0.412 | 0.473 | 0.52 | 0.568 | 0.586 |
| Japan | 0.637 | 0.87 | 0.91 | 0.946 | 0.971 | 0.978 |
| Jordan | 0.043 | 0.109 | 0.368 | 0.416 | 0.464 | 0.481 |
| Kazakhstan |  | 0.404 | 0.595 | 0.643 | 0.691 | 0.708 |
| Kenya | 0.323 | 0.884 | 0.795 | 0.842 | 0.886 | 0.901 |
| Kiribati | 0.022 | 0.085 | 0.353 | 0.4 | 0.448 | 0.466 |
| Kuwait |  | 0.064 | 0.295 | 0.342 | 0.39 | 0.408 |
| Kyrgyzstan | 0.168 | 0.414 | 0.577 | 0.624 | 0.672 | 0.689 |
| Lao People's Democratic Republic | 0.349 | 0.477 | 0.695 | 0.743 | 0.79 | 0.808 |
| Latvia |  | 0.04 | 0.263 | 0.31 | 0.358 | 0.376 |
| Lebanon | 0.012 | 0.058 | 0.304 | 0.352 | 0.399 | 0.417 |
| Lesotho | 0.062 | 0.17 | 0.417 | 0.465 | 0.512 | 0.53 |
| Liberia | 0.017 | 0.24 | 0.429 | 0.476 | 0.524 | 0.541 |
| Libyan Arab Jamahiriya |  | 0.076 | 0.283 | 0.331 | 0.378 | 0.396 |
| Lithuania |  | 0.115 | 0.32 | 0.368 | 0.415 | 0.433 |
| Luxembourg |  | 0.058 | 0.274 | 0.322 | 0.369 | 0.387 |
| Macao | 0.007 | 0.056 | 0.308 | 0.356 | 0.404 | 0.421 |
| Madagascar | 0.018 | 0.212 | 0.444 | 0.491 | 0.539 | 0.557 |
| Malawi | 0.129 | 0.706 | 0.724 | 0.771 | 0.818 | 0.835 |
| Malaysia | 0.254 | 0.879 | 0.835 | 0.88 | 0.92 | 0.933 |
| Maldives |  | 0.139 | 0.335 | 0.382 | 0.43 | 0.448 |
| Mali | 0.09 | 0.663 | 0.623 | 0.67 | 0.718 | 0.736 |
| Malta | 0.017 | 0.046 | 0.334 | 0.382 | 0.43 | 0.447 |
| Marshall Islands |  | 0.088 | 0.314 | 0.361 | 0.409 | 0.427 |
| Mauritania | 0.128 | 0.501 | 0.569 | 0.616 | 0.664 | 0.682 |
| Mauritius | 0.005 | 0.065 | 0.336 | 0.384 | 0.431 | 0.449 |
| Mexico | 0.699 | 0.918 | 0.985 | 0.995 | 0.998 | 0.999 |
| Mongolia | 0.1 | 0.187 | 0.419 | 0.466 | 0.514 | 0.532 |
| Montenegro |  | 0.324 | 0.418 | 0.465 | 0.513 | 0.531 |
| Morocco | 0.322 | 0.6 | 0.7 | 0.747 | 0.795 | 0.812 |
| Mozambique | 0.12 | 0.654 | 0.751 | 0.798 | 0.845 | 0.861 |
| Myanmar | 0.544 | 0.825 | 0.867 | 0.898 | 0.925 | 0.933 |
| Namibia | 0.08 | 0.44 | 0.547 | 0.594 | 0.642 | 0.66 |

**Table D1 (part 4 of 5)**

|  |  |  |  |
| --- | --- | --- | --- |
| country\_name | 1990 | 2010 | 2040 |
| SSP1\_26 | SSP2\_45 | SSP3\_70 | SSP5\_85 |
| Nepal | 0.734 | 0.887 | 0.985 | 0.994 | 0.998 | 0.999 |
| Netherlands | 0.054 | 0.122 | 0.385 | 0.432 | 0.48 | 0.498 |
| New Zealand | 0.453 | 0.713 | 0.849 | 0.893 | 0.932 | 0.943 |
