**Supplementary appendix**

**Road Traffic Death Rate and Human Development Index in 2007-2016 at the Global Level: Trend Analysis**

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**Supplementary tables**

**Table S1. comparing the performance of LGMM model with HDI and LGMM model with IHDI as time-invariant covariate (111 countries).**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model | AIC | BIC | CFI | RMSEA |
| Linear conditional LGMM with HDI as time-invariant covariate | 1681.155 | 1708.250 | 0.985 | 0.015 |
| Linear conditional LGMM with IHDI as time-invariant covariate | 1863.0 | 1890.096 | 0.968 | 0.020 |

**Table S2. The correlations between HDI components.**

|  |  |  |  |
| --- | --- | --- | --- |
| Pearson Correlations | | | |
|  | Mean life expectancy | Mean education | Mean income |
| Mean life expectancy | 1 | 0.819\*\* | 0.842\*\* |
| Mean education | 0.819\*\* | 1 | 0.854\*\* |
| Mean income | 0.842\*\* | 0.854\*\* | 1 |
| \*\* Correlation is significant at the 0.01 level (2-tailed) | | | |

**Table S3. The parameter estimations of linear conditional LGM (HDI as time-varying covariate).**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Estimate | S.E. | P-Value |
| HDI 2007 on road traffic death rate 2007 | -33.376 | 2.995 | 0.000 |
| HDI 2010 on road traffic death rate 2010 | -40.167 | 2.486 | 0.000 |
| HDI 2013 on road traffic death rate 2013 | -42.349 | 2.367 | 0.000 |
| HDI 2016 on road traffic death rate 2016 | -45.461 | 2.665 | 0.000 |

**Table S4. The parameter estimations of linear conditional LGM (education as time-varying covariate).**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Estimate | S.E. | P-Value |
| Education 2007 on road traffic death rate 2007 | -28.313 | 2.809 | 0.000 |
| Education 2010 on road traffic death rate 2010 | -33.673 | 2.488 | 0.000 |
| Education 2013 on road traffic death rate 2013 | -34.272 | 2.432 | 0.000 |
| Education 2016 on road traffic death rate 2016 | -36.012 | 2.704 | 0.000 |

**Table S5. The parameter estimations of linear conditional LGM (income as time-varying covariate).**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Estimate | S.E. | P-Value |
| Income 2007 on road traffic death rate 2007 | -23.480 | 3.355 | 0.000 |
| Income 2010 on road traffic death rate 2010 | -30.845 | 2.990 | 0.000 |
| Income 2013 on road traffic death rate 2013 | -33.803 | 2.796 | 0.000 |
| Income 2016 on road traffic death rate 2016 | -37.282 | 2.857 | 0.000 |

**Table S6. The parameter estimations of linear conditional LGM (life expectancy as time-varying covariate).**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Estimate | S.E. | P-Value |
| Life expectancy 2007 on road traffic death rate 2007 | -38.961 | 4.144 | 0.000 |
| Life expectancy 2010 on road traffic death rate 2010 | -47.395 | 3.322 | 0.000 |
| Life expectancy 2013 on road traffic death rate 2013 | -51.326 | 3.198 | 0.000 |
| Life expectancy 2016 on road traffic death rate 2016 | -56.235 | 3.811 | 0.000 |

**Table S7. Descriptive statistics of RTDR and HDI components of total 131 countries between 2007 and 2016 based on human development categories.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | very high development | high development | Medium development | low development |
|  | Mean | | | |
| RTDR 2007 | 12.110 | 17.206 | 21.542 | 30.342 |
| RTDR 2010 | 9.020 | 17.517 | 18.833 | 21.420 |
| RTDR 2013 | 7.928 | 16.757 | 19.013 | 26.409 |
| RTDR 2016 | 7.554 | 15.691 | 18.704 | 26.361 |
| HDI 2007 | 0.859 | 0.732 | 0.607 | 0.435 |
| HDI 2010 | 0.868 | 0.747 | 0.628 | 0.459 |
| HDI 2013 | 0.880 | 0.763 | 0.647 | 0.481 |
| HDI 2016 | 0.889 | 0.774 | 0.663 | 0.496 |
| Education index 2007 | 0.803 | 0.667 | 0.540 | 0.358 |
| Education index 2010 | 0.820 | 0.686 | 0.563 | 0.384 |
| Education index 2013 | 0.840 | 0.707 | 0.582 | 0.409 |
| Education index 2016 | 0.852 | 0.722 | 0.597 | 0.422 |
| Income index 2007 | 0.885 | 0.725 | 0.595 | 0.430 |
| Income index 2010 | 0.882 | 0.736 | 0.610 | 0.442 |
| Income index 2013 | 0.885 | 0.750 | 0.626 | 0.450 |
| Income index 2016 | 0.893 | 0.756 | 0.641 | 0.462 |
| Life expectancy index 2007 | 0.897 | 0.819 | 0.711 | 0.555 |
| Life expectancy index 2010 | 0.908 | 0.831 | 0.734 | 0.588 |
| Life expectancy index 2013 | 0.918 | 0.843 | 0.755 | 0.618 |
| Life expectancy index 2016 | 0.927 | 0.853 | 0.770 | 0.642 |

