Epidemiology and Infection

Community Movement and COVID-19: A global study using Google's Community Mobility Reports

M. SULYOK, M. WALKER

Supplementary Material

**S1: Results of Kendall’s τ correlations, time lag (days) resulting in strongest correlation for individual countries and results of clustering.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | country | Continent | Retail and recreation | Grocery and pharmacy | Parks | Transit stations | Workplaces | Residential | Retail and recreation | | Grocery and pharmacy | Parks | Transit stations | Workplaces | Residential | Cluster | |
|  |  |  | Lag in days | | | | | | | Tau value at maximal correlation | | | | | | |  |
| 1 | Afghanistan | AS | 1 | 4 | -28 | 1 | 1 | -28 | -0.553 | | -0.514 | -0.697 | -0.573 | -0.513 | 0.630 | 1 | |
| 2 | Angola | AF | 14 | 15 | 9 | 2 | 11 | 11 | -0.158 | | -0.129 | -0.141 | -0.177 | -0.165 | 0.148 | 2 | |
| 3 | Antigua and Barbuda | NorthAm | 11 | 10 | 11 | 10 | 21 | 24 | -0.250 | | -0.273 | -0.282 | -0.238 | -0.253 | 0.343 | 2 | |
| 4 | Argentina | SA | 28 | 28 | -26 | 28 | 28 | 26 | 0.343 | | 0.360 | -0.547 | 0.392 | 0.459 | -0.450 | 1 | |
| 5 | Australia | OC | 15 | 15 | 14 | 16 | 17 | 17 | -0.684 | | -0.560 | -0.575 | -0.706 | -0.694 | 0.676 | 2 | |
| 6 | Austria | EU | 3 | 3 | -1 | 3 | 5 | 5 | -0.730 | | -0.583 | -0.538 | -0.765 | -0.691 | 0.696 | 2 | |
| 7 | Bahrain | AS | -28 | -28 | -28 | -28 | -28 | -28 | -0.431 | | -0.399 | -0.393 | -0.412 | -0.456 | 0.659 | 3 | |
| 8 | Bangladesh | AS | -28 | -27 | -28 | -28 | -22 | -28 | -0.417 | | -0.409 | -0.623 | -0.404 | -0.384 | 0.439 | 3 | |
| 9 | Barbados | NorthAm | 15 | 16 | 12 | 15 | 12 | 11 | -0.467 | | -0.463 | -0.452 | -0.478 | -0.468 | 0.478 | 2 | |
| 10 | Belarus | EU | -26 | -26 | 25 | -24 | -22 | -23 | -0.717 | | -0.557 | 0.405 | -0.749 | -0.690 | 0.556 | 1 | |
| 11 | Belgium | EU | -6 | 1 | -6 | -2 | -3 | -2 | -0.750 | | -0.605 | -0.384 | -0.773 | -0.671 | 0.725 | 2 | |
| 12 | Belize | NorthAm | 13 | -24 | 13 | 13 | -26 | 15 | -0.376 | | 0.397 | -0.357 | -0.391 | 0.343 | 0.345 | 1 | |
| 13 | Benin | AF | -26 | -22 | 23 | -25 | -25 | -27 | -0.171 | | -0.183 | -0.207 | -0.216 | -0.145 | 0.201 | 1 | |
| 14 | Bolivia | SA | -27 | -27 | -27 | -27 | 28 | 28 | -0.373 | | -0.397 | -0.372 | -0.401 | 0.471 | -0.399 | 1 | |
| 15 | Bosnia and Herzegovina | EU | -4 | -3 | 28 | -3 | -1 | -8 | -0.468 | | -0.375 | 0.369 | -0.496 | -0.490 | 0.487 | 1 | |
| 16 | Botswana | AF | 4 | 5 | -3 | 5 | 8 | 4 | -0.146 | | -0.099 | 0.104 | -0.169 | -0.155 | 0.193 | 2 | |
| 17 | Brazil | SA | 28 | 28 | -25 | 28 | 28 | -28 | 0.386 | | 0.366 | -0.434 | 0.466 | 0.360 | 0.370 | 1 | |
| 18 | Bulgaria | EU | 27 | 27 | 26 | 28 | 28 | 28 | 0.547 | | 0.509 | 0.504 | 0.481 | 0.378 | -0.445 | 4 | |
| 19 | Burkina Faso | AF | 4 | 4 | 4 | 4 | 1 | 1 | -0.552 | | -0.519 | -0.490 | -0.603 | -0.447 | 0.591 | 2 | |
| 20 | Cambodia | AS | -24 | -24 | -28 | -28 | -27 | -25 | 0.504 | | 0.512 | 0.484 | 0.489 | 0.521 | -0.518 | 1 | |
| 21 | Cameroon | AF | -1 | -1 | -1 | -1 | 7 | -1 | -0.218 | | -0.215 | -0.278 | -0.212 | -0.207 | 0.244 | 2 | |
| 22 | Canada | NorthAm | -11 | -4 | -23 | -10 | -7 | -7 | -0.722 | | -0.614 | -0.475 | -0.730 | -0.631 | 0.656 | 2 | |
| 23 | Chile | SA | -6 | -4 | -6 | 2 | 0 | 0 | -0.484 | | -0.541 | -0.586 | -0.613 | -0.400 | 0.556 | 2 | |
| 24 | Colombia | SA | 28 | 28 | 28 | 28 | 28 | 28 | 0.512 | | 0.439 | 0.488 | 0.578 | 0.491 | -0.429 | 4 | |
| 25 | Costa Rica | NorthAm | 3 | 10 | 3 | 10 | 14 | 8 | -0.381 | | -0.385 | -0.423 | -0.433 | -0.407 | 0.417 | 2 | |
| 26 | Croatia | EU | 2 | 4 | 2 | 3 | 2 | 0 | -0.687 | | -0.553 | -0.504 | -0.709 | -0.659 | 0.657 | 2 | |
| 27 | Czechia | EU | 1 | 3 | 22 | -3 | 0 | -1 | -0.596 | | -0.418 | 0.250 | -0.596 | -0.571 | 0.574 | 1 | |
| 28 | Denmark | EU | 2 | -12 | -24 | 2 | 6 | -1 | -0.479 | | -0.419 | -0.264 | -0.636 | -0.509 | 0.549 | 2 | |
| 29 | Dominican Republic | NorthAm | 28 | 28 | 28 | 28 | 28 | 28 | 0.485 | | 0.443 | 0.469 | 0.463 | 0.485 | -0.429 | 4 | |
| 30 | Ecuador | SA | 28 | 28 | 28 | 28 | 28 | -7 | 0.325 | | 0.267 | 0.325 | 0.349 | 0.320 | 0.283 | 1 | |
| 31 | Egypt | AF | -21 | 28 | -28 | -21 | -20 | -21 | -0.417 | | 0.336 | -0.393 | -0.350 | -0.330 | 0.391 | 1 | |
| 32 | El Salvador | NorthAm | -28 | -28 | -28 | -28 | -23 | -28 | -0.512 | | -0.501 | -0.535 | -0.590 | -0.423 | 0.489 | 3 | |
| 33 | Estonia | EU | 1 | 3 | -24 | -1 | 6 | -1 | -0.602 | | -0.499 | -0.240 | -0.614 | -0.534 | 0.566 | 2 | |
| 34 | Fiji | OC | 6 | 7 | -28 | 6 | 11 | -28 | -0.371 | | -0.367 | 0.350 | -0.359 | -0.342 | -0.362 | 1 | |
| 35 | Finland | EU | -4 | -4 | 27 | -1 | -2 | -3 | -0.651 | | -0.471 | 0.327 | -0.662 | -0.455 | 0.569 | 1 | |
| 36 | France | EU | 2 | 4 | -2 | 3 | 0 | 0 | -0.601 | | -0.524 | -0.466 | -0.598 | -0.488 | 0.533 | 2 | |
| 37 | Gabon | AF | -24 | -28 | -10 | -19 | -28 | -28 | -0.344 | | -0.351 | -0.334 | -0.322 | -0.493 | 0.464 | 3 | |
| 38 | Georgia | AS | -7 | -6 | -7 | 4 | 4 | -6 | -0.556 | | -0.513 | -0.512 | -0.568 | -0.529 | 0.502 | 2 | |
| 39 | Germany | EU | 2 | 6 | -26 | 2 | 6 | 6 | -0.731 | | -0.411 | -0.325 | -0.756 | -0.590 | 0.664 | 2 | |
| 40 | Ghana | AF | -26 | -26 | -23 | -26 | -23 | -23 | -0.222 | | -0.213 | -0.239 | -0.231 | -0.185 | 0.270 | 3 | |
| 41 | Greece | EU | 9 | 10 | -6 | 10 | 10 | 6 | -0.548 | | -0.346 | -0.353 | -0.565 | -0.520 | 0.544 | 2 | |
| 42 | Guatemala | NorthAm | 28 | -26 | -26 | -28 | -23 | -28 | 0.320 | | -0.380 | -0.383 | -0.314 | -0.327 | 0.384 | 1 | |
| 43 | Haiti | NorthAm | -13 | -12 | -13 | -28 | -9 | 4 | -0.324 | | -0.278 | -0.352 | -0.290 | -0.258 | 0.311 | 1 | |
| 44 | Honduras | NorthAm | 28 | 28 | -18 | -18 | 28 | 27 | 0.381 | | 0.273 | -0.273 | -0.322 | 0.482 | -0.374 | 1 | |
| 45 | Hungary | EU | -5 | 2 | -17 | -2 | -2 | -9 | -0.670 | | -0.518 | -0.483 | -0.661 | -0.616 | 0.606 | 2 | |
| 46 | India | AS | -28 | 28 | -28 | 28 | 28 | 28 | -0.583 | | 0.598 | -0.652 | 0.566 | 0.444 | -0.418 | 1 | |
| 47 | Indonesia | AS | -25 | -25 | -26 | -18 | -22 | -22 | -0.492 | | -0.337 | -0.495 | -0.550 | -0.571 | 0.615 | 3 | |
| 48 | Iraq | AS | 28 | 28 | 28 | 28 | 28 | 28 | 0.362 | | 0.327 | 0.334 | 0.325 | 0.316 | -0.304 | 4 | |
| 49 | Ireland | EU | 7 | 4 | 8 | -2 | -2 | -2 | -0.778 | | -0.649 | -0.223 | -0.741 | -0.640 | 0.639 | 1 | |
| 50 | Israel | AS | 3 | 5 | -2 | -2 | -2 | -2 | -0.571 | | -0.408 | -0.531 | -0.603 | -0.523 | 0.529 | 2 | |
| 51 | Italy | EU | 7 | 3 | 2 | 3 | 5 | 5 | -0.798 | | -0.662 | -0.739 | -0.801 | -0.791 | 0.812 | 2 | |
| 52 | Jamaica | NorthAm | 0 | 4 | 4 | -3 | -2 | -2 | -0.404 | | -0.409 | -0.431 | -0.428 | -0.421 | 0.467 | 2 | |
| 53 | Japan | AS | 15 | 25 | -16 | 15 | 14 | 14 | -0.678 | | -0.372 | 0.291 | -0.688 | -0.736 | 0.680 | 1 | |
| 54 | Jordan | AS | 4 | 4 | 3 | 4 | 3 | 3 | -0.343 | | -0.275 | -0.337 | -0.369 | -0.395 | 0.367 | 2 | |
| 55 | Kazakhstan | AS | 28 | -28 | 28 | 28 | -23 | 28 | 0.358 | | -0.330 | 0.436 | 0.354 | -0.331 | -0.368 | 1 | |
| 56 | Kenya | AF | -28 | -24 | -28 | -27 | -24 | -28 | -0.403 | | -0.389 | -0.461 | -0.401 | -0.316 | 0.444 | 3 | |
| 57 | Kuwait | AS | -15 | 1 | 1 | 0 | -4 | -3 | -0.725 | | -0.739 | -0.693 | -0.682 | -0.714 | 0.720 | 2 | |
| 58 | Kyrgyzstan | AS | 28 | 28 | 28 | 28 | 28 | 28 | 0.387 | | 0.361 | 0.410 | 0.326 | 0.314 | -0.374 | 4 | |
| 59 | Laos | AS | 10 | 11 | 11 | 10 | -26 | 8 | -0.412 | | -0.420 | -0.382 | -0.404 | 0.435 | 0.413 | 1 | |
| 60 | Latvia | EU | 3 | 3 | -27 | 5 | 5 | 5 | -0.643 | | -0.509 | -0.209 | -0.635 | -0.579 | 0.568 | 2 | |
| 61 | Lebanon | AS | 4 | -22 | -28 | 7 | 5 | -24 | -0.298 | | 0.314 | 0.295 | -0.351 | -0.303 | -0.309 | 1 | |
| 62 | Libya | AF | 26 | -26 | 28 | 28 | -9 | -9 | 0.209 | | 0.303 | 0.216 | 0.236 | -0.166 | 0.145 | 1 | |
| 63 | Lithuania | EU | 0 | -3 | -28 | -3 | -2 | -2 | -0.696 | | -0.434 | -0.231 | -0.704 | -0.567 | 0.572 | 2 | |
| 64 | Luxembourg | EU | 4 | 4 | -1 | 5 | 6 | 6 | -0.739 | | -0.654 | -0.481 | -0.767 | -0.725 | 0.741 | 2 | |
| 65 | Malaysia | AS | 6 | 7 | 6 | 7 | 4 | 5 | -0.599 | | -0.593 | -0.631 | -0.656 | -0.649 | 0.664 | 2 | |
| 66 | Mali | AF | -27 | -25 | -25 | -17 | -22 | -26 | -0.486 | | -0.452 | -0.388 | -0.580 | -0.435 | 0.506 | 3 | |
| 67 | Malta | EU | 3 | 3 | 0 | 3 | 3 | 0 | -0.537 | | -0.505 | -0.473 | -0.550 | -0.524 | 0.510 | 2 | |
| 68 | Mauritius | AF | 0 | 0 | 3 | 4 | 4 | 5 | -0.484 | | -0.431 | -0.480 | -0.504 | -0.510 | 0.485 | 2 | |
| 69 | Mexico | NorthAm | -26 | -23 | -26 | -28 | -28 | -28 | -0.638 | | -0.566 | -0.686 | -0.728 | -0.535 | 0.681 | 3 | |
| 70 | Moldova | EU | 27 | 28 | 27 | 28 | 28 | 28 | 0.595 | | 0.553 | 0.594 | 0.509 | 0.442 | -0.486 | 4 | |
| 71 | Mongolia | AS | 12 | 17 | 10 | 17 | 26 | 12 | 0.285 | | 0.279 | 0.303 | 0.301 | 0.327 | -0.296 | 1 | |
| 72 | Morocco | AF | -7 | -7 | -8 | -7 | -10 | -4 | -0.553 | | -0.531 | -0.581 | -0.593 | -0.570 | 0.646 | 2 | |
| 73 | Mozambique | AF | -28 | -28 | 0 | 0 | -24 | -25 | -0.320 | | -0.173 | -0.426 | -0.299 | -0.277 | 0.309 | 1 | |
| 74 | Namibia | AF | 20 | -16 | 21 | 17 | -13 | 20 | -0.243 | | 0.323 | -0.262 | -0.232 | 0.223 | 0.223 | 1 | |
| 75 | Nepal | AS | 28 | 28 | 28 | 28 | 28 | 28 | 0.340 | | 0.365 | 0.337 | 0.356 | 0.322 | -0.329 | 4 | |
| 76 | Netherlands | EU | 0 | 3 | -27 | -3 | -3 | -2 | -0.726 | | -0.535 | -0.399 | -0.696 | -0.518 | 0.640 | 2 | |
| 77 | New Zealand | OC | 10 | 11 | 6 | 10 | 7 | 6 | -0.653 | | -0.579 | -0.623 | -0.669 | -0.659 | 0.640 | 2 | |
| 78 | Nicaragua | NorthAm | -2 | -2 | -2 | 21 | 1 | 20 | -0.237 | | -0.229 | -0.197 | -0.220 | -0.193 | 0.182 | 1 | |
| 79 | Niger | AF | -4 | -7 | -2 | 1 | -2 | -2 | -0.594 | | -0.457 | -0.571 | -0.582 | -0.493 | 0.594 | 2 | |
| 80 | Nigeria | AF | -28 | -27 | -28 | -28 | -28 | -28 | -0.473 | | -0.422 | -0.506 | -0.440 | -0.455 | 0.538 | 3 | |
| 81 | North Macedonia | EU | -7 | -4 | 28 | -6 | 4 | -6 | -0.308 | | -0.270 | 0.354 | -0.330 | -0.315 | 0.315 | 1 | |
| 82 | Norway | EU | 3 | -4 | -24 | 6 | 7 | 7 | -0.576 | | -0.313 | -0.456 | -0.685 | -0.581 | 0.626 | 2 | |
| 83 | Oman | AS | -28 | -26 | -22 | -28 | -24 | -24 | -0.407 | | -0.435 | -0.519 | -0.438 | -0.456 | 0.627 | 3 | |
| 84 | Pakistan | AS | 28 | 28 | 28 | 28 | -22 | 28 | 0.421 | | 0.386 | 0.372 | 0.401 | -0.300 | -0.356 | 1 | |
| 85 | Panama | NorthAm | -6 | -6 | -14 | 1 | -4 | -14 | -0.351 | | -0.352 | -0.352 | -0.345 | -0.248 | 0.320 | 2 | |
| 86 | Papua New Guinea | OC | 7 | -11 | 12 | 5 | 5 | 4 | -0.208 | | -0.191 | -0.216 | -0.185 | -0.198 | 0.203 | 1 | |
| 87 | Paraguay | SA | 27 | 27 | 27 | 27 | 28 | 27 | 0.374 | | 0.362 | 0.322 | 0.327 | 0.311 | -0.317 | 4 | |
| 88 | Peru | SA | -28 | -28 | 27 | 27 | 27 | 28 | -0.449 | | -0.410 | 0.473 | 0.484 | 0.523 | -0.471 | 1 | |
| 89 | Philippines | AS | -25 | 28 | -26 | 28 | 27 | -6 | -0.344 | | 0.228 | -0.404 | 0.267 | 0.274 | 0.309 | 1 | |
| 90 | Poland | EU | 27 | 27 | 28 | 28 | 28 | 28 | 0.507 | | 0.434 | 0.487 | 0.500 | 0.359 | -0.461 | 4 | |
| 91 | Portugal | EU | -5 | -4 | -5 | 1 | -1 | -1 | -0.597 | | -0.539 | -0.498 | -0.593 | -0.553 | 0.567 | 2 | |
| 92 | Qatar | AS | -28 | -28 | -28 | -28 | -28 | -27 | -0.585 | | -0.530 | -0.607 | -0.618 | -0.681 | 0.694 | 3 | |
| 93 | Romania | EU | -4 | -4 | -15 | -10 | -9 | -9 | -0.592 | | -0.576 | -0.503 | -0.612 | -0.602 | 0.599 | 2 | |
| 94 | Russia | EU | -28 | -28 | 28 | -28 | -25 | -25 | -0.662 | | -0.591 | 0.528 | -0.646 | -0.542 | 0.558 | 1 | |
| 95 | Rwanda | AF | -1 | -1 | 1 | 2 | -1 | -1 | -0.284 | | -0.277 | -0.278 | -0.262 | -0.253 | 0.287 | 2 | |
| 96 | Saudi Arabia | AS | -23 | -23 | -24 | -23 | -25 | -25 | -0.555 | | -0.549 | -0.637 | -0.623 | -0.628 | 0.662 | 3 | |
| 97 | Senegal | AF | -28 | -24 | -28 | -24 | -28 | -28 | -0.477 | | -0.486 | -0.593 | -0.527 | -0.418 | 0.542 | 3 | |
| 98 | Serbia | EU | -7 | -10 | -14 | -10 | -9 | -10 | -0.641 | | -0.511 | -0.555 | -0.651 | -0.631 | 0.588 | 2 | |
| 99 | Singapore | AS | 1 | -3 | 2 | -5 | -2 | -2 | -0.754 | | -0.497 | -0.752 | -0.748 | -0.716 | 0.711 | 2 | |
| 100 | Slovakia | EU | 3 | 3 | -21 | 1 | 6 | -1 | -0.618 | | -0.415 | -0.427 | -0.601 | -0.583 | 0.565 | 2 | |
| 101 | Slovenia | EU | 4 | 4 | 1 | 6 | 6 | 6 | -0.625 | | -0.545 | -0.446 | -0.678 | -0.683 | 0.657 | 2 | |
| 102 | South Africa | AF | -28 | -28 | -27 | -28 | -28 | -28 | -0.294 | | -0.260 | -0.460 | -0.345 | -0.361 | 0.402 | 3 | |
| 103 | Spain | EU | 2 | 2 | 2 | 3 | 6 | 6 | -0.742 | | -0.686 | -0.702 | -0.752 | -0.726 | 0.699 | 2 | |
| 104 | Sri Lanka | AS | -22 | -28 | -22 | -22 | -27 | -27 | -0.402 | | -0.396 | -0.402 | -0.401 | -0.434 | 0.439 | 3 | |
| 105 | Sweden | EU | 27 | 27 | 0 | -23 | -15 | -15 | 0.492 | | 0.329 | 0.548 | -0.378 | -0.463 | 0.476 | 1 | |
| 106 | Switzerland | EU | 9 | 4 | 23 | 6 | 6 | 6 | -0.761 | | -0.387 | 0.228 | -0.703 | -0.666 | 0.672 | 1 | |
| 107 | Tajikistan | AS | -10 | -11 | -8 | -10 | -10 | -10 | -0.721 | | -0.696 | -0.694 | -0.730 | -0.673 | 0.730 | 2 | |
| 108 | Tanzania | AF | 16 | 16 | 23 | 16 | 14 | 19 | -0.390 | | -0.395 | -0.392 | -0.398 | -0.370 | 0.406 | 2 | |
| 109 | Thailand | AS | 12 | 10 | 13 | 13 | 14 | 12 | -0.683 | | -0.591 | -0.652 | -0.717 | -0.570 | 0.682 | 2 | |
| 110 | Togo | AF | -27 | -27 | 28 | 2 | 26 | -27 | -0.348 | | -0.335 | 0.326 | -0.351 | 0.219 | 0.380 | 1 | |
| 111 | Trinidad and Tobago | NorthAm | 20 | 20 | 15 | -27 | 16 | -27 | -0.556 | | -0.514 | -0.549 | 0.533 | -0.493 | -0.513 | 1 | |
| 112 | Turkey | AS | -5 | -5 | -5 | -5 | 2 | -5 | -0.593 | | -0.290 | -0.483 | -0.620 | -0.644 | 0.621 | 2 | |
| 113 | Uganda | AF | -28 | -26 | -24 | -28 | -28 | -28 | -0.348 | | -0.345 | -0.508 | -0.405 | -0.337 | 0.388 | 3 | |
| 114 | Ukraine | EU | 27 | 28 | 28 | 28 | 28 | 28 | 0.552 | | 0.579 | 0.580 | 0.544 | 0.436 | -0.485 | 4 | |
| 115 | United Arab Emirates | AS | -28 | -26 | -28 | -28 | -28 | -27 | -0.641 | | -0.573 | -0.684 | -0.691 | -0.646 | 0.677 | 3 | |
| 116 | United Kingdom | EU | 2 | 4 | -11 | 0 | 0 | 0 | -0.759 | | -0.662 | -0.383 | -0.747 | -0.715 | 0.697 | 2 | |
| 117 | United States | NorthAm | -12 | -4 | -12 | -8 | -8 | -8 | -0.694 | | -0.577 | -0.374 | -0.690 | -0.680 | 0.695 | 2 | |
| 118 | Uruguay | SA | 1 | 4 | 1 | 1 | 6 | 1 | -0.677 | | -0.578 | -0.623 | -0.631 | -0.599 | 0.676 | 2 | |
| 119 | Venezuela | SA | 27 | 27 | 27 | 28 | 28 | 28 | 0.368 | | 0.314 | 0.338 | 0.383 | 0.318 | -0.302 | 4 | |
| 120 | Vietnam | AS | 12 | 12 | -25 | 14 | 15 | 15 | -0.549 | | -0.489 | 0.520 | -0.481 | -0.481 | 0.539 | 1 | |
| 121 | Yemen | AS | -16 | -16 | -19 | -16 | -16 | -5 | -0.376 | | -0.210 | -0.502 | -0.280 | -0.549 | 0.641 | 1 | |
| 122 | Zambia | AF | -26 | 28 | 27 | -26 | -21 | 8 | -0.283 | | 0.296 | 0.353 | -0.311 | -0.300 | 0.408 | 1 | |

