**Supplementary file 3A.** For each trip type and country, the model was reported that estimated the highest proportion of trips with estimated trip counts within ± 10% of the observed trips. In situations where the proportion of trips of estimated by two models differed by less than 0.5%, both models were included. The distance kernel used is indicated by exp (exponential) or pwr (power). See **Supplementary File 3B-C** for the trip proportions for all models.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Namibia** | **Kenya** | **Burkina Faso** | **Zambia** |
|   | Most accurate model | % trips | Most accurate model | % trips | Most accurate model | % trips  | Most accurate model | % trips  |
| **Rural - Rural** | Regional-expRegional-Urbanicity-exp | 4.44.1 | Radiation | 6.4 | Regional-Urbanicity-exp  | 16.3 | Urbanicity - exp | 26.9 |
| **Rural - Urban** | Basic-pwr | 8.1 | RadiationUrbanicity-pwr | 5.25.2 | Regional-Urbanicity-pwrUrbanicity-pwrRegional-pwr | 11.411.411.4 | Basic – exp | 13.1 |
| **Urban - Rural** | Regional-Urbanicity-exp | 8.1 | Urbanicity-pwrRegional-urbanicity-pwr | 4.44.3 | Regional-Urbanicity-pwrUrbanicity-pwr | 13.613.6 | Basic – exp | 13.1 |
| **Urban - Urban** | Regional-Urbanicity-pwr | 20.0 | Radiation | 4.1 | -- | -- | Regional-pwr | 16.7 |
| **Intra-regional** | Regional-Urbanicity-pwrRegional-Urbanicity-exp |  6.96.7 | RadiationRegional-urbanicity-exp | 4.94.7 | Regional-pwr | 9.2 | Regional-pwr | 4.2 |
| **Inter-regional** | Regional-expRegional-Urbanicity-exp | 4.74.3 | RadiationUrbanicity-pwr | 4.44.3 | Regional-Urbanicity-exp | 16.8 | Urbanicity - exp | 27.9 |
| **Intra:R-R** | Regional-Urbanicity-exp | 5.6 | Radiation  | 6.9 | Regional-pwr | 9.2 | Regional-exp | 3.9 |
| **Intra:R-U** | Regional-Urbanicity-pwr | 29.6 | Regional-Urbanicity-exp | 4.0 | -- | -- | Regional-pwr | 11.1 |
| **Intra:U-R** | Regional-Urbanicity-pwr | 33.3 | Regional-Urbanicity-expRegional-pwr | 3.33.3 | -- | -- | Regional-pwr | 11.1 |
| **Intra:U-U** | Regional-Urbanicity-pwr | 100 | Regional-Urbanicity-exp | 7.6 | **--** |  -- | -- | -- |
| **Inter:R-R** | Regional-expRegional-Urbanicity-expRegional-Model -pwr | 4.44.04.0 | Regional-Urbanicity-pwr | 5.8 | Regional-Urbanicity-exp | 17.2 | Urbanicity - exp | 29.4 |
| **Inter:R-U** | Basic-pwr | 8.6 | Radiation | 4.9 | Urbanicity-exp | 13.6 | Basic – exp | 13.6 |
| **Inter:U-R** | Regional-Urbanicity-pwrBasic-pwrRegional-expRegional-Urbanicity-exp | 6.86.86.86.4 | Urbanicity-pwrRegional-Urbanicity-pwrRadiation | 4.14.03.9 | Regional-Urbanicity-pwrUrbanicity-pwr | 13.613.6 | Basic – exp | 13.6 |
| **Inter:U-U** | Regional-exp | 17.9 | Urbanicity-pwrRadiation | 4.94.4 | -- | -- | Regional-pwr | 16.7 |

**Supplementary file 3B.** For each trip type in each country, the percentage of estimated trips that fell within ± 10% of the observed trip counts. (Power distance kernel used in gravity models)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Basic  | Urbanicity  | Regional  | Regional-Urbanicity  | Radiation |
| Burkina Faso |  |  |  |  |  |