**Table S8. The parameter estimations of linear unconditional LGM (human development grouping).**

|  |  |  |
| --- | --- | --- |
| Model | Intercept | Slope |
| very high development | 10.199\* | -1.118\* |
| high development | 18.144\* | -0.758\* |
| Medium development | 19.889\* | -0.425 |
| low development | 26.873\* | -0.100 |

\*Significant at 0.05 level

**Table S9. The parameter estimations of linear conditional LGM (HDI as a time-invariant covariate with human development grouping).**

|  |  |  |
| --- | --- | --- |
| Model | HDI on intercept | HDI on slope |
| very high development | -110.002\* | 8.757 |
| high development | -39.112 | -11.865 |
| Medium development | 22.100 | -19.930\* |
| low development | -36.456 \* | -4.933 |

\*Significant at 0.05 level, HDI Human development index

**Table S10. The parameter estimations of linear conditional LGM (life expectancy as a time-invariant covariate with human development grouping).**

|  |  |  |
| --- | --- | --- |
| Model | Life expectancy on intercept | Life expectancy on slope |
| very high development | -84.880\* | 3.157 |
| high development | -40.894 | 12.379\* |
| Medium development | -29.791\* | -2.724 |
| low development | -17.748 | -7.706\* |

\*Significant at 0.05 level

**Table S11. The parameter estimations of linear conditional LGM (Education as a time-invariant covariate with human development grouping).**

|  |  |  |
| --- | --- | --- |
| Model | Education on intercept | Education on slope |
| very high development | -59.688\* | 5.273 |
| high development | -25.902 | -4.035 |
| Medium development | 11.845 | -6.645 |
| low development | -18.069\* | 7.403 |

\*Significant at 0.05 level

**Table S12. The parameter estimations of linear conditional LGM (Income as a time-invariant covariate with human development grouping).**

|  |  |  |
| --- | --- | --- |
| Model | Income on intercept | Income on slope |
| very high development | -10.917 | 1.882 |
| high development | 14.642 | -4.735 |
| Medium development | 37.501\* | -12.118\* |
| low development | -16.093 | -8.342\* |

\*Significant at 0.05 level

**Table S13. CART pruning rules (mean of HDI as time-invariant covariates).**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Terminal node | Rule | Predicted class | Number of countries at each class | | Mean of mortality rate | Misclassified countries |
| 0 | 1 |
| 1 | If (M. HDI >= 0.6628) | 0 | 81 | 2 | 13.38 | Saudi Arabia, Thailand |
| 2 | If (0.5121 =< M. HDI < 0.5653) | 0 | 9 | 1 | 19.64 | Kenya |
| 3 | If (0.6071 =< M. HDI < 0.6628) | 0 | 6 | 2 | 19.90 | Vietnam, El Salva |
| 4 | If (0. 5653 =< M. HDI < 0.6071) | 1 | 1 | 3 | 21.80 | Honduras |
| 5 | If (M. HDI < 0.4016) | 0 | 3 | 2 | 28.29 | Burkina, Central |
| 6 | If (0.4976 =< M. HDI < 0.5121) | 0 | 2 | 2 | 27.22 | Cameroon, Madagascar |
| 7 | If (0.4586 =< M. HDI < 0.482) | 0 | 3 | 2 | 25.98 | Togo, Lesotho |
| 8 | If (0.4016 =< M. HDI < 0.4586) | 1 | 1 | 6 | 28.97 | Ethiopia |
| 9 | If (0.482 =< M. HDI < 0.4976) | 1 | 0 | 5 | 27.89 | - |