**S2: Cluster level aggregated summaries and comparisons.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| cluster | 1 | 2 | 3 | 4 | p |
| n | 41 | 52 | 18 | 11 |  |
| Continent (%) |  |  |  |  | 0.006 |
| AF | 7 ( 17.1) | 9 ( 17.3) | 8 ( 44.4) | 0 ( 0.0) |  |
| AS | 12 ( 29.3) | 9 ( 17.3) | 8 ( 44.4) | 3 ( 27.3) |  |
| EU | 9 ( 22.0) | 23 ( 44.2) | 0 ( 0.0) | 4 ( 36.4) |  |
| OC | 2 ( 4.9) | 2 ( 3.8) | 0 ( 0.0) | 0 ( 0.0) |  |
| SA | 5 ( 12.2) | 2 ( 3.8) | 0 ( 0.0) | 3 ( 27.3) |  |
| NorthAm | 6 ( 14.6) | 7 ( 13.5) | 2 ( 11.1) | 1 ( 9.1) |  |
| Retail and recreation-lag (median [IQR]) | 4.00 [-24.00, 20.00] | 2.00 [-4.25, 4.00] | -28.00 [-28.00, -26.00] | 27.00 [27.00, 28.00] | <0.001 |
| Grocery and pharmacy- lag (median [IQR]) | -2.00 [-24.00, 25.00] | 3.00 [-4.00, 4.25] | -26.00 [-28.00, -25.00] | 28.00 [27.00, 28.00] | <0.001 |
| Parks- lag (median [IQR]) | 10.00 [-25.00, 27.00] | -2.00 [-12.50, 2.25] | -26.50 [-28.00, -24.00] | 28.00 [27.00, 28.00] | <0.001 |
| Transit stations- lag (median [IQR]) | 2.00 [-21.00, 17.00] | 2.00 [-2.00, 5.00] | -28.00 [-28.00, -23.25] | 28.00 [28.00, 28.00] | <0.001 |
| Workplaces- lag (median [IQR]) | 0.00 [-21.00, 16.00] | 3.50 [-2.00, 6.00] | -27.50 [-28.00, -23.25] | 28.00 [28.00, 28.00] | <0.001 |
| Residential- lag (median [IQR]) | -3.00 [-24.00, 15.00] | 0.00 [-2.00, 6.00] | -28.00 [-28.00, -26.25] | 28.00 [28.00, 28.00] | <0.001 |
| Retail and recreation-Kendall`s τ (median [IQR]) | -0.34 [-0.55, 0.21] | -0.60 [-0.70, -0.48] | -0.45 [-0.51, -0.40] | 0.49 [0.37, 0.53] | <0.001 |
| Grocery and pharmacy- Kendall`s τ (median [IQR]) | -0.23 [-0.40, 0.30] | -0.51 [-0.58, -0.41] | -0.42 [-0.50, -0.36] | 0.42 [0.36, 0.48] | <0.001 |
| Parks- Kendall`s τ (median [IQR]) | 0.22 [-0.38, 0.35] | -0.47 [-0.55, -0.37] | -0.51 [-0.60, -0.42] | 0.47 [0.34, 0.50] | <0.001 |
| Transit stations- Kendall`s τ (median [IQR]) | -0.31 [-0.40, 0.27] | -0.63 [-0.70, -0.56] | -0.44 [-0.59, -0.40] | 0.46 [0.34, 0.50] | <0.001 |
| Workplaces- Kendall`s τ (median [IQR]) | -0.30 [-0.48, 0.32] | -0.57 [-0.66, -0.48] | -0.44 [-0.52, -0.39] | 0.36 [0.32, 0.44] | <0.001 |
| Residential- Kendall`s τ (median [IQR]) | 0.31 [-0.31, 0.49] | 0.59 [0.51, 0.67] | 0.52 [0.44, 0.65] | -0.42 [-0.45, -0.32] | <0.001 |
| cluster (%) |  |  |  |  | <0.001 |
| 1 | 41 (100.0) | 0 ( 0.0) | 0 ( 0.0) | 0 ( 0.0) |  |
| 2 | 0 ( 0.0) | 52 (100.0) | 0 ( 0.0) | 0 ( 0.0) |  |
| 3 | 0 ( 0.0) | 0 ( 0.0) | 18 (100.0) | 0 ( 0.0) |  |
| 4 | 0 ( 0.0) | 0 ( 0.0) | 0 ( 0.0) | 11 (100.0) |  |

**S3: Statistical code with output- R**

**library**(readr)  
**library**(ggpubr)

## Loading required package: ggplot2

*#mobility data*  
gmr <- **read\_csv**("Downloads/Global\_Mobility\_Report(1).csv", col\_types = **cols**(date = **col\_date**(format = "%Y-%m-%d")))  
  
**library**(data.table)  
**library**(ggplot2)  
  
### Loading country data  
  
countries <- **fread**("http://download.geonames.org/export/dump/countryInfo.txt", skip = "ISO3", na.strings = "")  
**names**(countries)[**c**(1,5, 9)] <- **c**("geo", "Country.Region", "Continent")  
countries**$**lang <- **sapply**(**strsplit**(**sapply**(**strsplit**(countries**$**Languages, ","), `[`, 1), "-"), `[`, 1)  
countries**$**translated <- "Coronavirus"  
  
### Obtaining the case numbers  
  
jhu\_url <- **paste0**("https://raw.githubusercontent.com/CSSEGISandData/COVID-19/master/csse\_covid\_19\_data/",  
 "csse\_covid\_19\_time\_series/time\_series\_covid19\_confirmed\_global.csv")  
CaseData <- **fread**(jhu\_url, check.names = TRUE)  
CaseData**$**Province.State[ CaseData**$**Province.State**==**"" ] <- CaseData**$**Country.Region[ CaseData**$**Province.State**==**"" ]  
CaseData <- **melt**(CaseData, id.vars = 1**:**4, variable.name = "Date", variable.factor = FALSE)  
CaseData**$**Date <- **as.Date**( **substring**(CaseData**$**Date, 2), format = "%m.%d.%y" )  
CaseData <- CaseData[ , .(CumCaseNumber = **sum**(value)), .(Country.Region, Date)][**order**(Country.Region, Date)]  
CaseData <- CaseData[ ,.(date = Date[**-**1], CumCaseNumber = CumCaseNumber[**-**1], IncCaseNumber = **diff**(CumCaseNumber)),  
 .(Country.Region)]  
  
CaseData[Country.Region**==**"US"]**$**Country.Region <- "United States"  
CaseData <- **merge**(CaseData,countries[,**c**("Country.Region", "geo", "Continent")])  
CaseData**$**country\_region<-CaseData**$**Country.Region  
  
CaseData**$**IncCaseNumber<-**ifelse**(CaseData**$**IncCaseNumber**<**0, 0, CaseData**$**IncCaseNumber )  
*#write.csv(CaseData, "CaseNumbers1407JHUreal.csv")*  
**levels**(**factor**(gmr**$**country\_region))

## [1] "Afghanistan" "Angola" "Antigua and Barbuda"   
## [4] "Argentina" "Aruba" "Australia"   
## [7] "Austria" "Bahrain" "Bangladesh"   
## [10] "Barbados" "Belarus" "Belgium"   
## [13] "Belize" "Benin" "Bolivia"   
## [16] "Bosnia and Herzegovina" "Botswana" "Brazil"   
## [19] "Bulgaria" "Burkina Faso" "Cambodia"   
## [22] "Cameroon" "Canada" "Cape Verde"   
## [25] "Chile" "Colombia" "Costa Rica"   
## [28] "Côte d'Ivoire" "Croatia" "Czechia"   
## [31] "Denmark" "Dominican Republic" "Ecuador"   
## [34] "Egypt" "El Salvador" "Estonia"   
## [37] "Fiji" "Finland" "France"   
## [40] "Gabon" "Georgia" "Germany"   
## [43] "Ghana" "Greece" "Guatemala"   
## [46] "Guinea-Bissau" "Haiti" "Honduras"   
## [49] "Hong Kong" "Hungary" "India"   
## [52] "Indonesia" "Iraq" "Ireland"   
## [55] "Israel" "Italy" "Jamaica"   
## [58] "Japan" "Jordan" "Kazakhstan"   
## [61] "Kenya" "Kuwait" "Kyrgyzstan"   
## [64] "Laos" "Latvia" "Lebanon"   
## [67] "Libya" "Liechtenstein" "Lithuania"   
## [70] "Luxembourg" "Malaysia" "Mali"   
## [73] "Malta" "Mauritius" "Mexico"   
## [76] "Moldova" "Mongolia" "Morocco"   
## [79] "Mozambique" "Myanmar (Burma)" "Namibia"   
## [82] "Nepal" "Netherlands" "New Zealand"   
## [85] "Nicaragua" "Niger" "Nigeria"   
## [88] "North Macedonia" "Norway" "Oman"   
## [91] "Pakistan" "Panama" "Papua New Guinea"   
## [94] "Paraguay" "Peru" "Philippines"   
## [97] "Poland" "Portugal" "Puerto Rico"   
## [100] "Qatar" "Réunion" "Romania"   
## [103] "Russia" "Rwanda" "Saudi Arabia"   
## [106] "Senegal" "Serbia" "Singapore"   
## [109] "Slovakia" "Slovenia" "South Africa"   
## [112] "South Korea" "Spain" "Sri Lanka"   
## [115] "Sweden" "Switzerland" "Taiwan"   
## [118] "Tajikistan" "Tanzania" "Thailand"   
## [121] "The Bahamas" "Togo" "Trinidad and Tobago"   
## [124] "Turkey" "Uganda" "Ukraine"   
## [127] "United Arab Emirates" "United Kingdom" "United States"   
## [130] "Uruguay" "Venezuela" "Vietnam"   
## [133] "Yemen" "Zambia" "Zimbabwe"

**levels**(**factor**(CaseData**$**country\_region))

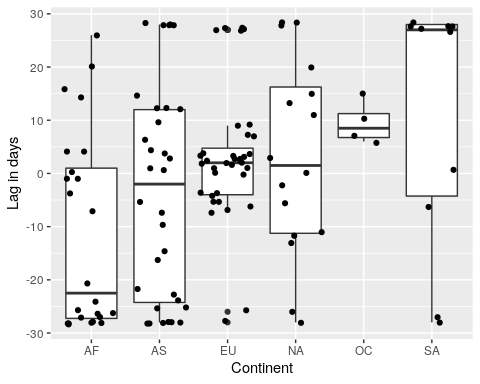
## [1] "Afghanistan" "Albania"   
## [3] "Algeria" "Andorra"   
## [5] "Angola" "Antigua and Barbuda"   
## [7] "Argentina" "Armenia"   
## [9] "Australia" "Austria"   
## [11] "Azerbaijan" "Bahamas"   
## [13] "Bahrain" "Bangladesh"   
## [15] "Barbados" "Belarus"   
## [17] "Belgium" "Belize"   
## [19] "Benin" "Bhutan"   
## [21] "Bolivia" "Bosnia and Herzegovina"   
## [23] "Botswana" "Brazil"   
## [25] "Brunei" "Bulgaria"   
## [27] "Burkina Faso" "Burundi"   
## [29] "Cabo Verde" "Cambodia"   
## [31] "Cameroon" "Canada"   
## [33] "Central African Republic" "Chad"   
## [35] "Chile" "China"   
## [37] "Colombia" "Comoros"   
## [39] "Costa Rica" "Croatia"   
## [41] "Cuba" "Cyprus"   
## [43] "Czechia" "Denmark"   
## [45] "Djibouti" "Dominica"   
## [47] "Dominican Republic" "Ecuador"   
## [49] "Egypt" "El Salvador"   
## [51] "Equatorial Guinea" "Eritrea"   
## [53] "Estonia" "Eswatini"   
## [55] "Ethiopia" "Fiji"   
## [57] "Finland" "France"   
## [59] "Gabon" "Gambia"   
## [61] "Georgia" "Germany"   
## [63] "Ghana" "Greece"   
## [65] "Grenada" "Guatemala"   
## [67] "Guinea" "Guinea-Bissau"   
## [69] "Guyana" "Haiti"   
## [71] "Honduras" "Hungary"   
## [73] "Iceland" "India"   
## [75] "Indonesia" "Iran"   
## [77] "Iraq" "Ireland"   
## [79] "Israel" "Italy"   
## [81] "Jamaica" "Japan"   
## [83] "Jordan" "Kazakhstan"   
## [85] "Kenya" "Kosovo"   
## [87] "Kuwait" "Kyrgyzstan"   
## [89] "Laos" "Latvia"   
## [91] "Lebanon" "Lesotho"   
## [93] "Liberia" "Libya"   
## [95] "Liechtenstein" "Lithuania"   
## [97] "Luxembourg" "Madagascar"   
## [99] "Malawi" "Malaysia"   
## [101] "Maldives" "Mali"   
## [103] "Malta" "Mauritania"   
## [105] "Mauritius" "Mexico"   
## [107] "Moldova" "Monaco"   
## [109] "Mongolia" "Montenegro"   
## [111] "Morocco" "Mozambique"   
## [113] "Namibia" "Nepal"   
## [115] "Netherlands" "New Zealand"   
## [117] "Nicaragua" "Niger"   
## [119] "Nigeria" "North Macedonia"   
## [121] "Norway" "Oman"   
## [123] "Pakistan" "Panama"   
## [125] "Papua New Guinea" "Paraguay"   
## [127] "Peru" "Philippines"   
## [129] "Poland" "Portugal"   
## [131] "Qatar" "Romania"   
## [133] "Russia" "Rwanda"   
## [135] "Saint Kitts and Nevis" "Saint Lucia"   
## [137] "Saint Vincent and the Grenadines" "San Marino"   
## [139] "Sao Tome and Principe" "Saudi Arabia"   
## [141] "Senegal" "Serbia"   
## [143] "Seychelles" "Sierra Leone"   
## [145] "Singapore" "Slovakia"   
## [147] "Slovenia" "Somalia"   
## [149] "South Africa" "South Sudan"   
## [151] "Spain" "Sri Lanka"   
## [153] "Sudan" "Suriname"   
## [155] "Sweden" "Switzerland"   
## [157] "Syria" "Tajikistan"   
## [159] "Tanzania" "Thailand"   
## [161] "Togo" "Trinidad and Tobago"   
## [163] "Tunisia" "Turkey"   
## [165] "Uganda" "Ukraine"   
## [167] "United Arab Emirates" "United Kingdom"   
## [169] "United States" "Uruguay"   
## [171] "Uzbekistan" "Venezuela"   
## [173] "Vietnam" "Western Sahara"   
## [175] "Yemen" "Zambia"   
## [177] "Zimbabwe"

countryanalysis<- **function**(x) {  
 xgmr<-**subset**(gmr, country\_region**==**x **&** **is.na**(sub\_region\_1)**==**TRUE)  
 xgmr<-xgmr[**c**(2,7**:**13)]  
 xmerged<-**merge**(xgmr, CaseData, by=**c**("country\_region", "date"))  
 crosscorr<-**function**(b) {ccfkendall <-**sapply**( **-**28**:**28, **function**(l) **cor.test**(b, Hmisc**::Lag**(xmerged**$**IncCaseNumber,l),method = "kendall", use = "complete.obs")**$**estimate )  
 }  
 cc<-**as.data.frame**(**lapply**(xmerged[3**:**8], crosscorr))  
 ccabs<-**abs**(cc)  
 a<-**as.data.frame**(**lapply**(ccabs[1**:**6], which.max))  
 b<-**as.data.frame**(**lapply**(cc[1**:**6], max ))  
 c<-**as.data.frame**(**lapply**(cc[1**:**6], min))  
 e<-**ifelse**(**abs**(b)**<abs**(c), c, b)  
 **names**(e) <-**c**("V1", "V2", "V3", "V4", "V5", "V6")  
 a**$**country\_region<-x  
 a<-**data.frame**(**cbind**(a,e))  
 }  
results<-NULL  
d<-NULL  
  
**for**( country\_region **in** **unique**(gmr**$**country\_region) ) {  
 skip\_to\_next <- FALSE  
 **tryCatch**(d<-**countryanalysis**(country\_region), **tryCatch**(results<-**rbind**(results, **data.frame**(d))), error = **function**(e) { skip\_to\_next <<- TRUE})  
 **if**(skip\_to\_next) { **next** }  
  
 }  
  
results<-**unique**(results)  
results**$**retail\_and\_recreation\_percent\_change\_from\_baseline<-results**$**retail\_and\_recreation\_percent\_change\_from\_baseline**-**29  
results**$**grocery\_and\_pharmacy\_percent\_change\_from\_baseline<- results**$**grocery\_and\_pharmacy\_percent\_change\_from\_baseline**-**29  
results**$**parks\_percent\_change\_from\_baseline<- results**$**parks\_percent\_change\_from\_baseline**-**29  
results**$**transit\_stations\_percent\_change\_from\_baseline<-results**$**transit\_stations\_percent\_change\_from\_baseline**-**29  
results**$**workplaces\_percent\_change\_from\_baseline<-results**$**workplaces\_percent\_change\_from\_baseline**-**29  
results**$**residential\_percent\_change\_from\_baseline<-results**$**workplaces\_percent\_change\_from\_baseline**-**29  
  
  
results<-**merge**(**unique**(CaseData[,6**:**7]), results, by="country\_region")  
  