| Rural - Rural | 0.79 | 1.59 | 1.48 | 2.17 | 2.11 |
| Rural - Urban | 9.09 | 11.36 | 11.36 | 11.36 | 2.27 |
| Urban - Rural | 4.55 | 13.64 | 9.09 | 13.64 | 4.55 |
| Urban - Urban | NaN | NaN | NaN | NaN | NaN |
| Intra-regional | 1.54 | 2.31 | 9.23 | 8.46 | 6.92 |
| Inter-regional | 1.03 | 2.05 | 1.35 | 2.22 | 1.84 |
| Intra:R-R | 1.54 | 2.31 | 9.23 | 8.46 | 6.92 |
| Inter:R-R | 0.74 | 1.53 | 0.91 | 1.7 | 1.76 |
| Intra:R-U | NaN | NaN | NaN | NaN | NaN |
| Inter:R-U | 9.09 | 11.36 | 11.36 | 11.36 | 2.27 |
| Intra:U-R | NaN | NaN | NaN | NaN | NaN |
| Inter:U-R | 4.55 | 13.64 | 9.09 | 13.64 | 4.55 |
| Intra:U-U | NaN | NaN | NaN | NaN | NaN |
| Inter:U-U | NaN | NaN | NaN | NaN | NaN |
| Kenya |  |  |  |  |  |
| Rural - Rural | 2.53 | 4.14 | 2.99 | 4.25 | 6.44 |
| Rural - Urban | 1.54 | 5.21 | 3.08 | 4.1 | 5.21 |
| Urban - Rural | 1.45 | 4.36 | 2.22 | 4.27 | 2.56 |
| Urban - Urban | 3.1 | 3.24 | 3.04 | 3.04 | 4.12 |
| Intra-regional | 3.51 | 3.51 | 3.51 | 3.24 | 4.86 |
| Inter-regional | 1.95 | 4.3 | 2.71 | 3.95 | 4.35 |
| Intra:R-R | 2.3 | 3.45 | 1.72 | 2.87 | 6.9 |
| Inter:R-R | 2.58 | 4.64 | 2.41 | 5.84 | 3.95 |
| Intra:R-U | 1.97 | 1.97 | 2.63 | 1.32 | 2.63 |
| Inter:R-U | 1.61 | 3.51 | 3.31 | 4.12 | 4.92 |
| Intra:U-R | 2.63 | 1.97 | 3.29 | 1.32 | 2.63 |
| Inter:U-R | 1.61 | 4.12 | 2.61 | 4.02 | 3.92 |
| Intra:U-U | 5.73 | 5.34 | 5.34 | 5.73 | 6.11 |
| Inter:U-U | 2.18 | 4.86 | 2.47 | 2.98 | 4.43 |
| Namibia |  |  |  |  |  |
| Rural - Rural | 2.57 | 2.89 | 3.91 | 3.59 | 3.87 |
| Rural - Urban | 8.14 | 6.06 | 5.11 | 6.63 | 4.55 |
| Urban - Rural | 6.44 | 5.49 | 4.92 | 8.14 | 2.84 |
| Urban - Urban | 6.67 | 6.67 | 0 | 20 | 3.33 |
| Intra-regional | 3.44 | 5.39 | 3.74 | 6.89 | 3.89 |
| Inter-regional | 3.13 | 3.07 | 4.05 | 3.88 | 3.84 |
| Intra:R-R | 3.76 | 4.9 | 3.1 | 4.41 | 3.76 |
| Inter:R-R | 2.47 | 2.71 | 3.98 | 3.52 | 3.88 |
| Intra:R-U | 0 | 11.11 | 11.11 | 29.63 | 7.41 |
| Inter:R-U | 8.58 | 5.79 | 4.79 | 5.39 | 4.39 |
| Intra:U-R | 0 | 11.11 | 11.11 | 33.33 | 3.7 |
| Inter:U-R | 6.79 | 5.19 | 4.59 | 6.79 | 2.79 |
| Intra:U-U | 0 | 0 | 0 | 100 | 0 |
| Inter:U-U | 7.14 | 7.14 | 0 | 14.29 | 3.57 |
| Zambia |  |  |  |  |  |
| Rural - Rural | 0.71 | 0.91 | 1.01 | 1.63 | 5.15 |
| Rural - Urban | 1.98 | 1.98 | 2.72 | 3.71 | 3.71 |
| Urban - Rural | 1.98 | 1.98 | 2.72 | 3.47 | 2.23 |
| Urban - Urban | 0 | 0 | 16.67 | 0 | 8.33 |
| Intra-regional | 2.29 | 3.44 | 2.86 | 2.86 | 2.77 |
| Inter-regional | 0.65 | 0.73 | 0.97 | 1.66 | 5.23 |
| Intra:R-R | 2.05 | 3.28 | 2.25 | 2.66 | 2.46 |
| Inter:R-R | 0.57 | 0.66 | 0.88 | 1.52 | 5.44 |
| Intra:R-U | 5.56 | 5.56 | 11.11 | 5.56 | 5.56 |
| Inter:R-U | 1.63 | 1.63 | 1.9 | 3.53 | 3.53 |
| Intra:U-R | 5.56 | 5.56 | 11.11 | 5.56 | 8.33 |
| Inter:U-R | 1.63 | 1.63 | 1.9 | 3.26 | 1.63 |
| Intra:U-U | NaN | NaN | NaN | NaN | NaN |
| Inter:U-U | 0 | 0 | 16.67 | 0 | 8.33 |