M. HDI = mean of Human Development Index

**Table S14. CART pruning rules (slope of HDI as time-invariant covariates).**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Terminal node | Rule | Predicted class | Number of countries at each class | | Mean of mortality rate | Misclassified countries |
| 0 | 1 |
| 1 | If (S.HDI < 0.0185) | 0 | 87 | 9 | 15.11 | Tanzania, Vietnam, Guinea-B, Thailand, Central Africa, Liberia, Gambia, Madagascar, El Salvador |
| 2 | If (0.0235 =< S. HDI < 0.0285) | 0 | 10 | 5 | 21.74 | Congo, India, Namibia, Malawi, Burkina Faso |
| 3 | If (0.0195=< S.HDI < 0.0215) | 0 | 5 | 2 | 23.81 | Mozambique, Togo |
| 4 | If (0.0185 =< S. HDI < 0.0195) | 1 | 2 | 3 | 24.75 | Bosnia and Herzegovina, Senegal |
| 5 | If (0.0215 =< S. HDI < 0.0235) | 1 | 2 | 4 | 26.03 | Niger, Albania |
| 6 | If (0.0285=< S.HDI) | 1 | 0 | 2 | 26.36 | - |

S. HDI = slope of Human Development Index

**Table S15. CART pruning rules (mean of education, income and life expectancy as time-invariant covariates).**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Terminal node | Rule | Predicted class | Number of countries at each class | | Mean of mortality rate | Misclassified countries |
| 0 | 1 |
| 1 | If (M. life expectancy >= 0.633) & (M. income >= 0.4928) & (M. education >= 0.6254) | 0 | 76 | 1 | 12.63 | Saudi Arabia |
| 2 | If (M. life expectancy >= 0.633) & (M. income >= 0.4928) & (M. education < 0.4914) | 0 | 13 | 0 | 19.14 | - |
| 3 | If (M. life expectancy >= 0.633) & (M. income >=0.6506) & (0.4914 =< M. education < 0.6254) | 0 | 7 | 1 | 21.74 | Thailand |
| 4 | If (M. life expectancy >= 0.633) & (0.4928 <= M. income < 0.6506) & (0.4914 =<M.education< 0.6254) | 1 | 1 | 3 | 21.70 | Ghana |
| 5 | If (M. life expectancy < 0.633) & (M. income < 0.4928) | 0 | 3 | 3 | 24.69 | Afghanistan, Ethiopia, Nepal |
| 6 | If (M. life expectancy < 0.633) & (M. education < 0.2923) | 0 | 3 | 1 | 28.31 | Burkina Faso |
| 7 | If (M. life expectancy < 0.633) & (M. education >= 0.2923) & (M. income >= 0.5823) | 0 | 3 | 1 | 27.70 | Namibia |
| 8 | If (M. life expectancy < 0.633) & (M. education >= 0.2923) & (M. income < 0.5823) | 1 | 0 | 15 | 28.12 | - |

M. life expectancy = mean of life expectancy, M. education = mean of education, M. income = mean of income

**Table S16. CART pruning rules (slope of education, income and life expectancy as time-invariant covariates).**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Terminal node | Rule | Predicted class | Number of countries at each class | | Mean of mortality rate | Misclassified countries |
| 0 | 1 |
| 1 | If (.0025=<S. life expectancy <0.0135) | 0 | 70 | 4 | 14.72 | El Salvador, Rwanda, Togo, Democratic Republic of the Congo |
| 2 | If (S. life expectancy < 0.0025) & (S. education < 0.0165) | 0 | 7 | 0 | 14.60 | - |
| 3 | If (S. life expectancy < 0.0025) & (S. education >= 0.0165) | 1 | 2 | 4 | 21.37 | Austria, Mexico |
| 4 | If (.023=<S. life expectancy <0.0305) | 0 | 6 | 0 | 18.54 | - |
| 5 | If (0.0135=<S. life expectancy < 0.023) & (S.income >= 0.012) | 0 | 11 | 2 | 17.79 | India, Congo |
| 6 | If (0.0135=<S. life expectancy < 0.0175) & (S. income < 0.012) | 0 | 6 | 3 | 20.49 | Liberia, Guinea-Bissau, Burkina Faso |
| 7 | If (0.0175=<S. life expectancy <.012) & (income < 0.012) | 1 | 1 | 4 | 25.54 | Guatemala |
| 8 | If (S. life expectancy >= 0.0305) | 1 | 3 | 8 | 27.40 | Kazakhstan, Botswana,  South Africa |

S. life expectancy = slope of life expectancy, S. education = slope of education, S. income = slope of income