**lapply**(results[,3**:**14], shapiro.test)

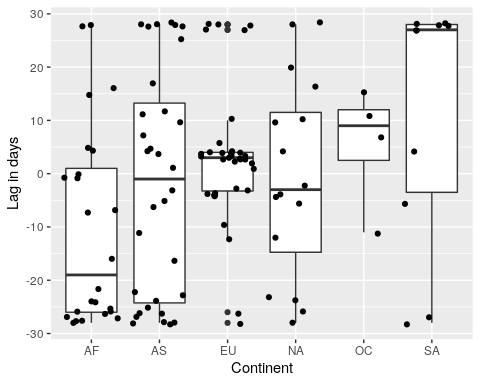
## $retail\_and\_recreation\_percent\_change\_from\_baseline  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.91749, p-value = 1.453e-06  
##   
##   
## $grocery\_and\_pharmacy\_percent\_change\_from\_baseline  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.9132, p-value = 8.296e-07  
##   
##   
## $parks\_percent\_change\_from\_baseline  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.88994, p-value = 5.096e-08  
##   
##   
## $transit\_stations\_percent\_change\_from\_baseline  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.92098, p-value = 2.319e-06  
##   
##   
## $workplaces\_percent\_change\_from\_baseline  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.92489, p-value = 3.973e-06  
##   
##   
## $residential\_percent\_change\_from\_baseline  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.92489, p-value = 3.973e-06  
##   
##   
## $V1  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.82322, p-value = 8.511e-11  
##   
##   
## $V2  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.82111, p-value = 7.151e-11  
##   
##   
## $V3  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.84402, p-value = 5.132e-10  
##   
##   
## $V4  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.8227, p-value = 8.157e-11  
##   
##   
## $V5  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.8301, p-value = 1.517e-10  
##   
##   
## $V6  
##   
## Shapiro-Wilk normality test  
##   
## data: X[[i]]  
## W = 0.79737, p-value = 1.101e-11

**library**(dunn.test)  
  
percontinetanalysislag<-**function**(x) {  
 **print**(x)  
p<-**ggplot**(results, **aes**(Continent, x)) **+** **geom\_boxplot**()**+** **geom\_jitter**()**+** **xlab**("Continent") **+** **ylab**("Lag in days") **+** **labs**(x)  
**print**(p)  
**dunn.test**(x, results**$**Continent, method="holm")}  
  
percontinetanalysistau<-**function**(x) {  
 **print**(x)  
p<-**ggplot**(results, **aes**(Continent, x)) **+** **geom\_boxplot**()**+** **geom\_jitter**()**+** **xlab**("Continent") **+** **ylab**("Kendall Tau") **+** **ggtitle**(x)  
**print**(p)  
**dunn.test**(x, results**$**Continent, method="holm")}  
  
  
**lapply**(results[,3**:**8], percontinetanalysislag)

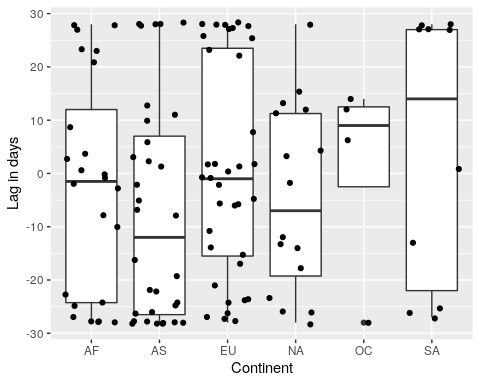
## [1] 1 14 11 28 15 3 -28 -28 15 -26 -6 13 -26 -27 -4 4 28 27  
## [19] 4 -24 -1 -11 -6 28 3 2 1 2 28 28 -21 -28 1 6 -4 2  
## [37] -24 -7 2 -26 9 28 -13 28 -5 -28 -25 28 7 3 7 0 15 4  
## [55] 28 -28 -15 28 10 3 4 26 0 4 6 -27 3 0 -26 27 12 -7  
## [73] -28 20 28 0 10 -2 -4 -28 -7 3 -28 28 -6 7 27 -28 -25 27  
## [91] -5 -28 -4 -28 -1 -23 -28 -7 1 3 4 -28 2 -22 27 9 -10 16  
## [109] 12 -27 20 -5 -28 27 -28 2 -12 1 27 12 -16 -26



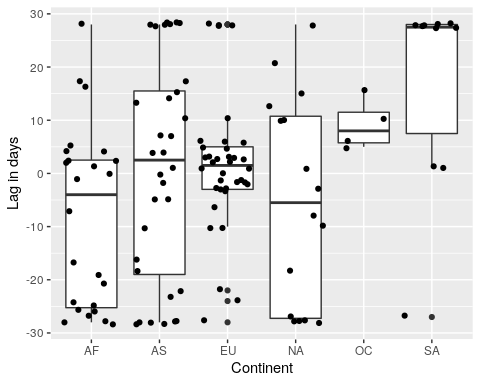
## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 14.4404, df = 5, p-value = 0.01  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | -1.644285  
## | 0.4505  
## |  
## EU | -2.672084 -1.070761  
## | 0.0528 0.8528  
## |  
## NA | -2.279588 -0.952773 -0.105097  
## | 0.1358 0.6814 0.4581  
## |  
## OC | -2.455773 -1.663607 -1.180376 -1.056381  
## | 0.0914 0.4810 0.9514 0.7270  
## |  
## SA | -2.917747 -1.805742 -1.102344 -0.899168 0.385506  
## | 0.0264 0.3903 0.9461 0.5528 0.6999  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2  
## [1] 4 15 10 28 15 3 -28 -27 16 -26 1 -24 -22 -27 -3 5 28 27  
## [19] 4 -24 -1 -4 -6 28 10 4 3 -12 28 28 28 -28 3 7 -4 4  
## [37] -28 -6 6 -26 10 -26 -12 28 2 28 -25 28 4 5 3 4 25 4  
## [55] -28 -24 1 28 11 3 -22 -26 -3 4 7 -25 3 0 -23 28 17 -7  
## [73] -28 -16 28 3 11 -2 -7 -27 -4 -4 -26 28 -6 -11 27 -28 28 27  
## [91] -4 -28 -4 -28 -1 -23 -24 -10 -3 3 4 -28 2 -28 28 4 -11 16  
## [109] 10 -27 20 -5 -26 28 -26 4 -4 4 27 12 -16 28



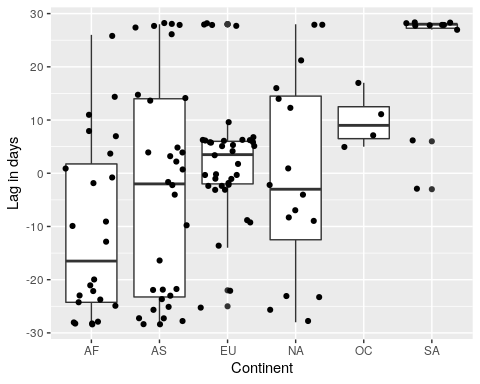
## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 10.2439, df = 5, p-value = 0.07  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | -1.675444  
## | 0.5631  
## |  
## EU | -2.453453 -0.798991  
## | 0.0990 1.0000  
## |  
## NA | -1.522557 -0.127313 0.516332  
## | 0.6393 0.8987 0.9084  
## |  
## OC | -1.756373 -0.935508 -0.573020 -0.817768  
## | 0.5137 1.0000 1.0000 1.0000  
## |  
## SA | -2.685858 -1.541602 -1.019354 -1.288763 -0.105425  
## | 0.0543 0.6774 1.0000 0.8887 0.4580  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2  
## [1] -28 9 11 -26 14 -1 -28 -28 12 25 -6 13 23 -27 28 -3 -25 26  
## [19] 4 -28 -1 -23 -13 28 3 2 22 -24 28 28 -28 -28 -24 -28 27 -2  
## [37] -10 -7 -26 -23 -6 -26 -13 -18 -17 -28 -26 28 8 -2 2 4 -16 3  
## [55] 28 -28 1 28 11 -27 -28 28 -28 -1 6 -25 0 3 -26 27 10 -8  
## [73] 0 21 28 -27 6 -2 -2 -28 28 -24 -22 28 -14 12 27 27 -26 28  
## [91] -5 -28 -15 28 1 -24 -28 -14 2 -21 1 -27 2 -22 -6 23 -8 23  
## [109] 13 28 15 -5 -24 28 -28 -11 -12 1 27 -25 -19 27



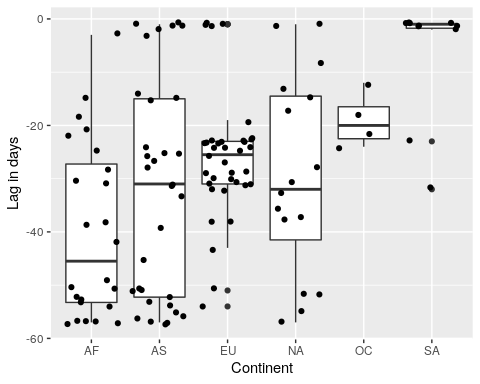
## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 4.0549, df = 5, p-value = 0.54  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | 0.736809  
## | 1.0000  
## |  
## EU | -0.772181 -1.656466  
## | 1.0000 0.7322  
## |  
## NA | -0.036585 -0.688369 0.637949  
## | 0.4854 1.0000 1.0000  
## |  
## OC | -0.441648 -0.824917 -0.066464 -0.405550  
## | 1.0000 1.0000 0.9470 1.0000  
## |  
## SA | -0.972515 -1.559556 -0.454747 -0.878745 -0.215555  
## | 1.0000 0.8321 1.0000 1.0000 1.0000  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2  
## [1] 1 2 10 28 16 3 -28 -28 15 -24 -2 13 -25 -27 -3 5 28 28  
## [19] 4 -28 -1 -10 1 28 10 3 -3 2 28 28 -21 -28 -1 6 -1 3  
## [37] -19 4 2 -26 10 -28 -28 -18 -2 28 -18 28 -2 -2 3 -3 15 4  
## [55] 28 -27 0 28 10 5 7 28 -3 5 7 -17 3 4 -28 28 17 -7  
## [73] 0 17 28 -3 10 21 1 -28 -6 6 -28 28 1 5 27 27 28 28  
## [91] 1 -28 -10 -28 2 -23 -24 -10 -5 1 6 -28 3 -22 -22 6 -10 16  
## [109] 13 2 -27 -5 -28 28 -28 0 -8 1 28 14 -16 -26



## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 14.2374, df = 5, p-value = 0.01  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | -1.641874  
## | 0.4528  
## |  
## EU | -1.628992 0.057950  
## | 0.4133 0.4769  
## |  
## NA | -0.396274 1.030287 1.003054  
## | 1.0000 0.7572 0.6317  
## |  
## OC | -2.122076 -1.325015 -1.359984 -1.821331  
## | 0.1861 0.5555 0.6084 0.3428  
## |  
## SA | -3.269011 -2.172476 -2.241183 -2.735000 -0.142592  
## | 0.0081\* 0.1789 0.1626 0.0437 0.8866  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2  
## [1] 1 11 21 28 17 5 -28 -22 12 -22 -3 -26 -25 28 -1 8 28 28  
## [19] 1 -27 7 -7 -3 28 14 2 0 6 28 28 -20 -23 6 11 -2 0  
## [37] -28 4 6 -23 10 -23 -9 28 -2 28 -22 28 -2 -2 5 -2 14 3  
## [55] -23 -24 -4 28 -26 5 5 -9 -2 6 4 -22 3 4 -28 28 26 -10  
## [73] -24 -13 28 -3 7 1 -2 -28 4 7 -24 -22 -4 5 28 27 27 28  
## [91] -1 -28 -9 -25 -1 -25 -28 -9 -2 6 6 -28 6 -27 -14 6 -10 14  
## [109] 14 26 16 2 -28 28 -28 0 -8 6 28 15 -16 -21



## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 26.2134, df = 5, p-value = 0  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | -1.399224  
## | 0.4044  
## |  
## EU | -2.825737 -1.509792  
## | 0.0283 0.4588  
## |  
## NA | -1.590471 -0.442504 0.769895  
## | 0.4469 0.3291 0.6620  
## |  
## OC | -2.457387 -1.790030 -1.105204 -1.455802  
## | 0.0700 0.3305 0.5381 0.4363  
## |  
## SA | -4.634629 -3.772111 -2.796853 -3.053954 -0.705315  
## | 0.0000\* 0.0011\* 0.0284 0.0147\* 0.4806  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2  
## [1] -28 -18 -8 -1 -12 -24 -57 -51 -17 -51 -32 -55 -54 -1 -30 -21 -1 -1  
## [19] -28 -56 -22 -36 -32 -1 -15 -27 -29 -23 -1 -1 -49 -52 -23 -18 -31 -29  
## [37] -57 -25 -23 -52 -19 -52 -38 -1 -31 -1 -51 -1 -31 -31 -24 -31 -15 -26  
## [55] -52 -53 -33 -1 -55 -24 -24 -38 -31 -23 -25 -51 -26 -25 -57 -1 -3 -39  
## [73] -53 -42 -1 -32 -22 -28 -31 -57 -25 -22 -53 -51 -33 -24 -1 -2 -2 -1  
## [91] -30 -57 -38 -54 -30 -54 -57 -38 -31 -23 -23 -57 -23 -56 -43 -23 -39 -15  
## [109] -15 -3 -13 -27 -57 -1 -57 -29 -37 -23 -1 -14 -45 -50

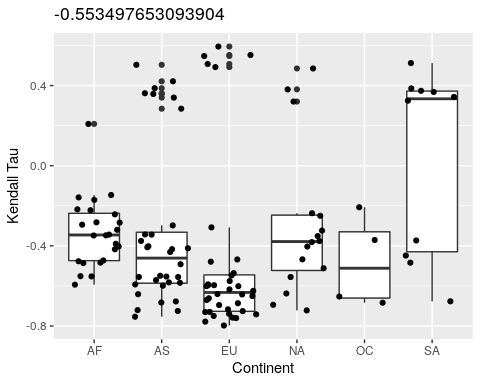


## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 26.2134, df = 5, p-value = 0  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | -1.399224  
## | 0.4044  
## |  
## EU | -2.825737 -1.509792  
## | 0.0283 0.4588  
## |  
## NA | -1.590471 -0.442504 0.769895  
## | 0.4469 0.3291 0.6620  
## |  
## OC | -2.457387 -1.790030 -1.105204 -1.455802  
## | 0.0700 0.3305 0.5381 0.4363  
## |  
## SA | -4.634629 -3.772111 -2.796853 -3.053954 -0.705315  
## | 0.0000\* 0.0011\* 0.0284 0.0147\* 0.4806  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2

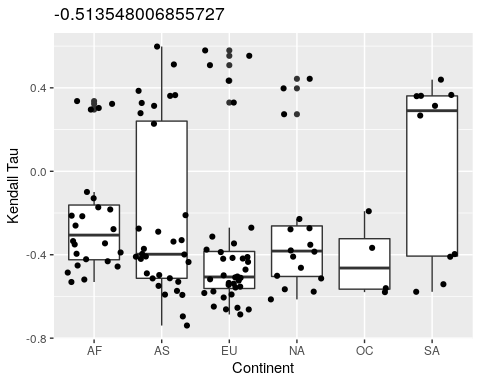
## $retail\_and\_recreation\_percent\_change\_from\_baseline  
## $retail\_and\_recreation\_percent\_change\_from\_baseline$chi2  
## [1] 14.44038  
##   
## $retail\_and\_recreation\_percent\_change\_from\_baseline$Z  
## [1] -1.6442859 -2.6720848 -1.0707613 -2.2795885 -0.9527733 -0.1050974  
## [7] -2.4557730 -1.6636074 -1.1803761 -1.0563811 -2.9177477 -1.8057425  
## [13] -1.1023442 -0.8991683 0.3855064  
##   
## $retail\_and\_recreation\_percent\_change\_from\_baseline$P  
## [1] 0.050058577 0.003769080 0.142138393 0.011316054 0.170352467 0.458149268  
## [7] 0.007029096 0.048095455 0.118925330 0.145397064 0.001762848 0.035479286  
## [13] 0.135156036 0.184281524 0.349931116  
##   
## $retail\_and\_recreation\_percent\_change\_from\_baseline$P.adjusted  
## [1] 0.45052719 0.05276712 0.85283036 0.13579265 0.68140987 0.45814927  
## [7] 0.09137825 0.48095455 0.95140264 0.72698532 0.02644272 0.39027214  
## [13] 0.94609225 0.55284457 0.69986223  
##   
## $retail\_and\_recreation\_percent\_change\_from\_baseline$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"  
##   
##   
## $grocery\_and\_pharmacy\_percent\_change\_from\_baseline  
## $grocery\_and\_pharmacy\_percent\_change\_from\_baseline$chi2  
## [1] 10.2439  
##   
## $grocery\_and\_pharmacy\_percent\_change\_from\_baseline$Z  
## [1] -1.6754445 -2.4534534 -0.7989914 -1.5225572 -0.1273131 0.5163322  
## [7] -1.7563733 -0.9355084 -0.5730203 -0.8177690 -2.6858584 -1.5416028  
## [13] -1.0193545 -1.2887635 -0.1054252  
##   
## $grocery\_and\_pharmacy\_percent\_change\_from\_baseline$P  
## [1] 0.046923528 0.007074594 0.212147693 0.063934763 0.449346310 0.302811207  
## [7] 0.039512348 0.174763177 0.283315465 0.206744562 0.003617187 0.061585076  
## [13] 0.154017349 0.098740168 0.458019197  
##   
## $grocery\_and\_pharmacy\_percent\_change\_from\_baseline$P.adjusted  
## [1] 0.56308234 0.09904431 1.00000000 0.63934763 0.89869262 0.90843362  
## [7] 0.51366053 1.00000000 1.00000000 1.00000000 0.05425780 0.67743584  
## [13] 1.00000000 0.88866151 0.45801920  
##   
## $grocery\_and\_pharmacy\_percent\_change\_from\_baseline$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"  
##   
##   
## $parks\_percent\_change\_from\_baseline  
## $parks\_percent\_change\_from\_baseline$chi2  
## [1] 4.054902  
##   
## $parks\_percent\_change\_from\_baseline$Z  
## [1] 0.73680959 -0.77218134 -1.65646634 -0.03658511 -0.68836908 0.63794913  
## [7] -0.44164848 -0.82491788 -0.06646435 -0.40555054 -0.97251571 -1.55955629  
## [13] -0.45474706 -0.87874596 -0.21555520  
##   
## $parks\_percent\_change\_from\_baseline$P  
## [1] 0.23061907 0.22000351 0.04881371 0.48540791 0.24561020 0.26175340  
## [7] 0.32937180 0.20470911 0.47350407 0.34253644 0.16539703 0.05943239  
## [13] 0.32464561 0.18976952 0.41466724  
##   
## $parks\_percent\_change\_from\_baseline$P.adjusted  
## [1] 1.0000000 1.0000000 0.7322056 0.4854079 1.0000000 1.0000000 1.0000000  
## [8] 1.0000000 0.9470081 1.0000000 1.0000000 0.8320534 1.0000000 1.0000000  
## [15] 1.0000000  
##   
## $parks\_percent\_change\_from\_baseline$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"  
##   
##   
## $transit\_stations\_percent\_change\_from\_baseline  
## $transit\_stations\_percent\_change\_from\_baseline$chi2  
## [1] 14.23744  
##   
## $transit\_stations\_percent\_change\_from\_baseline$Z  
## [1] -1.64187455 -1.62899279 0.05795077 -0.39627456 1.03028718 1.00305403  
## [7] -2.12207636 -1.32501519 -1.35998481 -1.82133131 -3.26901120 -2.17247631  
## [13] -2.24118343 -2.73500075 -0.14259256  
##   
## $transit\_stations\_percent\_change\_from\_baseline$P  
## [1] 0.0503080030 0.0516572727 0.4768939193 0.3459512457 0.1514376077  
## [6] 0.1579173971 0.0169156630 0.0925830562 0.0869173661 0.0342782547  
## [11] 0.0005396201 0.0149098774 0.0125070979 0.0031190067 0.4433059873  
##   
## $transit\_stations\_percent\_change\_from\_baseline$P.adjusted  
## [1] 0.452772027 0.413258182 0.476893919 1.000000000 0.757188038 0.631669588  
## [7] 0.186072293 0.555498337 0.608421562 0.342782547 0.008094302 0.178918529  
## [13] 0.162592273 0.043666093 0.886611975  
##   
## $transit\_stations\_percent\_change\_from\_baseline$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"  
##   
##   
## $workplaces\_percent\_change\_from\_baseline  
## $workplaces\_percent\_change\_from\_baseline$chi2  
## [1] 26.21336  
##   
## $workplaces\_percent\_change\_from\_baseline$Z  
## [1] -1.3992243 -2.8257379 -1.5097923 -1.5904718 -0.4425046 0.7698954  
## [7] -2.4573876 -1.7900309 -1.1052040 -1.4558027 -4.6346294 -3.7721120  
## [13] -2.7968537 -3.0539549 -0.7053153  
##   
## $workplaces\_percent\_change\_from\_baseline$P  
## [1] 8.087287e-02 2.358592e-03 6.554822e-02 5.586425e-02 3.290620e-01  
## [6] 2.206810e-01 6.997579e-03 3.672447e-02 1.345356e-01 7.272359e-02  
## [11] 1.787887e-06 8.093579e-05 2.580145e-03 1.129230e-03 2.403070e-01  
##   
## $workplaces\_percent\_change\_from\_baseline$P.adjusted  
## [1] 4.043644e-01 2.830311e-02 4.588375e-01 4.469140e-01 3.290620e-01  
## [6] 6.620429e-01 6.997579e-02 3.305202e-01 5.381424e-01 4.363415e-01  
## [11] 2.681831e-05 1.133101e-03 2.838159e-02 1.467999e-02 4.806141e-01  
##   
## $workplaces\_percent\_change\_from\_baseline$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"  
##   
##   
## $residential\_percent\_change\_from\_baseline  
## $residential\_percent\_change\_from\_baseline$chi2  
## [1] 26.21336  
##   
## $residential\_percent\_change\_from\_baseline$Z  
## [1] -1.3992243 -2.8257379 -1.5097923 -1.5904718 -0.4425046 0.7698954  
## [7] -2.4573876 -1.7900309 -1.1052040 -1.4558027 -4.6346294 -3.7721120  
## [13] -2.7968537 -3.0539549 -0.7053153  
##   
## $residential\_percent\_change\_from\_baseline$P  
## [1] 8.087287e-02 2.358592e-03 6.554822e-02 5.586425e-02 3.290620e-01  
## [6] 2.206810e-01 6.997579e-03 3.672447e-02 1.345356e-01 7.272359e-02  
## [11] 1.787887e-06 8.093579e-05 2.580145e-03 1.129230e-03 2.403070e-01  
##   
## $residential\_percent\_change\_from\_baseline$P.adjusted  
## [1] 4.043644e-01 2.830311e-02 4.588375e-01 4.469140e-01 3.290620e-01  
## [6] 6.620429e-01 6.997579e-02 3.305202e-01 5.381424e-01 4.363415e-01  
## [11] 2.681831e-05 1.133101e-03 2.838159e-02 1.467999e-02 4.806141e-01  
##   
## $residential\_percent\_change\_from\_baseline$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"