**Supplementary File 3C.**  For each trip type in each country, the percentage of estimated trips that fell within ± 10% of the observed trip counts. (Exponential distance kernel used in gravity models).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Basic  | Urbanicity  | Regional  | Regional-Urbanicity  | Radiation |
| Burkina Faso |  |  |  |  |  |
| Rural - Rural | 4.28 | 15.43 | 3.44 | 16.28 | 2.11 |
| Rural - Urban | 6.82 | 13.64 | 4.55 | 9.09 | 2.27 |
| Urban - Rural | 4.55 | 11.36 | 2.27 | 6.82 | 4.55 |
| Urban - Urban | NaN | NaN | NaN | NaN | NaN |
| Intra-regional | 3.08 | 4.62 | 6.15 | 3.85 | 6.92 |
| Inter-regional | 4.43 | 16.05 | 3.24 | 16.76 | 1.84 |
| Intra:R-R | 3.08 | 4.62 | 6.15 | 3.85 | 6.92 |
| Inter:R-R | 4.37 | 16.23 | 3.23 | 17.2 | 1.76 |
| Intra:R-U | NaN | NaN | NaN | NaN | NaN |
| Inter:R-U | 6.82 | 13.64 | 4.55 | 9.09 | 2.27 |
| Intra:U-R | NaN | NaN | NaN | NaN | NaN |
| Inter:U-R | 4.55 | 11.36 | 2.27 | 6.82 | 4.55 |
| Intra:U-U | NaN | NaN | NaN | NaN | NaN |
| Inter:U-U | NaN | NaN | NaN | NaN | NaN |
| Kenya |  |  |  |  |  |
| Rural - Rural | 1.84 | 2.3 | 2.76 | 2.64 | 6.44 |
| Rural - Urban | 2.31 | 1.54 | 2.99 | 1.54 | 5.21 |
| Urban - Rural | 2.65 | 1.62 | 3.16 | 2.39 | 2.56 |
| Urban - Urban | 2.5 | 3.51 | 2.7 | 3.31 | 4.12 |
| Intra-regional | 1.62 | 2.84 | 3.51 | 4.73 | 4.86 |
| Inter-regional | 2.51 | 2.23 | 2.78 | 2.1 | 4.35 |
| Intra:R-R | 0.57 | 4.02 | 2.3 | 2.3 | 6.9 |
| Inter:R-R | 2.75 | 2.41 | 2.58 | 2.75 | 3.95 |
| Intra:R-U | 1.97 | 1.97 | 2.63 | 3.95 | 2.63 |
| Inter:R-U | 2.31 | 1.61 | 3.41 | 1.61 | 4.92 |
| Intra:U-R | 1.32 | 1.32 | 1.97 | 3.29 | 2.63 |
| Inter:U-R | 2.51 | 1.71 | 3.51 | 2.31 | 3.92 |
| Intra:U-U | 2.29 | 3.44 | 5.73 | 7.63 | 6.11 |
| Inter:U-U | 2.54 | 2.98 | 1.89 | 2.03 | 4.43 |
| Namibia |  |  |  |  |  |
| Rural - Rural | 3.4 | 3.37 | 4.38 | 4.13 | 3.87 |
| Rural - Urban | 5.11 | 4.17 | 7.01 | 6.63 | 4.55 |
| Urban - Rural | 4.55 | 2.84 | 6.82 | 7.01 | 2.84 |
| Urban - Urban | 0 | 10 | 16.67 | 10 | 3.33 |
| Intra-regional | 2.84 | 3.29 | 4.64 | 6.59 | 3.89 |
| Inter-regional | 3.62 | 3.42 | 4.73 | 4.3 | 3.84 |
| Intra:R-R | 2.94 | 2.94 | 4.41 | 5.56 | 3.76 |
| Inter:R-R | 3.44 | 3.41 | 4.37 | 4 | 3.88 |
| Intra:R-U | 0 | 7.41 | 7.41 | 18.52 | 7.41 |
| Inter:R-U | 5.39 | 3.99 | 6.99 | 5.99 | 4.39 |
| Intra:U-R | 3.7 | 7.41 | 7.41 | 18.52 | 3.7 |
| Inter:U-R | 4.59 | 2.59 | 6.79 | 6.39 | 2.79 |
| Intra:U-U | 0 | 0 | 0 | 0 | 0 |
| Inter:U-U | 0 | 10.71 | 17.86 | 10.71 | 3.57 |
| Zambia |  |  |  |  |  |
| Rural - Rural | 25.33 | 26.89 | 16.91 | 18.93 | 5.15 |
| Rural - Urban | 13.12 | 9.9 | 9.16 | 7.92 | 3.71 |
| Urban - Rural | 13.12 | 9.9 | 9.16 | 7.92 | 2.23 |
| Urban - Urban | 0 | 0 | 0 | 0 | 8.33 |
| Intra-regional | 3.63 | 3.63 | 4.2 | 3.24 | 2.77 |
| Inter-regional | 26.6 | 27.94 | 17.61 | 19.67 | 5.23 |
| Intra:R-R | 3.28 | 3.28 | 3.89 | 2.87 | 2.46 |
| Inter:R-R | 27.69 | 29.42 | 18.3 | 20.65 | 5.44 |
| Intra:R-U | 8.33 | 8.33 | 8.33 | 8.33 | 5.56 |
| Inter:R-U | 13.59 | 10.05 | 9.24 | 7.88 | 3.53 |
| Intra:U-R | 8.33 | 8.33 | 8.33 | 8.33 | 8.33 |
| Inter:U-R | 13.59 | 10.05 | 9.24 | 7.88 | 1.63 |
| Intra:U-U | NaN | NaN | NaN | NaN | NaN |
| Inter:U-U | 0 | 0 | 0 | 0 | 8.33 |