| Nicaragua | 0.343 | 0.608 | 0.635 | 0.682 | 0.73 | 0.748 |
| Niger | 0.137 | 0.654 | 0.644 | 0.691 | 0.739 | 0.756 |
| Nigeria | 0.138 | 0.913 | 0.742 | 0.789 | 0.836 | 0.853 |
| Northern Mariana Islands |  | 0.022 | 0.253 | 0.301 | 0.348 | 0.366 |
| Norway | 0.045 | 0.1 | 0.375 | 0.423 | 0.47 | 0.488 |
| Oman | 0.01 | 0.035 | 0.334 | 0.381 | 0.429 | 0.446 |
| Pakistan | 0.803 | 0.97 | 0.999 | 1 | 1 | 1 |
| Palau |  | 0.005 | 0.267 | 0.315 | 0.363 | 0.38 |
| Panama | 0.451 | 0.927 | 0.781 | 0.828 | 0.873 | 0.889 |
| Papua New Guinea | 0.405 | 0.583 | 0.702 | 0.75 | 0.797 | 0.815 |
| Paraguay | 0.29 | 0.453 | 0.633 | 0.68 | 0.728 | 0.746 |
| Peru | 0.697 | 0.871 | 0.994 | 0.998 | 1 | 1 |
| Philippines | 0.838 | 0.987 | 1 | 1 | 1 | 1 |
| Plurinational State of Bolivia | 0.548 | 0.71 | 0.867 | 0.897 | 0.923 | 0.931 |
| Poland |  | 0.435 | 0.556 | 0.604 | 0.651 | 0.669 |
| Portugal | 0.155 | 0.446 | 0.538 | 0.586 | 0.633 | 0.651 |
| Puerto Rico | 0.121 | 0.362 | 0.474 | 0.522 | 0.569 | 0.587 |
| Qatar |  | 0.047 | 0.262 | 0.309 | 0.357 | 0.374 |
| Republic of Korea | 0.571 | 0.753 | 0.81 | 0.856 | 0.899 | 0.913 |
| Republic of Moldova |  | 0.326 | 0.483 | 0.53 | 0.578 | 0.596 |
| Romania |  | 0.911 | 0.98 | 0.993 | 0.998 | 0.998 |
| Russian Federation | 0.635 | 0.945 | 1 | 1 | 1 | 1 |
| Saint Kitts and Nevis | 0.165 | 0.494 | 0.539 | 0.586 | 0.634 | 0.651 |
| Saint Lucia | 0.029 | 0.088 | 0.328 | 0.375 | 0.423 | 0.441 |
| Saint Vincent and The Grenadines | 0.054 | 0.199 | 0.388 | 0.436 | 0.483 | 0.501 |
| Samoa | 0.008 | 0.182 | 0.385 | 0.433 | 0.48 | 0.498 |
| San Marino |  | 0.329 | 0.453 | 0.5 | 0.548 | 0.565 |
| Sao Tome and Principe |  | 0.046 | 0.277 | 0.324 | 0.372 | 0.39 |
| Saudi Arabia | 0.01 | 0.029 | 0.33 | 0.377 | 0.425 | 0.443 |
| Senegal | 0.062 | 0.928 | 0.692 | 0.739 | 0.785 | 0.801 |
| Serbia |  | 0.464 | 0.585 | 0.631 | 0.677 | 0.694 |
| Seychelles | 0.045 | 0.497 | 0.593 | 0.64 | 0.687 | 0.704 |
| Sierra Leone | 0.014 | 0.007 | 0.36 | 0.407 | 0.455 | 0.473 |
| Singapore | 0.148 | 0.46 | 0.619 | 0.665 | 0.711 | 0.728 |
| Slovakia |  | 0.063 | 0.276 | 0.323 | 0.371 | 0.389 |
| Slovenia |  | 0.814 | 0.887 | 0.914 | 0.937 | 0.944 |
| Solomon Islands |   | 0.025 | 0.263 | 0.311 | 0.359 | 0.376 |

**Table D1 (part 5 of 5)**

|  |  |  |  |