**lapply**(results[,9**:**14], percontinetanalysistau)

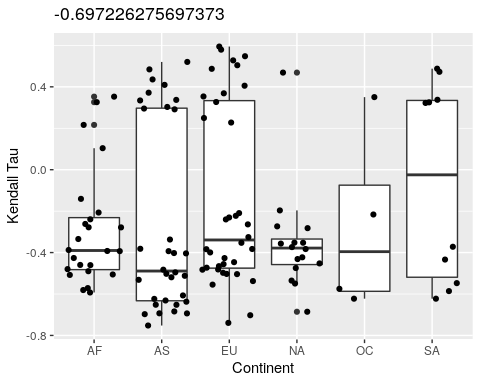
## [1] -0.5534977 -0.1582540 -0.2499850 0.3433071 -0.6839898 -0.7298250  
## [7] -0.4306285 -0.4168797 -0.4674413 -0.7168852 -0.7499364 -0.3761730  
## [13] -0.1706894 -0.3732628 -0.4679852 -0.1464787 0.3857661 0.5474611  
## [19] -0.5515555 0.5036446 -0.2180149 -0.7223672 -0.4842100 0.5123257  
## [25] -0.3814631 -0.6866255 -0.5964913 -0.4793979 0.4853103 0.3246045  
## [31] -0.4173397 -0.5121667 -0.6015127 -0.3708448 -0.6507424 -0.6010145  
## [37] -0.3439793 -0.5556870 -0.7306371 -0.2222320 -0.5480343 0.3201554  
## [43] -0.3240138 0.3808841 -0.6704902 -0.5826455 -0.4918616 0.3616783  
## [49] -0.7783861 -0.5710822 -0.7978336 -0.4036024 -0.6775705 -0.3433811  
## [55] 0.3579900 -0.4029831 -0.7252601 0.3866533 -0.4122310 -0.6427474  
## [61] -0.2981789 0.2085345 -0.6957270 -0.7393324 -0.5991855 -0.4859687  
## [67] -0.5365017 -0.4838013 -0.6379013 0.5947028 0.2845355 -0.5527216  
## [73] -0.3200635 -0.2428333 0.3398790 -0.7259035 -0.6530664 -0.2373977  
## [79] -0.5939036 -0.4730018 -0.3079249 -0.5758381 -0.4068586 0.4213663  
## [85] -0.3514292 -0.2075643 0.3737949 -0.4485486 -0.3441840 0.5074654  
## [91] -0.5968379 -0.5845451 -0.5924457 -0.6618138 -0.2841941 -0.5554798  
## [97] -0.4770963 -0.6408547 -0.7538761 -0.6176974 -0.6249448 -0.2944822  
## [103] -0.7418862 -0.4021148 0.4921492 -0.7605880 -0.7207047 -0.3899516  
## [109] -0.6830308 -0.3484619 -0.5556397 -0.5928170 -0.3476033 0.5523905  
## [115] -0.6414562 -0.7585932 -0.6943479 -0.6770242 0.3680166 -0.5494112  
## [121] -0.3755799 -0.2828116



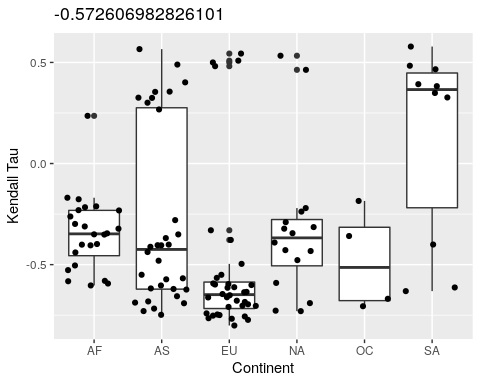
## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 25.2021, df = 5, p-value = 0  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | 1.640670  
## | 0.5043  
## |  
## EU | 4.056906 2.576829  
## | 0.0004\* 0.0598  
## |  
## NA | 0.666262 -0.744632 -2.842461  
## | 0.5052 0.6847 0.0291  
## |  
## OC | 1.199958 0.386589 -0.798861 0.774603  
## | 0.8055 0.3495 1.0000 0.8771  
## |  
## SA | -0.776362 -2.029466 -3.808259 -1.258326 -1.589336  
## | 1.0000 0.2333 0.0010\* 0.8331 0.5039  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2  
## [1] -0.51354801 -0.12938710 -0.27306551 0.36003319 -0.56033235 -0.58347992  
## [7] -0.39882599 -0.40948631 -0.46255253 -0.55706838 -0.60497910 0.39737548  
## [13] -0.18308884 -0.39696283 -0.37549759 -0.09917067 0.36593233 0.50854969  
## [19] -0.51890173 0.51203351 -0.21546209 -0.61399682 -0.54139385 0.43922040  
## [25] -0.38532322 -0.55301195 -0.41821734 -0.41923781 0.44326424 0.26721237  
## [31] 0.33643340 -0.50096681 -0.49888154 -0.36699504 -0.47116528 -0.52388508  
## [37] -0.35068567 -0.51265156 -0.41117673 -0.21280964 -0.34589176 -0.37951396  
## [43] -0.27812298 0.27344488 -0.51770147 0.59780899 -0.33697341 0.32737623  
## [49] -0.64857755 -0.40839186 -0.66184077 -0.40921771 -0.37177725 -0.27476062  
## [55] -0.33003698 -0.38911793 -0.73927898 0.36144433 -0.41991039 -0.50857061  
## [61] 0.31359050 0.30324938 -0.43433797 -0.65426120 -0.59264147 -0.45159470  
## [67] -0.50457893 -0.43130415 -0.56555128 0.55345038 0.27852564 -0.53071113  
## [73] -0.17269028 0.32314266 0.36497813 -0.53534543 -0.57925417 -0.22866182  
## [79] -0.45659089 -0.42165697 -0.27038318 -0.31320577 -0.43493240 0.38554247  
## [85] -0.35226047 -0.19143881 0.36169863 -0.40966432 0.22776153 0.43421299  
## [91] -0.53891293 -0.52963339 -0.57599133 -0.59056810 -0.27730343 -0.54924603  
## [97] -0.48553274 -0.51061770 -0.49749072 -0.41519710 -0.54471810 -0.26020249  
## [103] -0.68615505 -0.39639005 0.32935841 -0.38734993 -0.69564062 -0.39536215  
## [109] -0.59107766 -0.33468418 -0.51362709 -0.28957593 -0.34539200 0.57927103  
## [115] -0.57329060 -0.66235837 -0.57689134 -0.57756282 0.31370966 -0.48936936  
## [121] -0.21046230 0.29587002



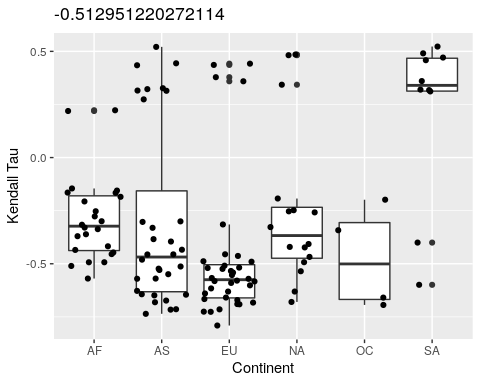
## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 13.1473, df = 5, p-value = 0.02  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | 1.091962  
## | 0.9620  
## |  
## EU | 2.976356 2.014663  
## | 0.0219\* 0.2856  
## |  
## NA | 0.987528 0.077926 -1.549661  
## | 0.9702 0.4689 0.7273  
## |  
## OC | 1.319954 0.788175 -0.135627 0.705046  
## | 0.9343 1.0000 0.8921 0.9616  
## |  
## SA | -0.472704 -1.305005 -2.691931 -1.232020 -1.505686  
## | 0.9546 0.8635 0.0497 0.8718 0.7268  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2  
## [1] -0.6972263 -0.1406743 -0.2820707 -0.5474599 -0.5749035 -0.5375181  
## [7] -0.3931160 -0.6234311 -0.4522494 0.4054679 -0.3836653 -0.3566681  
## [13] -0.2067056 -0.3718782 0.3688151 0.1039652 -0.4336895 0.5043227  
## [19] -0.4899501 0.4842701 -0.2779962 -0.4746373 -0.5858973 0.4876603  
## [25] -0.4227897 -0.5039871 0.2495798 -0.2638605 0.4688289 0.3252128  
## [31] -0.3930422 -0.5351902 -0.2399288 0.3504618 0.3268300 -0.4655647  
## [37] -0.3344597 -0.5119941 -0.3253124 -0.2394384 -0.3527943 -0.3828613  
## [43] -0.3524789 -0.2733995 -0.4825393 -0.6519975 -0.4954826 0.3343076  
## [49] -0.2225099 -0.5314196 -0.7393493 -0.4313110 0.2913841 -0.3370043  
## [55] 0.4357961 -0.4606250 -0.6931503 0.4095125 -0.3816546 -0.2094598  
## [61] 0.2952211 0.2163014 -0.2305994 -0.4814768 -0.6311546 -0.3875723  
## [67] -0.4729177 -0.4797767 -0.6855731 0.5944762 0.3030080 -0.5808705  
## [73] -0.4261764 -0.2617667 0.3371022 -0.3992977 -0.6225580 -0.1965018  
## [79] -0.5713760 -0.5056637 0.3536219 -0.4557112 -0.5191949 0.3717892  
## [85] -0.3519320 -0.2161225 0.3223731 0.4726078 -0.4038322 0.4870364  
## [91] -0.4975984 -0.6068624 -0.5030600 0.5278162 -0.2783857 -0.6370951  
## [97] -0.5926375 -0.5547067 -0.7520335 -0.4266185 -0.4462395 -0.4596031  
## [103] -0.7024191 -0.4022653 0.5478339 0.2276984 -0.6935712 -0.3922300  
## [109] -0.6517403 0.3261033 -0.5494581 -0.4825813 -0.5079187 0.5795392  
## [115] -0.6841033 -0.3826084 -0.3735142 -0.6225834 0.3375566 0.5203411  
## [121] -0.5024829 0.3526681



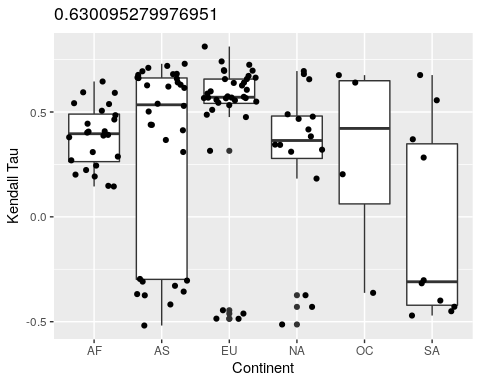
## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 5.5825, df = 5, p-value = 0.35  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | 1.036327  
## | 1.0000  
## |  
## EU | -0.961316 -2.194508  
## | 1.0000 0.2115  
## |  
## NA | 0.204442 -0.698454 1.062736  
## | 1.0000 1.0000 1.0000  
## |  
## OC | 0.272717 -0.249950 0.760111 0.145435  
## | 1.0000 1.0000 1.0000 0.8844  
## |  
## SA | -0.660534 -1.458678 0.013184 -0.780425 -0.669194  
## | 1.0000 1.0000 0.4947 1.0000 1.0000  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2  
## [1] -0.5726070 -0.1766209 -0.2377148 0.3923511 -0.7056835 -0.7648966  
## [7] -0.4118530 -0.4043994 -0.4777787 -0.7493716 -0.7730150 -0.3907032  
## [13] -0.2161860 -0.4006054 -0.4962252 -0.1692275 0.4661006 0.4813273  
## [19] -0.6028944 0.4893664 -0.2117865 -0.7299455 -0.6129206 0.5784570  
## [25] -0.4327298 -0.7089791 -0.5961135 -0.6363822 0.4634063 0.3488880  
## [31] -0.3502570 -0.5903386 -0.6142577 -0.3585332 -0.6622662 -0.5983316  
## [37] -0.3223121 -0.5676438 -0.7563131 -0.2306099 -0.5653600 -0.3143399  
## [43] -0.2900600 -0.3221777 -0.6614548 0.5657969 -0.5500090 0.3245195  
## [49] -0.7411780 -0.6030977 -0.8010124 -0.4282175 -0.6876772 -0.3686877  
## [55] 0.3543151 -0.4011943 -0.6819579 0.3256387 -0.4038790 -0.6348178  
## [61] -0.3505466 0.2358338 -0.7041428 -0.7674922 -0.6561378 -0.5801924  
## [67] -0.5502790 -0.5041723 -0.7276408 0.5086579 0.3007417 -0.5934412  
## [73] -0.2986417 -0.2320672 0.3555856 -0.6960974 -0.6688991 -0.2203254  
## [79] -0.5821476 -0.4396744 -0.3300947 -0.6845743 -0.4376073 0.4013670  
## [85] -0.3445700 -0.1850663 0.3267276 0.4836605 0.2674712 0.4998710  
## [91] -0.5931153 -0.6176555 -0.6116445 -0.6455171 -0.2620028 -0.6232359  
## [97] -0.5270826 -0.6512402 -0.7481810 -0.6008805 -0.6782901 -0.3452520  
## [103] -0.7521519 -0.4010383 -0.3778988 -0.7033298 -0.7297485 -0.3981229  
## [109] -0.7173616 -0.3512519 0.5330842 -0.6203814 -0.4045483 0.5437310  
## [115] -0.6909615 -0.7465325 -0.6902400 -0.6310369 0.3825599 -0.4806138  
## [121] -0.2798201 -0.3112147



## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 27.7418, df = 5, p-value = 0  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | 1.271955  
## | 0.8136  
## |  
## EU | 4.001761 2.926819  
## | 0.0004\* 0.0223\*  
## |  
## NA | 0.593247 -0.496421 -2.872526  
## | 0.8295 0.3098 0.0244\*  
## |  
## OC | 1.162868 0.536559 -0.809294 0.780926  
## | 0.7346 0.5916 1.0000 0.8697  
## |  
## SA | -1.235293 -2.231437 -4.250835 -1.628371 -1.847453  
## | 0.7585 0.1411 0.0002\* 0.4655 0.3234  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2  
## [1] -0.5129512 -0.1648298 -0.2531381 0.4585050 -0.6940019 -0.6909161  
## [7] -0.4558520 -0.3840352 -0.4677658 -0.6897786 -0.6710472 0.3430625  
## [13] -0.1453652 0.4709181 -0.4903037 -0.1553609 0.3602114 0.3784390  
## [19] -0.4469237 0.5211389 -0.2065658 -0.6307847 -0.4003338 0.4907732  
## [25] -0.4070730 -0.6590935 -0.5708910 -0.5090364 0.4851721 0.3198620  
## [31] -0.3296240 -0.4230355 -0.5339414 -0.3421886 -0.4553937 -0.4882581  
## [37] -0.4929486 -0.5293585 -0.5902462 -0.1848314 -0.5199858 -0.3273797  
## [43] -0.2581092 0.4819861 -0.6160800 0.4438532 -0.5705209 0.3155529  
## [49] -0.6399573 -0.5231711 -0.7907835 -0.4206808 -0.7357722 -0.3953319  
## [55] -0.3307258 -0.3162344 -0.7141558 0.3144720 0.4346101 -0.5793986  
## [61] -0.3029128 -0.1660522 -0.5671096 -0.7254762 -0.6487601 -0.4348773  
## [67] -0.5241339 -0.5103348 -0.5352543 0.4421402 0.3265441 -0.5696662  
## [73] -0.2770015 0.2226941 0.3221619 -0.5180469 -0.6593436 -0.1928450  
## [79] -0.4930406 -0.4545520 -0.3149534 -0.5814699 -0.4561900 -0.3004274  
## [85] -0.2479336 -0.1984179 0.3114031 0.5226940 0.2740420 0.3592096  
## [91] -0.5531972 -0.6812070 -0.6016859 -0.5417365 -0.2528229 -0.6277069  
## [97] -0.4177485 -0.6308793 -0.7160368 -0.5831742 -0.6828104 -0.3611030  
## [103] -0.7263155 -0.4338291 -0.4631977 -0.6661455 -0.6733437 -0.3702215  
## [109] -0.5697671 0.2192677 -0.4926538 -0.6435807 -0.3370956 0.4362986  
## [115] -0.6455565 -0.7146775 -0.6798596 -0.5991029 0.3176600 -0.4806887  
## [121] -0.5491790 -0.2997764



## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 31.6534, df = 5, p-value = 0  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | 1.963568  
## | 0.2231  
## |  
## EU | 3.939164 2.090239  
## | 0.0006\* 0.1830  
## |  
## NA | 0.339520 -1.373818 -3.090172  
## | 0.3671 0.4237 0.0120\*  
## |  
## OC | 1.525038 0.553222 -0.406883 1.277304  
## | 0.3817 0.8702 0.6841 0.4030  
## |  
## SA | -1.684832 -3.213972 -4.678028 -1.844961 -2.464068  
## | 0.3221 0.0085\* 0.0000\* 0.2602 0.0756  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2  
## [1] 0.6300953 0.1478741 0.3432874 -0.4500194 0.6757498 0.6960393  
## [7] 0.6589533 0.4394048 0.4778985 0.5557610 0.7251281 0.3445480  
## [13] 0.2014684 -0.3993238 0.4870678 0.1925446 0.3699210 -0.4454225  
## [19] 0.5913820 -0.5181839 0.2444784 0.6562264 0.5559480 -0.4287644  
## [25] 0.4168785 0.6569495 0.5744941 0.5494818 -0.4293238 0.2827904  
## [31] 0.3909724 0.4891530 0.5664777 -0.3624062 0.5686990 0.5327202  
## [37] 0.4642563 0.5022371 0.6636567 0.2695202 0.5439880 0.3837516  
## [43] 0.3105690 -0.3737575 0.6059915 -0.4177808 0.6149725 -0.3040186  
## [49] 0.6386089 0.5292433 0.8120832 0.4672500 0.6803916 0.3665787  
## [55] -0.3683447 0.4441851 0.7198547 -0.3742581 0.4127730 0.5684164  
## [61] -0.3087898 0.1448971 0.5723127 0.7412086 0.6644456 0.5059272  
## [67] 0.5102731 0.4846305 0.6809069 -0.4861235 -0.2962409 0.6455039  
## [73] 0.3088654 0.2232864 -0.3288082 0.6401722 0.6402898 0.1824793  
## [79] 0.5939883 0.5378781 0.3148797 0.6263767 0.6270833 -0.3564462  
## [85] 0.3202322 0.2031230 -0.3167914 -0.4706038 0.3093554 -0.4612694  
## [91] 0.5666173 0.6942468 0.5985987 0.5581997 0.2874489 0.6616901  
## [97] 0.5419160 0.5875159 0.7105066 0.5654094 0.6572900 0.4018575  
## [103] 0.6994592 0.4386276 0.4757399 0.6721069 0.7298431 0.4063304  
## [109] 0.6818833 0.3795784 -0.5131745 0.6212946 0.3876472 -0.4854047  
## [115] 0.6769021 0.6971996 0.6951800 0.6762063 -0.3022770 0.5393764  
## [121] 0.6412054 0.4080639



## Kruskal-Wallis rank sum test  
##   
## data: x and group  
## Kruskal-Wallis chi-squared = 19.0864, df = 5, p-value = 0  
##   
##   
## Comparison of x by group   
## (Holm)   
## Col Mean-|  
## Row Mean | AF AS EU NA OC  
## ---------+-------------------------------------------------------  
## AS | -1.785756  
## | 0.4078  
## |  
## EU | -3.032992 -1.304984  
## | 0.0169\* 0.7676  
## |  
## NA | -0.062062 1.509469 2.593444  
## | 0.4753 0.6559 0.0570  
## |  
## OC | -0.626160 0.271612 0.874872 -0.569096  
## | 1.0000 0.7859 0.9541 0.8539  
## |  
## SA | 1.227780 2.606595 3.528738 1.196067 1.352728  
## | 0.7684 0.0594 0.0031\* 0.6950 0.7926  
##   
## alpha = 0.05  
## Reject Ho if p <= alpha/2

## $V1  
## $V1$chi2  
## [1] 25.20206  
##   
## $V1$Z  
## [1] 1.6406704 4.0569067 2.5768299 0.6662625 -0.7446329 -2.8424618  
## [7] 1.1999584 0.3865894 -0.7988619 0.7746031 -0.7763629 -2.0294663  
## [13] -3.8082596 -1.2583266 -1.5893362  
##   
## $V1$P  
## [1] 5.043292e-02 2.486346e-05 4.985550e-03 2.526217e-01 2.282468e-01  
## [6] 2.238330e-03 1.150777e-01 3.495301e-01 2.121853e-01 2.192871e-01  
## [11] 2.187674e-01 2.120541e-02 6.997415e-05 1.041368e-01 5.599225e-02  
##   
## $V1$P.adjusted  
## [1] 0.5043292280 0.0003729520 0.0598265984 0.5052433054 0.6847404776  
## [6] 0.0290982867 0.8055442011 0.3495301194 1.0000000000 0.8771484244  
## [11] 1.0000000000 0.2332595002 0.0009796381 0.8330946347 0.5039302804  
##   
## $V1$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"  
##   
##   
## $V2  
## $V2$chi2  
## [1] 13.14727  
##   
## $V2$Z  
## [1] 1.0919622 2.9763566 2.0146639 0.9875289 0.0779267 -1.5496613  
## [7] 1.3199543 0.7881757 -0.1356277 0.7050469 -0.4727048 -1.3050054  
## [13] -2.6919319 -1.2320201 -1.5056869  
##   
## $V2$P  
## [1] 0.137424865 0.001458477 0.021969937 0.161691721 0.468943179 0.060611417  
## [7] 0.093425143 0.215296966 0.446057816 0.240390518 0.318211898 0.095945509  
## [13] 0.003551972 0.108970781 0.066073779  
##   
## $V2$P.adjusted  
## [1] 0.96197405 0.02187716 0.28560918 0.97015033 0.46894318 0.72733701  
## [7] 0.93425143 1.00000000 0.89211563 0.96156207 0.95463569 0.86350958  
## [13] 0.04972761 0.87176625 0.72681157  
##   
## $V2$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"  
##   
##   
## $V3  
## $V3$chi2  
## [1] 5.5825  
##   
## $V3$Z  
## [1] 1.03632773 -0.96131699 -2.19450855 0.20444220 -0.69845415 1.06273693  
## [7] 0.27271782 -0.24995001 0.76011111 0.14543569 -0.66053453 -1.45867890  
## [13] 0.01318497 -0.78042557 -0.66919420  
##   
## $V3$P  
## [1] 0.15002464 0.16819640 0.01409944 0.41900398 0.24244661 0.14395064  
## [7] 0.39253507 0.40131300 0.22359409 0.44218344 0.25445543 0.07232675  
## [13] 0.49474011 0.21757021 0.25168580  
##   
## $V3$P.adjusted  
## [1] 1.0000000 1.0000000 0.2114915 1.0000000 1.0000000 1.0000000 1.0000000  
## [8] 1.0000000 1.0000000 0.8843669 1.0000000 1.0000000 0.4947401 1.0000000  
## [15] 1.0000000  
##   
## $V3$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"  
##   
##   
## $V4  
## $V4$chi2  
## [1] 27.74177  
##   
## $V4$Z  
## [1] 1.2719559 4.0017614 2.9268197 0.5932475 -0.4964220 -2.8725269  
## [7] 1.1628688 0.5365594 -0.8092948 0.7809264 -1.2352935 -2.2314372  
## [13] -4.2508352 -1.6283711 -1.8474540  
##   
## $V4$P  
## [1] 1.016944e-01 3.143634e-05 1.712237e-03 2.765078e-01 3.097984e-01  
## [6] 2.036017e-03 1.224414e-01 2.957860e-01 2.091728e-01 2.174229e-01  
## [11] 1.083606e-01 1.282609e-02 1.064874e-05 5.172311e-02 3.234069e-02  
##   
## $V4$P.adjusted  
## [1] 0.8135551056 0.0004401088 0.0222590781 0.8295233259 0.3097983684  
## [6] 0.0244322022 0.7346482080 0.5915720188 1.0000000000 0.8696915531  
## [11] 0.7585245319 0.1410869980 0.0001597311 0.4655079976 0.3234068627  
##   
## $V4$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"  
##   
##   
## $V5  
## $V5$chi2  
## [1] 31.65336  
##   
## $V5$Z  
## [1] 1.9635683 3.9391640 2.0902391 0.3395201 -1.3738189 -3.0901723  
## [7] 1.5250381 0.5532227 -0.4068830 1.2773047 -1.6848326 -3.2139721  
## [13] -4.6780283 -1.8449611 -2.4640686  
##   
## $V5$P  
## [1] 2.479009e-02 4.088301e-05 1.829816e-02 3.671090e-01 8.474896e-02  
## [6] 1.000202e-03 6.362480e-02 2.900555e-01 3.420470e-01 1.007473e-01  
## [11] 4.601043e-02 6.545619e-04 1.448233e-06 3.252160e-02 6.868490e-03  
##   
## $V5$P.adjusted  
## [1] 2.231108e-01 5.723621e-04 1.829816e-01 3.671090e-01 4.237448e-01  
## [6] 1.200242e-02 3.817488e-01 8.701664e-01 6.840939e-01 4.029894e-01  
## [11] 3.220730e-01 8.509305e-03 2.172349e-05 2.601728e-01 7.555339e-02  
##   
## $V5$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"  
##   
##   
## $V6  
## $V6$chi2  
## [1] 19.08643  
##   
## $V6$Z  
## [1] -1.78575632 -3.03299235 -1.30498492 -0.06206281 1.50946909 2.59344411  
## [7] -0.62616013 0.27161235 0.87487298 -0.56909617 1.22778030 2.60659578  
## [13] 3.52873820 1.19606795 1.35272827  
##   
## $V6$P  
## [1] 0.037069361 0.001210709 0.095948992 0.475256406 0.065589474 0.004750999  
## [7] 0.265604959 0.392960051 0.190821512 0.284645438 0.109764726 0.004572362  
## [13] 0.000208773 0.115835022 0.088071228  
##   
## $V6$P.adjusted  
## [1] 0.407762974 0.016949922 0.767591934 0.475256406 0.655894743 0.057011989  
## [7] 1.000000000 0.785920103 0.954107559 0.853936315 0.768353081 0.059440709  
## [13] 0.003131595 0.695010132 0.792641054  
##   
## $V6$comparisons  
## [1] "AF - AS" "AF - EU" "AS - EU" "AF - NA" "AS - NA" "EU - NA" "AF - OC"  
## [8] "AS - OC" "EU - OC" "NA - OC" "AF - SA" "AS - SA" "EU - SA" "NA - SA"  
## [15] "OC - SA"

**library**(tableone)  
vars<-**c**(**colnames**(results[,3**:**14]))  
factorvars<-**c**("Continent")  
tab1<-**CreateTableOne**(vars=vars, strata="Continent", data=results)  
**print**(tab1, nonnormal=vars)

## Stratified by Continent  
## AF   
## n 24   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) -22.50 [-27.25, 1.00]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) -19.00 [-26.00, 1.00]   
## parks\_percent\_change\_from\_baseline (median [IQR]) -1.50 [-24.25, 12.00]   
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) -4.00 [-25.25, 2.50]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) -16.50 [-24.25, 1.75]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -45.50 [-53.25, -27.25]  
## V1 (median [IQR]) -0.35 [-0.47, -0.24]   
## V2 (median [IQR]) -0.31 [-0.42, -0.16]   
## V3 (median [IQR]) -0.39 [-0.48, -0.23]   
## V4 (median [IQR]) -0.35 [-0.46, -0.23]   
## V5 (median [IQR]) -0.32 [-0.44, -0.18]   
## V6 (median [IQR]) 0.40 [0.26, 0.49]   
## Stratified by Continent  
## AS   
## n 32   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) -2.00 [-24.25, 12.00]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) -1.00 [-24.25, 13.25]   
## parks\_percent\_change\_from\_baseline (median [IQR]) -12.00 [-26.50, 7.00]   
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) 2.50 [-19.00, 15.50]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) -2.00 [-23.25, 14.00]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -31.00 [-52.25, -15.00]  
## V1 (median [IQR]) -0.46 [-0.59, -0.33]   
## V2 (median [IQR]) -0.40 [-0.51, 0.24]   
## V3 (median [IQR]) -0.49 [-0.63, 0.30]   
## V4 (median [IQR]) -0.42 [-0.62, 0.28]   
## V5 (median [IQR]) -0.47 [-0.63, -0.16]   
## V6 (median [IQR]) 0.53 [-0.30, 0.66]   
## Stratified by Continent  
## EU   
## n 36   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) 2.00 [-4.00, 4.75]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) 3.00 [-3.25, 4.00]   
## parks\_percent\_change\_from\_baseline (median [IQR]) -1.00 [-15.50, 23.50]   
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) 1.50 [-3.00, 5.00]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) 3.50 [-2.00, 6.00]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -25.50 [-31.00, -23.00]  
## V1 (median [IQR]) -0.63 [-0.73, -0.55]   
## V2 (median [IQR]) -0.51 [-0.56, -0.38]   
## V3 (median [IQR]) -0.34 [-0.48, 0.33]   
## V4 (median [IQR]) -0.65 [-0.72, -0.59]   
## V5 (median [IQR]) -0.58 [-0.66, -0.50]   
## V6 (median [IQR]) 0.57 [0.54, 0.66]   
## Stratified by Continent  
## NA   
## n 16   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) 1.50 [-11.25, 16.25]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) -3.00 [-14.75, 11.50]   
## parks\_percent\_change\_from\_baseline (median [IQR]) -7.00 [-19.25, 11.25]   
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) -5.50 [-27.25, 10.75]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) -3.00 [-12.50, 14.50]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -32.00 [-41.50, -14.50]  
## V1 (median [IQR]) -0.38 [-0.52, -0.25]   
## V2 (median [IQR]) -0.38 [-0.50, -0.26]   
## V3 (median [IQR]) -0.38 [-0.46, -0.33]   
## V4 (median [IQR]) -0.37 [-0.51, -0.28]   
## V5 (median [IQR]) -0.37 [-0.47, -0.23]   
## V6 (median [IQR]) 0.36 [0.28, 0.48]   
## Stratified by Continent  
## OC   
## n 4   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) 8.50 [6.75, 11.25]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) 9.00 [2.50, 12.00]   
## parks\_percent\_change\_from\_baseline (median [IQR]) 9.00 [-2.50, 12.50]   
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) 8.00 [5.75, 11.50]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) 9.00 [6.50, 12.50]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -20.00 [-22.50, -16.50]  
## V1 (median [IQR]) -0.51 [-0.66, -0.33]   
## V2 (median [IQR]) -0.46 [-0.57, -0.32]   
## V3 (median [IQR]) -0.40 [-0.59, -0.07]   
## V4 (median [IQR]) -0.51 [-0.68, -0.32]   
## V5 (median [IQR]) -0.50 [-0.67, -0.31]   
## V6 (median [IQR]) 0.42 [0.06, 0.65]   
## Stratified by Continent  
## SA   
## n 10   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) 27.00 [-4.25, 28.00]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) 27.00 [-3.50, 28.00]   
## parks\_percent\_change\_from\_baseline (median [IQR]) 14.00 [-22.00, 27.00]  
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) 27.50 [7.50, 28.00]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) 28.00 [27.25, 28.00]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -1.00 [-1.75, -1.00]   
## V1 (median [IQR]) 0.33 [-0.43, 0.37]   
## V2 (median [IQR]) 0.29 [-0.41, 0.36]   
## V3 (median [IQR]) -0.02 [-0.52, 0.33]   
## V4 (median [IQR]) 0.37 [-0.22, 0.45]   
## V5 (median [IQR]) 0.34 [0.31, 0.47]   
## V6 (median [IQR]) -0.31 [-0.42, 0.35]   
## Stratified by Continent  
## p   
## n   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) 0.013  
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) 0.069  
## parks\_percent\_change\_from\_baseline (median [IQR]) 0.542  
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) 0.014  
## workplaces\_percent\_change\_from\_baseline (median [IQR]) <0.001  
## residential\_percent\_change\_from\_baseline (median [IQR]) <0.001  
## V1 (median [IQR]) <0.001  
## V2 (median [IQR]) 0.022  
## V3 (median [IQR]) 0.349  
## V4 (median [IQR]) <0.001  
## V5 (median [IQR]) <0.001  
## V6 (median [IQR]) 0.002  
## Stratified by Continent  
## test   
## n   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## parks\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## workplaces\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## residential\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## V1 (median [IQR]) nonnorm  
## V2 (median [IQR]) nonnorm  
## V3 (median [IQR]) nonnorm  
## V4 (median [IQR]) nonnorm  
## V5 (median [IQR]) nonnorm  
## V6 (median [IQR]) nonnorm

**write.csv**(**print**(tab1, nonnormal=vars), "correlationtablescovidcontinentrev.csv")

## Stratified by Continent  
## AF   
## n 24   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) -22.50 [-27.25, 1.00]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) -19.00 [-26.00, 1.00]   
## parks\_percent\_change\_from\_baseline (median [IQR]) -1.50 [-24.25, 12.00]   
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) -4.00 [-25.25, 2.50]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) -16.50 [-24.25, 1.75]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -45.50 [-53.25, -27.25]  
## V1 (median [IQR]) -0.35 [-0.47, -0.24]   
## V2 (median [IQR]) -0.31 [-0.42, -0.16]   
## V3 (median [IQR]) -0.39 [-0.48, -0.23]   
## V4 (median [IQR]) -0.35 [-0.46, -0.23]   
## V5 (median [IQR]) -0.32 [-0.44, -0.18]   
## V6 (median [IQR]) 0.40 [0.26, 0.49]   
## Stratified by Continent  
## AS   
## n 32   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) -2.00 [-24.25, 12.00]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) -1.00 [-24.25, 13.25]   
## parks\_percent\_change\_from\_baseline (median [IQR]) -12.00 [-26.50, 7.00]   
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) 2.50 [-19.00, 15.50]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) -2.00 [-23.25, 14.00]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -31.00 [-52.25, -15.00]  
## V1 (median [IQR]) -0.46 [-0.59, -0.33]   
## V2 (median [IQR]) -0.40 [-0.51, 0.24]   
## V3 (median [IQR]) -0.49 [-0.63, 0.30]   
## V4 (median [IQR]) -0.42 [-0.62, 0.28]   
## V5 (median [IQR]) -0.47 [-0.63, -0.16]   
## V6 (median [IQR]) 0.53 [-0.30, 0.66]   
## Stratified by Continent  
## EU   
## n 36   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) 2.00 [-4.00, 4.75]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) 3.00 [-3.25, 4.00]   
## parks\_percent\_change\_from\_baseline (median [IQR]) -1.00 [-15.50, 23.50]   
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) 1.50 [-3.00, 5.00]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) 3.50 [-2.00, 6.00]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -25.50 [-31.00, -23.00]  
## V1 (median [IQR]) -0.63 [-0.73, -0.55]   
## V2 (median [IQR]) -0.51 [-0.56, -0.38]   
## V3 (median [IQR]) -0.34 [-0.48, 0.33]   
## V4 (median [IQR]) -0.65 [-0.72, -0.59]   
## V5 (median [IQR]) -0.58 [-0.66, -0.50]   
## V6 (median [IQR]) 0.57 [0.54, 0.66]   
## Stratified by Continent  
## NA   
## n 16   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) 1.50 [-11.25, 16.25]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) -3.00 [-14.75, 11.50]   
## parks\_percent\_change\_from\_baseline (median [IQR]) -7.00 [-19.25, 11.25]   
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) -5.50 [-27.25, 10.75]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) -3.00 [-12.50, 14.50]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -32.00 [-41.50, -14.50]  
## V1 (median [IQR]) -0.38 [-0.52, -0.25]   
## V2 (median [IQR]) -0.38 [-0.50, -0.26]   
## V3 (median [IQR]) -0.38 [-0.46, -0.33]   
## V4 (median [IQR]) -0.37 [-0.51, -0.28]   
## V5 (median [IQR]) -0.37 [-0.47, -0.23]   
## V6 (median [IQR]) 0.36 [0.28, 0.48]   
## Stratified by Continent  
## OC   
## n 4   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) 8.50 [6.75, 11.25]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) 9.00 [2.50, 12.00]   
## parks\_percent\_change\_from\_baseline (median [IQR]) 9.00 [-2.50, 12.50]   
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) 8.00 [5.75, 11.50]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) 9.00 [6.50, 12.50]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -20.00 [-22.50, -16.50]  
## V1 (median [IQR]) -0.51 [-0.66, -0.33]   
## V2 (median [IQR]) -0.46 [-0.57, -0.32]   
## V3 (median [IQR]) -0.40 [-0.59, -0.07]   
## V4 (median [IQR]) -0.51 [-0.68, -0.32]   
## V5 (median [IQR]) -0.50 [-0.67, -0.31]   
## V6 (median [IQR]) 0.42 [0.06, 0.65]   
## Stratified by Continent  
## SA   
## n 10   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) 27.00 [-4.25, 28.00]   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) 27.00 [-3.50, 28.00]   
## parks\_percent\_change\_from\_baseline (median [IQR]) 14.00 [-22.00, 27.00]  
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) 27.50 [7.50, 28.00]   
## workplaces\_percent\_change\_from\_baseline (median [IQR]) 28.00 [27.25, 28.00]   
## residential\_percent\_change\_from\_baseline (median [IQR]) -1.00 [-1.75, -1.00]   
## V1 (median [IQR]) 0.33 [-0.43, 0.37]   
## V2 (median [IQR]) 0.29 [-0.41, 0.36]   
## V3 (median [IQR]) -0.02 [-0.52, 0.33]   
## V4 (median [IQR]) 0.37 [-0.22, 0.45]   
## V5 (median [IQR]) 0.34 [0.31, 0.47]   
## V6 (median [IQR]) -0.31 [-0.42, 0.35]   
## Stratified by Continent  
## p   
## n   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) 0.013  
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) 0.069  
## parks\_percent\_change\_from\_baseline (median [IQR]) 0.542  
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) 0.014  
## workplaces\_percent\_change\_from\_baseline (median [IQR]) <0.001  
## residential\_percent\_change\_from\_baseline (median [IQR]) <0.001  
## V1 (median [IQR]) <0.001  
## V2 (median [IQR]) 0.022  
## V3 (median [IQR]) 0.349  
## V4 (median [IQR]) <0.001  
## V5 (median [IQR]) <0.001  
## V6 (median [IQR]) 0.002  
## Stratified by Continent  
## test   
## n   
## retail\_and\_recreation\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## parks\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## transit\_stations\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## workplaces\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## residential\_percent\_change\_from\_baseline (median [IQR]) nonnorm  
## V1 (median [IQR]) nonnorm  
## V2 (median [IQR]) nonnorm  
## V3 (median [IQR]) nonnorm  
## V4 (median [IQR]) nonnorm  
## V5 (median [IQR]) nonnorm  
## V6 (median [IQR]) nonnorm