| --- | --- | --- | --- |
| country\_name | 1990 | 2010 | 2040 |
| SSP1\_26 | SSP2\_45 | SSP3\_70 | SSP5\_85 |
| South Africa | 0.061 | 0.194 | 0.427 | 0.474 | 0.522 | 0.54 |
| Spain | 0.105 | 0.352 | 0.492 | 0.54 | 0.587 | 0.605 |
| Sri Lanka | 0.657 | 0.946 | 0.965 | 0.985 | 0.994 | 0.996 |
| Sudan | 0.442 | 0.705 | 0.821 | 0.857 | 0.888 | 0.898 |
| Suriname | 0.741 | 0.876 | 0.921 | 0.943 | 0.96 | 0.965 |
| Swaziland | 0.016 | 0.049 | 0.34 | 0.387 | 0.435 | 0.453 |
| Sweden | 0.018 | 0.049 | 0.341 | 0.388 | 0.436 | 0.453 |
| Switzerland | 0.176 | 0.346 | 0.537 | 0.583 | 0.629 | 0.645 |
| Tajikistan | 0.163 | 0.354 | 0.536 | 0.583 | 0.629 | 0.645 |
| Thailand | 0.718 | 0.897 | 0.958 | 0.97 | 0.979 | 0.982 |
| The Democratic Republic of the Congo | 0.161 | 0.726 | 0.682 | 0.729 | 0.777 | 0.794 |
| The Former Yugoslav Republic of Macedonia |  | 0.378 | 0.509 | 0.556 | 0.603 | 0.621 |
| Timor-Leste |  | 0.286 | 0.476 | 0.524 | 0.571 | 0.589 |
| Togo | 0.117 | 0.821 | 0.719 | 0.765 | 0.809 | 0.825 |
| Tonga | 0.046 | 0.136 | 0.358 | 0.406 | 0.453 | 0.471 |
| Trinidad and Tobago | 0.044 | 0.119 | 0.367 | 0.414 | 0.462 | 0.479 |
| Tunisia | 0.057 | 0.099 | 0.376 | 0.423 | 0.471 | 0.488 |
| Turkey | 0.039 | 0.158 | 0.397 | 0.444 | 0.492 | 0.51 |
| Turkmenistan | 0.755 | 0.909 | 0.977 | 0.984 | 0.989 | 0.991 |
| Tuvalu |  | 0.009 | 0.268 | 0.315 | 0.363 | 0.381 |
| U.S. Virgin Islands |  | 0.992 | 0.995 | 0.997 | 0.998 | 0.999 |
| Uganda | 0.041 | 0.162 | 0.383 | 0.43 | 0.478 | 0.495 |
| Ukraine | 0.204 | 0.767 | 0.813 | 0.85 | 0.884 | 0.895 |
| United Arab Emirates | 0.025 | 0.067 | 0.339 | 0.386 | 0.434 | 0.452 |
| United Kingdom | 0.052 | 0.086 | 0.378 | 0.426 | 0.474 | 0.491 |
| United Republic of Tanzania | 0.031 | 0.119 | 0.353 | 0.401 | 0.448 | 0.466 |
| United States | 0.417 | 0.628 | 0.756 | 0.795 | 0.831 | 0.843 |
| Uruguay | 0.496 | 0.651 | 0.791 | 0.831 | 0.867 | 0.88 |
| Uzbekistan | 0.084 | 0.206 | 0.422 | 0.469 | 0.517 | 0.534 |
| Vanuatu | 0.044 | 0.129 | 0.368 | 0.416 | 0.463 | 0.481 |
| Viet Nam | 0.302 | 0.455 | 0.664 | 0.709 | 0.751 | 0.767 |
| Yemen |  | 0.103 | 0.326 | 0.374 | 0.421 | 0.439 |
| Zambia | 0.39 | 0.947 | 0.883 | 0.915 | 0.941 | 0.949 |
| Zimbabwe | 0.257 | 0.756 | 0.752 | 0.795 | 0.834 | 0.848 |