**library**(dplyr)

##   
## Attaching package: 'dplyr'

## The following objects are masked from 'package:data.table':  
##   
## between, first, last

## The following objects are masked from 'package:stats':  
##   
## filter, lag

## The following objects are masked from 'package:base':  
##   
## intersect, setdiff, setequal, union

**require**(maps)

## Loading required package: maps

**require**(viridis)

## Loading required package: viridis

## Loading required package: viridisLite

**theme\_set**(**theme\_void**())  
  
world\_map <- **map\_data**("world")  
  
  
results**$**region<-results**$**country\_region  
**print**(**levels**(**factor**(world\_map**$**region)))

## [1] "Afghanistan"   
## [2] "Albania"   
## [3] "Algeria"   
## [4] "American Samoa"   
## [5] "Andorra"   
## [6] "Angola"   
## [7] "Anguilla"   
## [8] "Antarctica"   
## [9] "Antigua"   
## [10] "Argentina"   
## [11] "Armenia"   
## [12] "Aruba"   
## [13] "Ascension Island"   
## [14] "Australia"   
## [15] "Austria"   
## [16] "Azerbaijan"   
## [17] "Azores"   
## [18] "Bahamas"   
## [19] "Bahrain"   
## [20] "Bangladesh"   
## [21] "Barbados"   
## [22] "Barbuda"   
## [23] "Belarus"   
## [24] "Belgium"   
## [25] "Belize"   
## [26] "Benin"   
## [27] "Bermuda"   
## [28] "Bhutan"   
## [29] "Bolivia"   
## [30] "Bonaire"   
## [31] "Bosnia and Herzegovina"   
## [32] "Botswana"   
## [33] "Brazil"   
## [34] "Brunei"   
## [35] "Bulgaria"   
## [36] "Burkina Faso"   
## [37] "Burundi"   
## [38] "Cambodia"   
## [39] "Cameroon"   
## [40] "Canada"   
## [41] "Canary Islands"   
## [42] "Cape Verde"   
## [43] "Cayman Islands"   
## [44] "Central African Republic"   
## [45] "Chad"   
## [46] "Chagos Archipelago"   
## [47] "Chile"   
## [48] "China"   
## [49] "Christmas Island"   
## [50] "Cocos Islands"   
## [51] "Colombia"   
## [52] "Comoros"   
## [53] "Cook Islands"   
## [54] "Costa Rica"   
## [55] "Croatia"   
## [56] "Cuba"   
## [57] "Curacao"   
## [58] "Cyprus"   
## [59] "Czech Republic"   
## [60] "Democratic Republic of the Congo"   
## [61] "Denmark"   
## [62] "Djibouti"   
## [63] "Dominica"   
## [64] "Dominican Republic"   
## [65] "Ecuador"   
## [66] "Egypt"   
## [67] "El Salvador"   
## [68] "Equatorial Guinea"   
## [69] "Eritrea"   
## [70] "Estonia"   
## [71] "Ethiopia"   
## [72] "Falkland Islands"   
## [73] "Faroe Islands"   
## [74] "Fiji"   
## [75] "Finland"   
## [76] "France"   
## [77] "French Guiana"   
## [78] "French Polynesia"   
## [79] "French Southern and Antarctic Lands"  
## [80] "Gabon"   
## [81] "Gambia"   
## [82] "Georgia"   
## [83] "Germany"   
## [84] "Ghana"   
## [85] "Greece"   
## [86] "Greenland"   
## [87] "Grenada"   
## [88] "Grenadines"   
## [89] "Guadeloupe"   
## [90] "Guam"   
## [91] "Guatemala"   
## [92] "Guernsey"   
## [93] "Guinea"   
## [94] "Guinea-Bissau"   
## [95] "Guyana"   
## [96] "Haiti"   
## [97] "Heard Island"   
## [98] "Honduras"   
## [99] "Hungary"   
## [100] "Iceland"   
## [101] "India"   
## [102] "Indonesia"   
## [103] "Iran"   
## [104] "Iraq"   
## [105] "Ireland"   
## [106] "Isle of Man"   
## [107] "Israel"   
## [108] "Italy"   
## [109] "Ivory Coast"   
## [110] "Jamaica"   
## [111] "Japan"   
## [112] "Jersey"   
## [113] "Jordan"   
## [114] "Kazakhstan"   
## [115] "Kenya"   
## [116] "Kiribati"   
## [117] "Kosovo"   
## [118] "Kuwait"   
## [119] "Kyrgyzstan"   
## [120] "Laos"   
## [121] "Latvia"   
## [122] "Lebanon"   
## [123] "Lesotho"   
## [124] "Liberia"   
## [125] "Libya"   
## [126] "Liechtenstein"   
## [127] "Lithuania"   
## [128] "Luxembourg"   
## [129] "Macedonia"   
## [130] "Madagascar"   
## [131] "Madeira Islands"   
## [132] "Malawi"   
## [133] "Malaysia"   
## [134] "Maldives"   
## [135] "Mali"   
## [136] "Malta"   
## [137] "Marshall Islands"   
## [138] "Martinique"   
## [139] "Mauritania"   
## [140] "Mauritius"   
## [141] "Mayotte"   
## [142] "Mexico"   
## [143] "Micronesia"   
## [144] "Moldova"   
## [145] "Monaco"   
## [146] "Mongolia"   
## [147] "Montenegro"   
## [148] "Montserrat"   
## [149] "Morocco"   
## [150] "Mozambique"   
## [151] "Myanmar"   
## [152] "Namibia"   
## [153] "Nauru"   
## [154] "Nepal"   
## [155] "Netherlands"   
## [156] "Nevis"   
## [157] "New Caledonia"   
## [158] "New Zealand"   
## [159] "Nicaragua"   
## [160] "Niger"   
## [161] "Nigeria"   
## [162] "Niue"   
## [163] "Norfolk Island"   
## [164] "North Korea"   
## [165] "Northern Mariana Islands"   
## [166] "Norway"   
## [167] "Oman"   
## [168] "Pakistan"   
## [169] "Palau"   
## [170] "Palestine"   
## [171] "Panama"   
## [172] "Papua New Guinea"   
## [173] "Paraguay"   
## [174] "Peru"   
## [175] "Philippines"   
## [176] "Pitcairn Islands"   
## [177] "Poland"   
## [178] "Portugal"   
## [179] "Puerto Rico"   
## [180] "Qatar"   
## [181] "Republic of Congo"   
## [182] "Reunion"   
## [183] "Romania"   
## [184] "Russia"   
## [185] "Rwanda"   
## [186] "Saba"   
## [187] "Saint Barthelemy"   
## [188] "Saint Helena"   
## [189] "Saint Kitts"   
## [190] "Saint Lucia"   
## [191] "Saint Martin"   
## [192] "Saint Pierre and Miquelon"   
## [193] "Saint Vincent"   
## [194] "Samoa"   
## [195] "San Marino"   
## [196] "Sao Tome and Principe"   
## [197] "Saudi Arabia"   
## [198] "Senegal"   
## [199] "Serbia"   
## [200] "Seychelles"   
## [201] "Siachen Glacier"   
## [202] "Sierra Leone"   
## [203] "Singapore"   
## [204] "Sint Eustatius"   
## [205] "Sint Maarten"   
## [206] "Slovakia"   
## [207] "Slovenia"   
## [208] "Solomon Islands"   
## [209] "Somalia"   
## [210] "South Africa"   
## [211] "South Georgia"   
## [212] "South Korea"   
## [213] "South Sandwich Islands"   
## [214] "South Sudan"   
## [215] "Spain"   
## [216] "Sri Lanka"   
## [217] "Sudan"   
## [218] "Suriname"   
## [219] "Swaziland"   
## [220] "Sweden"   
## [221] "Switzerland"   
## [222] "Syria"   
## [223] "Taiwan"   
## [224] "Tajikistan"   
## [225] "Tanzania"   
## [226] "Thailand"   
## [227] "Timor-Leste"   
## [228] "Tobago"   
## [229] "Togo"   
## [230] "Tonga"   
## [231] "Trinidad"   
## [232] "Tunisia"   
## [233] "Turkey"   
## [234] "Turkmenistan"   
## [235] "Turks and Caicos Islands"   
## [236] "Uganda"   
## [237] "UK"   
## [238] "Ukraine"   
## [239] "United Arab Emirates"   
## [240] "Uruguay"   
## [241] "USA"   
## [242] "Uzbekistan"   
## [243] "Vanuatu"   
## [244] "Vatican"   
## [245] "Venezuela"   
## [246] "Vietnam"   
## [247] "Virgin Islands"   
## [248] "Wallis and Futuna"   
## [249] "Western Sahara"   
## [250] "Yemen"   
## [251] "Zambia"   
## [252] "Zimbabwe"

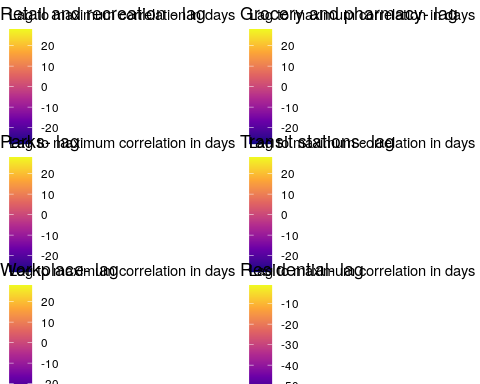
**print**(**levels**(**factor**(results**$**region)))

## [1] "Afghanistan" "Angola" "Antigua and Barbuda"   
## [4] "Argentina" "Australia" "Austria"   
## [7] "Bahrain" "Bangladesh" "Barbados"   
## [10] "Belarus" "Belgium" "Belize"   
## [13] "Benin" "Bolivia" "Bosnia and Herzegovina"  
## [16] "Botswana" "Brazil" "Bulgaria"   
## [19] "Burkina Faso" "Cambodia" "Cameroon"   
## [22] "Canada" "Chile" "Colombia"   
## [25] "Costa Rica" "Croatia" "Czechia"   
## [28] "Denmark" "Dominican Republic" "Ecuador"   
## [31] "Egypt" "El Salvador" "Estonia"   
## [34] "Fiji" "Finland" "France"   
## [37] "Gabon" "Georgia" "Germany"   
## [40] "Ghana" "Greece" "Guatemala"   
## [43] "Haiti" "Honduras" "Hungary"   
## [46] "India" "Indonesia" "Iraq"   
## [49] "Ireland" "Israel" "Italy"   
## [52] "Jamaica" "Japan" "Jordan"   
## [55] "Kazakhstan" "Kenya" "Kuwait"   
## [58] "Kyrgyzstan" "Laos" "Latvia"   
## [61] "Lebanon" "Libya" "Lithuania"   
## [64] "Luxembourg" "Malaysia" "Mali"   
## [67] "Malta" "Mauritius" "Mexico"   
## [70] "Moldova" "Mongolia" "Morocco"   
## [73] "Mozambique" "Namibia" "Nepal"   
## [76] "Netherlands" "New Zealand" "Nicaragua"   
## [79] "Niger" "Nigeria" "North Macedonia"   
## [82] "Norway" "Oman" "Pakistan"   
## [85] "Panama" "Papua New Guinea" "Paraguay"   
## [88] "Peru" "Philippines" "Poland"   
## [91] "Portugal" "Qatar" "Romania"   
## [94] "Russia" "Rwanda" "Saudi Arabia"   
## [97] "Senegal" "Serbia" "Singapore"   
## [100] "Slovakia" "Slovenia" "South Africa"   
## [103] "Spain" "Sri Lanka" "Sweden"   
## [106] "Switzerland" "Tajikistan" "Tanzania"   
## [109] "Thailand" "Togo" "Trinidad and Tobago"   
## [112] "Turkey" "Uganda" "Ukraine"   
## [115] "United Arab Emirates" "United Kingdom" "United States"   
## [118] "Uruguay" "Venezuela" "Vietnam"   
## [121] "Yemen" "Zambia"

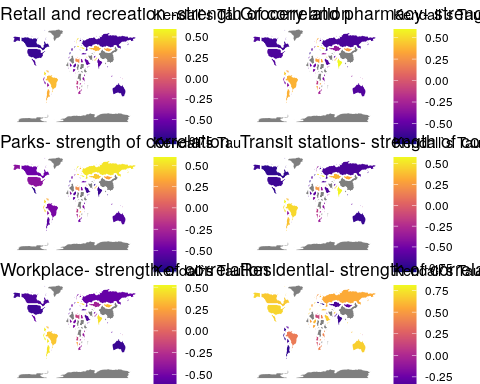
different2 <- **anti\_join**(results, world\_map, by = "region")  
**print**(**levels**(**factor**(different2**$**region )))

## [1] "Antigua and Barbuda" "Czechia" "North Macedonia"   
## [4] "Trinidad and Tobago" "United Kingdom" "United States"

world\_map <- **map\_data**("world")  
 world\_map<-world\_map **%>%** *#here change all county names that do not match in the world map to the data terminology*  
 **mutate**(region = **ifelse**(region **==**"USA", "United States", region))   
 world\_map<-world\_map **%>%** *#here change all county names that do not match in the world map to the data terminology*  
 **mutate**(region = **ifelse**(region **==**"UK", "United Kingdom", region))   
 world\_map<-world\_map **%>%** *#here change all county names that do not match in the world map to the data terminology*  
 **mutate**(region = **ifelse**(region **==**"Trinidad", "Trinidad and Tobago", region))   
 world\_map<-world\_map **%>%** *#here change all county names that do not match in the world map to the data terminology*  
 **mutate**(region = **ifelse**(region **==**"Macedonia", "North Macedonia", region))   
 world\_map<-world\_map **%>%** *#here change all county names that do not match in the world map to the data terminology*  
 **mutate**(region = **ifelse**(region **==**"Czech Republic", "Czechia", region))   
 world\_map<-world\_map **%>%** *#here change all county names that do not match in the world map to the data terminology*  
 **mutate**(region = **ifelse**(region **==**"Antigua", "Antigua and Barbuda", region))   
  
corrmap <- **full\_join**( world\_map, results, by = "region")  
  
  
 p1<-**ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = retail\_and\_recreation\_percent\_change\_from\_baseline ), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Retail and recreation - lag") **+** **labs**(fill = "Lag to maximum correlation in days")  
p2<- **ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = V1 ), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Retail and recreation -strength of correlation") **+** **labs**(fill = "Kendall`s Tau")  
  
 p3<-**ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = grocery\_and\_pharmacy\_percent\_change\_from\_baseline), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Grocery and pharmacy- lag") **+** **labs**(fill = "Lag to maximum correlation in days")  
p4<- **ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = V2 ), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Grocery and pharmacy- strength of correlation") **+** **labs**(fill = "Kendall`s Tau")  
  
 p5<-**ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = parks\_percent\_change\_from\_baseline), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Parks- lag") **+** **labs**(fill = "Lag to maximum correlation in days")  
p6<- **ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = V3 ), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Parks- strength of correlation") **+** **labs**(fill = "Kendall`s Tau")  
 p7<-**ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = transit\_stations\_percent\_change\_from\_baseline), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Transit stations- lag") **+** **labs**(fill = "Lag to maximum correlation in days")  
p8<- **ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = V4 ), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Transit stations- strength of correlation") **+** **labs**(fill = "Kendall`s Tau")  
p9<-**ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = workplaces\_percent\_change\_from\_baseline), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Workplace- lag") **+** **labs**(fill = "Lag to maximum correlation in days")  
p10<- **ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = V5 ), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Workplace- strength of correlation") **+** **labs**(fill = "Kendall`s Tau")  
p11<-**ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = residential\_percent\_change\_from\_baseline), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Residential- lag") **+** **labs**(fill = "Lag to maximum correlation in days")  
p12<- **ggplot**(corrmap, **aes**(long, lat, group=group))**+**  
 **geom\_polygon**(**aes**(fill = V6), color = "white")**+**  
 **scale\_fill\_viridis\_c**(option = "C") **+** **ggtitle**("Residential- strength of correlation") **+** **labs**(fill = "Kendall`s Tau")  
  
  
   
**library**(ggpubr)  
lags<- **ggarrange**(p1, p3, p5, p7, p9, p11 , ncol = 2, nrow = 3)  
lags



taus<- **ggarrange**(p2, p4, p6, p8, p10, p12, ncol = 2, nrow = 3)  
taus



**summary**(results)

## country\_region Continent   
## Length:122 Length:122   
## Class :character Class :character   
## Mode :character Mode :character   
##   
##   
##   
## retail\_and\_recreation\_percent\_change\_from\_baseline  
## Min. :-28.0000   
## 1st Qu.:-15.7500   
## Median : 1.0000   
## Mean : -0.7705   
## 3rd Qu.: 11.7500   
## Max. : 28.0000   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline  
## Min. :-28.0000   
## 1st Qu.:-20.5000   
## Median : 2.0000   
## Mean : -0.6721   
## 3rd Qu.: 10.7500   
## Max. : 28.0000   
## parks\_percent\_change\_from\_baseline  
## Min. :-28.000   
## 1st Qu.:-24.000   
## Median : -2.000   
## Mean : -2.566   
## 3rd Qu.: 13.000   
## Max. : 28.000   
## transit\_stations\_percent\_change\_from\_baseline  
## Min. :-28.00000   
## 1st Qu.:-14.50000   
## Median : 1.00000   
## Mean : 0.02459   
## 3rd Qu.: 10.00000   
## Max. : 28.00000   
## workplaces\_percent\_change\_from\_baseline  
## Min. :-28.00000   
## 1st Qu.:-15.50000   
## Median : 1.00000   
## Mean : -0.08197   
## 3rd Qu.: 11.00000   
## Max. : 28.00000   
## residential\_percent\_change\_from\_baseline V1 V2   
## Min. :-57.00 Min. :-0.7978 Min. :-0.7393   
## 1st Qu.:-44.50 1st Qu.:-0.6231 1st Qu.:-0.5186   
## Median :-28.00 Median :-0.4705 Median :-0.3979   
## Mean :-29.08 Mean :-0.3464 Mean :-0.2611   
## 3rd Qu.:-18.00 3rd Qu.:-0.2582 3rd Qu.:-0.1852   
## Max. : -1.00 Max. : 0.5947 Max. : 0.5978   
## V3 V4 V5 V6   
## Min. :-0.7520 Min. :-0.8010 Min. :-0.7908 Min. :-0.5182   
## 1st Qu.:-0.5052 1st Qu.:-0.6432 1st Qu.:-0.5810 1st Qu.: 0.2507   
## Median :-0.3856 Median :-0.4386 Median :-0.4550 Median : 0.4881   
## Mean :-0.2289 Mean :-0.3451 Mean :-0.3100 Mean : 0.3439   
## 3rd Qu.: 0.2248 3rd Qu.:-0.2335 3rd Qu.:-0.1942 3rd Qu.: 0.6293   
## Max. : 0.5945 Max. : 0.5785 Max. : 0.5227 Max. : 0.8121   
## region   
## Length:122   
## Class :character   
## Mode :character   
##   
##   
##

**write.csv**(results, "resultscovidcorrgmd.csv")

#mobility data  
gmr <- read\_csv("Downloads/Global\_Mobility\_Report(2).csv", col\_types = cols(date = col\_date(format = "%Y-%m-%d")))  
  
  
  
### Loading country data  
  
countries <- fread("http://download.geonames.org/export/dump/countryInfo.txt", skip = "ISO3", na.strings = "")  
names(countries)[c(1,5, 9)] <- c("geo", "Country.Region", "Continent")  
countries$lang <- sapply(strsplit(sapply(strsplit(countries$Languages, ","), `[`, 1), "-"), `[`, 1)  
countries$translated <- "Coronavirus"  
  
### Obtaining the case numbers  
  
jhu\_url <- paste0("https://raw.githubusercontent.com/CSSEGISandData/COVID-19/master/csse\_covid\_19\_data/",  
 "csse\_covid\_19\_time\_series/time\_series\_covid19\_confirmed\_global.csv")  
CaseData <- fread(jhu\_url, check.names = TRUE)  
CaseData$Province.State[ CaseData$Province.State=="" ] <- CaseData$Country.Region[ CaseData$Province.State=="" ]  
CaseData <- melt(CaseData, id.vars = 1:4, variable.name = "Date", variable.factor = FALSE)  
CaseData$Date <- as.Date( substring(CaseData$Date, 2), format = "%m.%d.%y" )  
CaseData <- CaseData[ , .(CumCaseNumber = sum(value)), .(Country.Region, Date)][order(Country.Region, Date)]  
CaseData <- CaseData[ ,.(date = Date[-1], CumCaseNumber = CumCaseNumber[-1], IncCaseNumber = diff(CumCaseNumber)),  
 .(Country.Region)]  
  
CaseData[Country.Region=="US"]$Country.Region <- "United States"  
CaseData <- merge(CaseData,countries[,c("Country.Region", "geo", "Continent")])  
CaseData$country\_region<-CaseData$Country.Region  
  
CaseData$IncCaseNumber<-ifelse(CaseData$IncCaseNumber<0, 0, CaseData$IncCaseNumber )  
write.csv(CaseData, "CaseNumbberseptember0110.csv")  
  
  
  
  
allmerged<-merge(gmr, CaseData, by=c("country\_region", "date"))  
all<-allmerged  
all$NumDate <- as.numeric(all$date)-min(as.numeric(all$date))  
data<- subset(all, is.na(all$sub\_region\_1)==TRUE)  
data$IncCaseNumber<-ifelse(data$IncCaseNumber<0, 0, data$IncCaseNumber )  
  
data<-data[c(1,2, 9:14, 17,20)]  
summary(data)

## country\_region date   
## Length:38439 Min. :2020-02-15   
## Class :character 1st Qu.:2020-04-06   
## Mode :character Median :2020-05-28   
## Mean :2020-05-27   
## 3rd Qu.:2020-07-19   
## Max. :2020-09-08   
##   
## retail\_and\_recreation\_percent\_change\_from\_baseline  
## Min. :-98.00   
## 1st Qu.:-47.00   
## Median :-21.00   
## Mean :-26.45   
## 3rd Qu.: -4.00   
## Max. : 66.00   
## NA's :305   
## grocery\_and\_pharmacy\_percent\_change\_from\_baseline  
## Min. :-98.00   
## 1st Qu.:-24.00   
## Median : -7.00   
## Mean :-11.98   
## 3rd Qu.: 3.00   
## Max. :100.00   
## NA's :350   
## parks\_percent\_change\_from\_baseline  
## Min. :-97.000   
## 1st Qu.:-35.000   
## Median :-11.000   
## Mean : -2.264   
## 3rd Qu.: 11.000   
## Max. :517.000   
## NA's :333   
## transit\_stations\_percent\_change\_from\_baseline  
## Min. :-96.00   
## 1st Qu.:-51.00   
## Median :-30.00   
## Mean :-31.12   
## 3rd Qu.: -9.00   
## Max. : 67.00   
## NA's :214   
## workplaces\_percent\_change\_from\_baseline  
## Min. :-93.00   
## 1st Qu.:-39.00   
## Median :-24.00   
## Mean :-24.97   
## 3rd Qu.: -8.00   
## Max. : 80.00   
## NA's :60   
## residential\_percent\_change\_from\_baseline IncCaseNumber NumDate   
## Min. :-35.00 Min. : 0 Min. : 0.0   
## 1st Qu.: 2.00 1st Qu.: 2 1st Qu.: 51.0   
## Median : 10.00 Median : 72 Median :103.0   
## Mean : 10.82 Mean : 1297 Mean :102.9   
## 3rd Qu.: 18.00 3rd Qu.: 637 3rd Qu.:155.0   
## Max. : 55.00 Max. :90802 Max. :206.0   
## NA's :534

data<-na.omit(data)  
  
  
   
  
library(dlnm)

## This is dlnm 2.4.2. For details: help(dlnm) and vignette('dlnmOverview').

library(lme4)

## Loading required package: Matrix

library(lmerTest)

##   
## Attaching package: 'lmerTest'

## The following object is masked from 'package:lme4':  
##   
## lmer

## The following object is masked from 'package:stats':  
##   
## step

library(gamm4)

## Loading required package: mgcv

## Loading required package: nlme

##   
## Attaching package: 'nlme'

## The following object is masked from 'package:lme4':  
##   
## lmList

## This is mgcv 1.8-33. For overview type 'help("mgcv-package")'.

## This is gamm4 0.2-6

library(dplyr)

##   
## Attaching package: 'dplyr'

## The following object is masked from 'package:nlme':  
##   
## collapse

## The following objects are masked from 'package:data.table':  
##   
## between, first, last

## The following objects are masked from 'package:stats':  
##   
## filter, lag

## The following objects are masked from 'package:base':  
##   
## intersect, setdiff, setequal, union

data$country\_region<-factor(data$country\_region)  
  
datat<-data %>%  
 filter(date<= "2020-06-19")  
datav<-data %>%  
 filter(date> "2020-06-19")  
  
cb1 <- crossbasis(datat$grocery\_and\_pharmacy\_percent\_change\_from\_baseline , lag=14, argvar=list(fun="bs"),arglag=list(df=5), group=datat$country\_region)  
cb2 <- crossbasis(datat$retail\_and\_recreation\_percent\_change\_from\_baseline , lag=14, argvar=list(fun="bs"),arglag=list(df=5), group=datat$country\_region)  
cb4 <- crossbasis(datat$transit\_stations\_percent\_change\_from\_baseline , lag=14, argvar=list(fun="bs"),arglag=list(df=5), group=datat$country\_region)  
cb5 <- crossbasis(datat$workplaces\_percent\_change\_from\_baseline , lag=14, argvar=list(fun="bs"),arglag=list(df=5), group=datat$country\_region)  
cb6 <- crossbasis(datat$residential\_percent\_change\_from\_baseline , lag=14, argvar=list(fun="bs"),arglag=list(df=5), group=datat$country\_region)  
  
 #make data identical to the dataset with crossbasis (deleting the first 14 observations in all countries)  
datam<-datat %>%  
 group\_by(country\_region) %>%  
 slice(-c(1:14))  
set.seed(2020)  
fittweedie<-gam(IncCaseNumber~s(NumDate) + s(country\_region, bs="re"), data=datam, family="tw")  
summary(fittweedie) # just to estimate p , with gam instead of gamm model ######

##   
## Family: Tweedie(p=1.656)   
## Link function: log   
##   
## Formula:  
## IncCaseNumber ~ s(NumDate) + s(country\_region, bs = "re")  
##   
## Parametric coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.2818 0.2192 14.97 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Approximate significance of smooth terms:  
## edf Ref.df F p-value   
## s(NumDate) 8.896 8.994 2675.8 <2e-16 \*\*\*  
## s(country\_region) 121.568 122.000 647.3 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## R-sq.(adj) = 0.664 Deviance explained = 83.9%  
## -REML = 1.0975e+05 Scale est. = 6.5753 n = 21311

BIC(fittweedie)

## [1] 220034.9

fit1 <- gamm(IncCaseNumber~s(NumDate), random=list(country\_region=~1), data=datam, family=Tweedie(p=1.656)) ####modify power functin accordingly

##   
## Maximum number of PQL iterations: 20

## iteration 1

## iteration 2

## iteration 3

## iteration 4

## iteration 5

## iteration 6

## iteration 7

fit2 <- gamm(IncCaseNumber~s(NumDate)+s(retail\_and\_recreation\_percent\_change\_from\_baseline)+s(grocery\_and\_pharmacy\_percent\_change\_from\_baseline)+ s(transit\_stations\_percent\_change\_from\_baseline)+s(workplaces\_percent\_change\_from\_baseline+residential\_percent\_change\_from\_baseline), random=list(country\_region=~1), data=datam, family=Tweedie(p=1.656))

##   
## Maximum number of PQL iterations: 20

## iteration 1

## iteration 2

## iteration 3

## iteration 4

## iteration 5

## iteration 6

## iteration 7

fitcb<- gamm(IncCaseNumber~s(NumDate) + cb1 + cb2 + cb4 + cb5 + cb6, random=list(country\_region=~1), data=datat, family=Tweedie(p=1.656))

##   
## Maximum number of PQL iterations: 20

## iteration 1

## iteration 2

## iteration 3

## iteration 4

## iteration 5

## iteration 6

## iteration 7

## iteration 8

## iteration 9

## iteration 10

## iteration 11

BIC(fit1$lme)

## [1] 79802.47

BIC(fit2$lme)

## [1] 79096.29

BIC(fitcb$lme)

## [1] 80286.14

summary(fit1$lme)

## Linear mixed-effects model fit by maximum likelihood  
## Data: data   
## AIC BIC logLik  
## 79762.63 79802.47 -39876.32  
##   
## Random effects:  
## Formula: ~Xr - 1 | g  
## Structure: pdIdnot  
## Xr1 Xr2 Xr3 Xr4 Xr5 Xr6 Xr7 Xr8  
## StdDev: 8.205045 8.205045 8.205045 8.205045 8.205045 8.205045 8.205045 8.205045  
##   
## Formula: ~1 | country\_region %in% g  
## (Intercept) Residual  
## StdDev: 2.412045 3.046468  
##   
## Variance function:  
## Structure: fixed weights  
## Formula: ~invwt   
## Fixed effects: list(fixed)   
## Value Std.Error DF t-value p-value  
## X(Intercept) 3.286403 0.2181920 21187 15.06198 0  
## Xs(NumDate)Fx1 8.575054 0.5385667 21187 15.92199 0  
## Correlation:   
## X(Int)  
## Xs(NumDate)Fx1 -0.016  
##   
## Standardized Within-Group Residuals:  
## Min Q1 Med Q3 Max   
## -1.6850292 -0.4765888 -0.2406981 0.2216138 22.4753197   
##   
## Number of Observations: 21311  
## Number of Groups:   
## g country\_region %in% g   
## 1 123

summary(fit2$lme)

## Linear mixed-effects model fit by maximum likelihood  
## Data: data   
## AIC BIC logLik  
## 78992.72 79096.29 -39483.36  
##   
## Random effects:  
## Formula: ~Xr - 1 | g  
## Structure: pdIdnot  
## Xr1 Xr2 Xr3 Xr4 Xr5 Xr6 Xr7 Xr8  
## StdDev: 20.31991 20.31991 20.31991 20.31991 20.31991 20.31991 20.31991 20.31991  
##   
## Formula: ~Xr.0 - 1 | g.0 %in% g  
## Structure: pdIdnot  
## Xr.01 Xr.02 Xr.03 Xr.04 Xr.05 Xr.06 Xr.07 Xr.08  
## StdDev: 4.320994 4.320994 4.320994 4.320994 4.320994 4.320994 4.320994 4.320994  
##   
## Formula: ~Xr.1 - 1 | g.1 %in% g.0 %in% g  
## Structure: pdIdnot  
## Xr.11 Xr.12 Xr.13 Xr.14 Xr.15 Xr.16 Xr.17 Xr.18  
## StdDev: 4.58942 4.58942 4.58942 4.58942 4.58942 4.58942 4.58942 4.58942  
##   
## Formula: ~Xr.2 - 1 | g.2 %in% g.1 %in% g.0 %in% g  
## Structure: pdIdnot  
## Xr.21 Xr.22 Xr.23 Xr.24 Xr.25 Xr.26 Xr.27 Xr.28  
## StdDev: 1.560062 1.560062 1.560062 1.560062 1.560062 1.560062 1.560062 1.560062  
##   
## Formula: ~Xr.3 - 1 | g.3 %in% g.2 %in% g.1 %in% g.0 %in% g  
## Structure: pdIdnot  
## Xr.31 Xr.32 Xr.33 Xr.34 Xr.35 Xr.36 Xr.37 Xr.38  
## StdDev: 2.60778 2.60778 2.60778 2.60778 2.60778 2.60778 2.60778 2.60778  
##   
## Formula: ~1 | country\_region %in% g.3 %in% g.2 %in% g.1 %in% g.0 %in% g  
## (Intercept) Residual  
## StdDev: 2.150661 2.912942  
##   
## Variance function:  
## Structure: fixed weights  
## Formula: ~invwt   
## Fixed effects: list(fixed)   
## Value Std.Error  
## X(Intercept) 3.136555 0.1947519  
## Xs(NumDate)Fx1 14.876413 0.6673706  
## Xs(retail\_and\_recreation\_percent\_change\_from\_baseline)Fx1 -1.335009 0.5947718  
## Xs(grocery\_and\_pharmacy\_percent\_change\_from\_baseline)Fx1 0.333238 0.3623668  
## Xs(transit\_stations\_percent\_change\_from\_baseline)Fx1 -0.325932 0.3616842  
## Xs(workplaces\_percent\_change\_from\_baseline)Fx1 -0.417412 0.5124154  
## DF t-value  
## X(Intercept) 21183 16.105393  
## Xs(NumDate)Fx1 21183 22.291083  
## Xs(retail\_and\_recreation\_percent\_change\_from\_baseline)Fx1 21183 -2.244573  
## Xs(grocery\_and\_pharmacy\_percent\_change\_from\_baseline)Fx1 21183 0.919616  
## Xs(transit\_stations\_percent\_change\_from\_baseline)Fx1 21183 -0.901151  
## Xs(workplaces\_percent\_change\_from\_baseline)Fx1 21183 -0.814596  
## p-value  
## X(Intercept) 0.0000  
## Xs(NumDate)Fx1 0.0000  
## Xs(retail\_and\_recreation\_percent\_change\_from\_baseline)Fx1 0.0248  
## Xs(grocery\_and\_pharmacy\_percent\_change\_from\_baseline)Fx1 0.3578  
## Xs(transit\_stations\_percent\_change\_from\_baseline)Fx1 0.3675  
## Xs(workplaces\_percent\_change\_from\_baseline)Fx1 0.4153  
## Correlation:   
## X(Int) X(ND)F  
## Xs(NumDate)Fx1 -0.028   
## Xs(retail\_and\_recreation\_percent\_change\_from\_baseline)Fx1 0.001 -0.029  
## Xs(grocery\_and\_pharmacy\_percent\_change\_from\_baseline)Fx1 0.001 -0.005  
## Xs(transit\_stations\_percent\_change\_from\_baseline)Fx1 0.000 0.004  
## Xs(workplaces\_percent\_change\_from\_baseline)Fx1 0.001 -0.005  
## Xs(r\_\_\_\_\_\_)F1  
## Xs(NumDate)Fx1   
## Xs(retail\_and\_recreation\_percent\_change\_from\_baseline)Fx1   
## Xs(grocery\_and\_pharmacy\_percent\_change\_from\_baseline)Fx1 -0.075   
## Xs(transit\_stations\_percent\_change\_from\_baseline)Fx1 -0.167   
## Xs(workplaces\_percent\_change\_from\_baseline)Fx1 0.001   
## Xs(g\_\_\_\_\_\_)F1  
## Xs(NumDate)Fx1   
## Xs(retail\_and\_recreation\_percent\_change\_from\_baseline)Fx1   
## Xs(grocery\_and\_pharmacy\_percent\_change\_from\_baseline)Fx1   
## Xs(transit\_stations\_percent\_change\_from\_baseline)Fx1 -0.032   
## Xs(workplaces\_percent\_change\_from\_baseline)Fx1 -0.010   
## X(\_\_\_\_\_)  
## Xs(NumDate)Fx1   
## Xs(retail\_and\_recreation\_percent\_change\_from\_baseline)Fx1   
## Xs(grocery\_and\_pharmacy\_percent\_change\_from\_baseline)Fx1   
## Xs(transit\_stations\_percent\_change\_from\_baseline)Fx1   
## Xs(workplaces\_percent\_change\_from\_baseline)Fx1 -0.007   
##   
## Standardized Within-Group Residuals:  
## Min Q1 Med Q3 Max   
## -1.5295620 -0.4709505 -0.2391705 0.2085456 24.0972046   
##   
## Number of Observations: 21311  
## Number of Groups:   
## g   
## 1   
## g.0 %in% g   
## 1   
## g.1 %in% g.0 %in% g   
## 1   
## g.2 %in% g.1 %in% g.0 %in% g   
## 1   
## g.3 %in% g.2 %in% g.1 %in% g.0 %in% g   
## 1   
## country\_region %in% g.3 %in% g.2 %in% g.1 %in% g.0 %in% g   
## 123

ranef(fit2$lme)

## Level: g   
## Xr1 Xr2 Xr3 Xr4 Xr5 Xr6 Xr7 Xr8  
## 1 -2.645335 -17.34849 -8.200305 17.14152 -24.29321 14.39787 -19.26648 -38.23257  
##   
## Level: g.0 %in% g   
## Xr.01 Xr.02 Xr.03 Xr.04 Xr.05 Xr.06 Xr.07 Xr.08  
## 1/1 -0.6495366 -4.323514 -6.4993 -3.740349 3.320843 4.614124 3.131036 4.916534  
##   
## Level: g.1 %in% g.0 %in% g   
## Xr.11 Xr.12 Xr.13 Xr.14 Xr.15 Xr.16 Xr.17  
## 1/1/1 -0.511122 -8.843325 4.893857 -6.596312 -2.704825 0.03800879 -0.5052104  
## Xr.18  
## 1/1/1 -0.9439142  
##   
## Level: g.2 %in% g.1 %in% g.0 %in% g   
## Xr.21 Xr.22 Xr.23 Xr.24 Xr.25 Xr.26 Xr.27  
## 1/1/1/1 -1.79714 0.3400537 -1.035872 1.309102 1.588855 2.022742 1.313216  
## Xr.28  
## 1/1/1/1 0.7984307  
##   
## Level: g.3 %in% g.2 %in% g.1 %in% g.0 %in% g   
## Xr.31 Xr.32 Xr.33 Xr.34 Xr.35 Xr.36 Xr.37  
## 1/1/1/1/1 -1.778276 1.37795 2.905501 -2.577511 -1.935447 -4.35463 0.5206838  
## Xr.38  
## 1/1/1/1/1 -0.3468908  
##   
## Level: country\_region %in% g.3 %in% g.2 %in% g.1 %in% g.0 %in% g   
## (Intercept)  
## 1/1/1/1/1/Afghanistan 0.82515705  
## 1/1/1/1/1/Angola -3.45004752  
## 1/1/1/1/1/Antigua and Barbuda -4.84650933  
## 1/1/1/1/1/Argentina 0.55553471  
## 1/1/1/1/1/Australia 0.99466991  
## 1/1/1/1/1/Austria 0.87086586  
## 1/1/1/1/1/Bahrain 0.84307958  
## 1/1/1/1/1/Bangladesh 2.27287969  
## 1/1/1/1/1/Barbados -3.95456454  
## 1/1/1/1/1/Belarus 2.60209951  
## 1/1/1/1/1/Belgium 1.82565805  
## 1/1/1/1/1/Belize -5.94335234  
## 1/1/1/1/1/Benin -1.30841483  
## 1/1/1/1/1/Bolivia 0.49063069  
## 1/1/1/1/1/Bosnia and Herzegovina -0.41730139  
## 1/1/1/1/1/Botswana -3.67544032  
## 1/1/1/1/1/Brazil 4.28496046  
## 1/1/1/1/1/Bulgaria -0.38520228  
## 1/1/1/1/1/Burkina Faso -0.73972329  
## 1/1/1/1/1/Cambodia -2.80167204  
## 1/1/1/1/1/Cameroon 0.87493408  
## 1/1/1/1/1/Canada 2.52753550  
## 1/1/1/1/1/Chile 3.02937654  
## 1/1/1/1/1/Colombia 1.57244002  
## 1/1/1/1/1/Costa Rica -1.22693919  
## 1/1/1/1/1/Croatia -0.76480507  
## 1/1/1/1/1/Czechia 0.63790108  
## 1/1/1/1/1/Denmark 1.66359570  
## 1/1/1/1/1/Dominican Republic 0.76823382  
## 1/1/1/1/1/Ecuador 1.65234907  
## 1/1/1/1/1/Egypt 1.26778044  
## 1/1/1/1/1/El Salvador -1.12195570  
## 1/1/1/1/1/Estonia -0.59371712  
## 1/1/1/1/1/Fiji -4.72664807  
## 1/1/1/1/1/Finland 0.35392354  
## 1/1/1/1/1/France 2.74662230  
## 1/1/1/1/1/Gabon -0.43969863  
## 1/1/1/1/1/Georgia -1.15675223  
## 1/1/1/1/1/Germany 3.77957291  
## 1/1/1/1/1/Ghana 0.98195091  
## 1/1/1/1/1/Greece -0.82071769  
## 1/1/1/1/1/Guatemala -0.24563662  
## 1/1/1/1/1/Haiti -0.49402759  
## 1/1/1/1/1/Honduras -0.27096873  
## 1/1/1/1/1/Hungary -0.05668553  
## 1/1/1/1/1/India 2.98768726  
## 1/1/1/1/1/Indonesia 1.70184924  
## 1/1/1/1/1/Iraq 1.09860298  
## 1/1/1/1/1/Ireland 0.44911657  
## 1/1/1/1/1/Israel 0.80077454  
## 1/1/1/1/1/Italy 3.21306594  
## 1/1/1/1/1/Jamaica -2.08375966  
## 1/1/1/1/1/Japan 1.77953652  
## 1/1/1/1/1/Jordan -2.23877282  
## 1/1/1/1/1/Kazakhstan 1.18078171  
## 1/1/1/1/1/Kenya -0.31688688  
## 1/1/1/1/1/Kuwait 1.33621901  
## 1/1/1/1/1/Kyrgyzstan -0.68374040  
## 1/1/1/1/1/Laos -4.90661153  
## 1/1/1/1/1/Latvia -0.98396716  
## 1/1/1/1/1/Lebanon -1.41848885  
## 1/1/1/1/1/Libya -2.34508236  
## 1/1/1/1/1/Lithuania -1.12872125  
## 1/1/1/1/1/Luxembourg -0.87803005  
## 1/1/1/1/1/Malaysia 0.11260757  
## 1/1/1/1/1/Mali -0.28760153  
## 1/1/1/1/1/Malta -2.16236755  
## 1/1/1/1/1/Mauritius -3.02813113  
## 1/1/1/1/1/Mexico 2.43013965  
## 1/1/1/1/1/Moldova 0.78446551  
## 1/1/1/1/1/Mongolia -1.94205675  
## 1/1/1/1/1/Morocco -0.21154634  
## 1/1/1/1/1/Mozambique -1.80544464  
## 1/1/1/1/1/Namibia -4.22976681  
## 1/1/1/1/1/Nepal -0.29508093  
## 1/1/1/1/1/Netherlands 2.30098227  
## 1/1/1/1/1/New Zealand -1.84767497  
## 1/1/1/1/1/Nicaragua -1.81590615  
## 1/1/1/1/1/Niger -0.87480667  
## 1/1/1/1/1/Nigeria 1.02297189  
## 1/1/1/1/1/North Macedonia -0.58719893  
## 1/1/1/1/1/Norway 1.21939899  
## 1/1/1/1/1/Oman 0.89436259  
## 1/1/1/1/1/Pakistan 3.17893161  
## 1/1/1/1/1/Panama 0.44775797  
## 1/1/1/1/1/Papua New Guinea -4.14588082  
## 1/1/1/1/1/Paraguay -1.78291266  
## 1/1/1/1/1/Peru 2.47618468  
## 1/1/1/1/1/Philippines 0.65991590  
## 1/1/1/1/1/Poland 1.76727126  
## 1/1/1/1/1/Portugal 1.35506275  
## 1/1/1/1/1/Qatar 2.03709950  
## 1/1/1/1/1/Romania 1.23983141  
## 1/1/1/1/1/Russia 4.25094421  
## 1/1/1/1/1/Rwanda -2.06032742  
## 1/1/1/1/1/Saudi Arabia 1.96760536  
## 1/1/1/1/1/Senegal -0.20516455  
## 1/1/1/1/1/Serbia 0.75320461  
## 1/1/1/1/1/Singapore 1.13593352  
## 1/1/1/1/1/Slovakia -1.26490194  
## 1/1/1/1/1/Slovenia -0.67846650  
## 1/1/1/1/1/South Africa 1.85103903  
## 1/1/1/1/1/Spain 2.76847864  
## 1/1/1/1/1/Sri Lanka -1.20330048  
## 1/1/1/1/1/Sweden 3.06343627  
## 1/1/1/1/1/Switzerland 1.64883278  
## 1/1/1/1/1/Tajikistan -0.14664654  
## 1/1/1/1/1/Tanzania -2.08203956  
## 1/1/1/1/1/Thailand -0.18399797  
## 1/1/1/1/1/Togo -1.98610547  
## 1/1/1/1/1/Trinidad and Tobago -3.66118591  
## 1/1/1/1/1/Turkey 2.84148940  
## 1/1/1/1/1/Uganda -2.31370354  
## 1/1/1/1/1/Ukraine 1.65702526  
## 1/1/1/1/1/United Arab Emirates 1.15915934  
## 1/1/1/1/1/United Kingdom 3.11615380  
## 1/1/1/1/1/United States 5.97640294  
## 1/1/1/1/1/Uruguay -1.67223723  
## 1/1/1/1/1/Venezuela -0.92658152  
## 1/1/1/1/1/Vietnam -1.53492182  
## 1/1/1/1/1/Yemen -1.34686890  
## 1/1/1/1/1/Zambia -0.80761949  
## 1/1/1/1/1/Zimbabwe -2.57078815

summary(fitcb$lme)

## Linear mixed-effects model fit by maximum likelihood  
## Data: data   
## AIC BIC logLik  
## 79648.78 80286.14 -39744.39  
##   
## Random effects:  
## Formula: ~Xr - 1 | g  
## Structure: pdIdnot  
## Xr1 Xr2 Xr3 Xr4 Xr5 Xr6 Xr7 Xr8  
## StdDev: 25.28211 25.28211 25.28211 25.28211 25.28211 25.28211 25.28211 25.28211  
##   
## Formula: ~1 | country\_region %in% g  
## (Intercept) Residual  
## StdDev: 2.105007 2.934869  
##   
## Variance function:  
## Structure: fixed weights  
## Formula: ~invwt   
## Fixed effects: list(fixed)   
## Value Std.Error DF t-value p-value  
## X(Intercept) 5.020970 0.4592959 21112 10.931886 0.0000  
## Xcb1v1.l1 0.374865 0.3721891 21112 1.007189 0.3139  
## Xcb1v1.l2 -0.255013 0.3618270 21112 -0.704794 0.4809  
## Xcb1v1.l3 0.143252 0.3475072 21112 0.412226 0.6802  
## Xcb1v1.l4 1.783361 0.2565186 21112 6.952170 0.0000  
## Xcb1v1.l5 -1.160218 0.3261709 21112 -3.557087 0.0004  
## Xcb1v2.l1 0.944672 0.3661131 21112 2.580273 0.0099  
## Xcb1v2.l2 0.646309 0.3600314 21112 1.795146 0.0726  
## Xcb1v2.l3 -0.643013 0.3467898 21112 -1.854187 0.0637  
## Xcb1v2.l4 0.881516 0.2438502 21112 3.614987 0.0003  
## Xcb1v2.l5 -2.082041 0.3049360 21112 -6.827797 0.0000  
## Xcb1v3.l1 -1.015948 0.4887558 21112 -2.078641 0.0377  
## Xcb1v3.l2 -0.474631 0.4783082 21112 -0.992311 0.3211  
## Xcb1v3.l3 -1.342914 0.4596649 21112 -2.921506 0.0035  
## Xcb1v3.l4 2.870586 0.3304954 21112 8.685706 0.0000  
## Xcb1v3.l5 -2.247276 0.4112231 21112 -5.464859 0.0000  
## Xcb2v1.l1 -0.193364 0.4257012 21112 -0.454225 0.6497  
## Xcb2v1.l2 0.111292 0.4031299 21112 0.276071 0.7825  
## Xcb2v1.l3 0.591788 0.3934023 21112 1.504281 0.1325  
## Xcb2v1.l4 -1.773234 0.2747198 21112 -6.454701 0.0000  
## Xcb2v1.l5 2.713757 0.3302797 21112 8.216544 0.0000  
## Xcb2v2.l1 -0.427686 0.3300349 21112 -1.295882 0.1950  
## Xcb2v2.l2 -0.362205 0.3128055 21112 -1.157925 0.2469  
## Xcb2v2.l3 -0.235648 0.2948090 21112 -0.799324 0.4241  
## Xcb2v2.l4 0.718468 0.2109788 21112 3.405404 0.0007  
## Xcb2v2.l5 0.144222 0.2595512 21112 0.555659 0.5785  
## Xcb2v3.l1 -0.133090 0.5150176 21112 -0.258418 0.7961  
## Xcb2v3.l2 0.287773 0.4761248 21112 0.604407 0.5456  
## Xcb2v3.l3 1.654037 0.4520969 21112 3.658590 0.0003  
## Xcb2v3.l4 -4.603246 0.3150966 21112 -14.608999 0.0000  
## Xcb2v3.l5 4.743748 0.3740915 21112 12.680716 0.0000  
## Xcb4v1.l1 -0.465572 0.4425798 21112 -1.051950 0.2928  
## Xcb4v1.l2 -0.515572 0.4308014 21112 -1.196773 0.2314  
## Xcb4v1.l3 -0.337342 0.4171748 21112 -0.808634 0.4187  
## Xcb4v1.l4 -1.231644 0.2959405 21112 -4.161796 0.0000  
## Xcb4v1.l5 0.281375 0.3503950 21112 0.803024 0.4220  
## Xcb4v2.l1 -0.017281 0.3836048 21112 -0.045048 0.9641  
## Xcb4v2.l2 0.266413 0.3688443 21112 0.722290 0.4701  
## Xcb4v2.l3 0.953939 0.3558674 21112 2.680604 0.0074  
## Xcb4v2.l4 0.146267 0.2447881 21112 0.597525 0.5502  
## Xcb4v2.l5 1.221864 0.3058759 21112 3.994639 0.0001  
## Xcb4v3.l1 -0.384795 0.5819877 21112 -0.661174 0.5085  
## Xcb4v3.l2 -0.640216 0.5525944 21112 -1.158564 0.2466  
## Xcb4v3.l3 -0.587180 0.5326345 21112 -1.102408 0.2703  
## Xcb4v3.l4 -0.583482 0.3787949 21112 -1.540363 0.1235  
## Xcb4v3.l5 -0.337323 0.4448719 21112 -0.758247 0.4483  
## Xcb5v1.l1 -0.550332 0.4952625 21112 -1.111193 0.2665  
## Xcb5v1.l2 0.435913 0.4862241 21112 0.896526 0.3700  
## Xcb5v1.l3 0.683760 0.4611893 21112 1.482603 0.1382  
## Xcb5v1.l4 -1.564225 0.3379852 21112 -4.628088 0.0000  
## Xcb5v1.l5 0.028591 0.4099131 21112 0.069750 0.9444  
## Xcb5v2.l1 0.362309 0.5902433 21112 0.613831 0.5393  
## Xcb5v2.l2 -0.350162 0.5703016 21112 -0.613995 0.5392  
## Xcb5v2.l3 -1.448650 0.5459400 21112 -2.653497 0.0080  
## Xcb5v2.l4 3.124060 0.4028864 21112 7.754196 0.0000  
## Xcb5v2.l5 -0.932454 0.5025987 21112 -1.855266 0.0636  
## Xcb5v3.l1 -0.475463 1.1974424 21112 -0.397065 0.6913  
## Xcb5v3.l2 1.080989 1.1616697 21112 0.930547 0.3521  
## Xcb5v3.l3 2.917503 1.1124234 21112 2.622655 0.0087  
## Xcb5v3.l4 -7.782315 0.8356822 21112 -9.312529 0.0000  
## Xcb5v3.l5 2.910286 1.0319802 21112 2.820099 0.0048  
## Xcb6v1.l1 -0.053014 0.4578367 21112 -0.115792 0.9078  
## Xcb6v1.l2 0.139500 0.4463850 21112 0.312511 0.7547  
## Xcb6v1.l3 -0.330962 0.4260007 21112 -0.776904 0.4372  
## Xcb6v1.l4 -0.010815 0.2860972 21112 -0.037802 0.9698  
## Xcb6v1.l5 0.358085 0.3619518 21112 0.989318 0.3225  
## Xcb6v2.l1 -0.067358 0.3337206 21112 -0.201840 0.8400  
## Xcb6v2.l2 0.262183 0.3256508 21112 0.805106 0.4208  
## Xcb6v2.l3 -0.310227 0.3084347 21112 -1.005810 0.3145  
## Xcb6v2.l4 0.529682 0.2117236 21112 2.501762 0.0124  
## Xcb6v2.l5 -0.668605 0.2841891 21112 -2.352675 0.0186  
## Xcb6v3.l1 -0.463214 0.4340200 21112 -1.067263 0.2859  
## Xcb6v3.l2 0.622814 0.4237996 21112 1.469596 0.1417  
## Xcb6v3.l3 -0.693762 0.4008974 21112 -1.730522 0.0836  
## Xcb6v3.l4 0.016487 0.2764178 21112 0.059645 0.9524  
## Xcb6v3.l5 -0.010858 0.3645467 21112 -0.029786 0.9762  
## Xs(NumDate)Fx1 17.181707 0.7366950 21112 23.322688 0.0000  
## Correlation:   
## X(Int) Xc11.1 Xc11.2 Xc11.3 Xc11.4 Xc11.5 Xc12.1 Xc12.2 Xc12.3  
## Xcb1v1.l1 -0.061   
## Xcb1v1.l2 -0.070 -0.582   
## Xcb1v1.l3 -0.066 0.237 -0.578   
## Xcb1v1.l4 -0.219 -0.198 -0.289 -0.046   
## Xcb1v1.l5 -0.020 0.139 0.181 -0.379 -0.068   
## Xcb1v2.l1 0.031 -0.301 0.194 -0.085 0.024 -0.010   
## Xcb1v2.l2 0.026 0.145 -0.300 0.179 0.096 -0.084 -0.601   
## Xcb1v2.l3 0.004 -0.031 0.149 -0.299 0.031 0.129 0.245 -0.591   
## Xcb1v2.l4 0.136 0.062 0.073 -0.006 -0.330 -0.014 -0.227 -0.321 -0.107  
## Xcb1v2.l5 -0.022 -0.058 -0.019 0.080 0.071 -0.340 0.077 0.179 -0.378  
## Xcb1v3.l1 -0.061 0.722 -0.439 0.190 -0.104 0.059 -0.515 0.302 -0.129  
## Xcb1v3.l2 -0.066 -0.406 0.729 -0.434 -0.187 0.145 0.326 -0.506 0.308  
## Xcb1v3.l3 -0.053 0.178 -0.402 0.727 -0.054 -0.261 -0.178 0.307 -0.513  
## Xcb1v3.l4 -0.193 -0.145 -0.194 0.003 0.742 -0.017 0.089 0.113 0.038  
## Xcb1v3.l5 -0.015 0.071 0.133 -0.266 -0.038 0.745 0.012 -0.139 0.198  
## Xcb2v1.l1 0.009 -0.441 0.240 -0.085 0.142 -0.034 -0.169 0.124 -0.114  
## Xcb2v1.l2 0.007 0.275 -0.442 0.247 0.148 -0.064 0.125 -0.158 0.128  
## Xcb2v1.l3 0.010 -0.110 0.256 -0.436 0.028 0.181 -0.076 0.136 -0.169  
## Xcb2v1.l4 0.005 0.117 0.177 0.064 -0.446 -0.004 0.061 0.000 0.054  
## Xcb2v1.l5 0.014 -0.077 -0.101 0.188 0.005 -0.405 -0.024 -0.022 0.083  
## Xcb2v2.l1 -0.009 0.188 -0.153 0.091 -0.016 -0.034 -0.305 0.207 -0.073  
## Xcb2v2.l2 -0.004 -0.062 0.173 -0.140 -0.064 0.090 0.150 -0.320 0.202  
## Xcb2v2.l3 0.004 0.016 -0.068 0.183 -0.057 -0.105 -0.035 0.154 -0.319  
## Xcb2v2.l4 -0.021 -0.103 -0.027 -0.004 0.195 0.016 0.102 0.117 0.018  
## Xcb2v2.l5 0.001 0.060 -0.017 -0.015 -0.051 0.180 -0.071 -0.022 0.090  
## Xcb2v3.l1 0.017 -0.334 0.205 -0.084 0.082 -0.004 -0.080 0.043 -0.061  
## Xcb2v3.l2 0.015 0.193 -0.338 0.209 0.105 -0.062 0.083 -0.065 0.041  
## Xcb2v3.l3 0.016 -0.088 0.182 -0.335 0.043 0.139 -0.050 0.093 -0.074  
## Xcb2v3.l4 0.052 0.118 0.120 0.023 -0.344 -0.007 0.020 -0.006 0.066  
## Xcb2v3.l5 0.028 -0.059 -0.064 0.122 0.002 -0.301 -0.023 -0.017 0.054  
## Xcb4v1.l1 -0.018 -0.213 0.183 -0.130 0.043 0.022 -0.024 0.026 0.023  
## Xcb4v1.l2 -0.003 0.123 -0.210 0.168 0.048 -0.090 -0.013 -0.048 0.030  
## Xcb4v1.l3 0.005 -0.070 0.136 -0.206 0.040 0.104 0.014 -0.017 -0.042  
## Xcb4v1.l4 -0.008 0.082 0.012 0.040 -0.162 0.022 0.021 0.042 -0.041  
## Xcb4v1.l5 0.013 -0.031 -0.011 0.075 0.008 -0.128 0.016 0.005 -0.021  
## Xcb4v2.l1 0.003 0.105 -0.067 0.040 -0.039 0.020 -0.133 0.074 -0.052  
## Xcb4v2.l2 -0.004 -0.084 0.099 -0.072 -0.010 0.012 0.106 -0.128 0.078  
## Xcb4v2.l3 -0.003 0.056 -0.079 0.100 -0.023 -0.042 -0.058 0.102 -0.132  
## Xcb4v2.l4 -0.025 -0.026 -0.015 -0.025 0.066 -0.020 0.020 0.025 0.036  
## Xcb4v2.l5 0.012 -0.001 0.026 -0.055 -0.005 0.066 0.003 -0.029 0.065  
## Xcb4v3.l1 -0.025 -0.129 0.112 -0.082 0.031 0.012 -0.024 0.020 0.015  
## Xcb4v3.l2 -0.010 0.078 -0.125 0.104 0.023 -0.058 -0.009 -0.049 0.027  
## Xcb4v3.l3 0.008 -0.053 0.086 -0.123 0.029 0.069 0.022 -0.012 -0.047  
## Xcb4v3.l4 -0.089 0.059 0.000 0.029 -0.093 0.011 0.010 0.044 -0.033  
## Xcb4v3.l5 0.008 -0.020 -0.009 0.051 0.007 -0.063 0.015 0.010 -0.016  
## Xcb5v1.l1 -0.014 -0.127 0.041 0.051 0.003 -0.079 -0.082 0.050 -0.003  
## Xcb5v1.l2 -0.009 0.065 -0.146 0.049 0.093 0.032 0.038 -0.077 0.045  
## Xcb5v1.l3 0.008 0.006 0.046 -0.136 -0.003 0.024 -0.004 0.036 -0.069  
## Xcb5v1.l4 -0.138 -0.002 0.117 -0.041 -0.188 0.016 0.033 0.043 0.003  
## Xcb5v1.l5 -0.011 -0.017 -0.031 0.075 0.006 -0.184 -0.033 -0.013 0.042  
## Xcb5v2.l1 0.014 0.059 0.001 -0.065 0.007 0.063 -0.034 0.029 -0.012  
## Xcb5v2.l2 0.008 -0.023 0.072 -0.005 -0.063 -0.040 0.025 -0.038 0.032  
## Xcb5v2.l3 -0.008 -0.018 -0.002 0.064 -0.003 0.002 -0.021 0.022 -0.034  
## Xcb5v2.l4 0.112 0.010 -0.090 0.037 0.126 -0.018 0.007 0.004 -0.015  
## Xcb5v2.l5 -0.007 0.001 0.021 -0.043 0.008 0.116 0.004 0.003 0.029  
## Xcb5v3.l1 -0.021 -0.077 0.014 0.061 -0.008 -0.065 -0.036 0.014 -0.003  
## Xcb5v3.l2 -0.014 0.031 -0.095 0.019 0.078 0.036 0.024 -0.030 0.013  
## Xcb5v3.l3 0.008 0.022 0.014 -0.084 -0.003 0.008 -0.007 0.024 -0.030  
## Xcb5v3.l4 -0.165 -0.008 0.098 -0.035 -0.136 0.016 0.010 0.015 0.012  
## Xcb5v3.l5 0.015 -0.011 -0.018 0.048 0.001 -0.135 -0.011 -0.020 0.019  
## Xcb6v1.l1 -0.030 0.022 -0.034 0.009 0.032 -0.027 0.012 -0.027 0.019  
## Xcb6v1.l2 -0.018 0.028 0.033 -0.027 -0.042 0.033 -0.011 0.007 -0.018  
## Xcb6v1.l3 -0.016 -0.039 0.020 0.024 -0.002 -0.028 0.016 -0.014 0.001  
## Xcb6v1.l4 -0.237 -0.022 -0.019 0.025 0.069 -0.001 -0.015 0.023 -0.001  
## Xcb6v1.l5 -0.017 0.034 -0.032 0.020 0.006 0.037 0.014 -0.009 0.009  
## Xcb6v2.l1 0.021 0.072 -0.022 0.009 -0.053 0.042 -0.122 0.104 -0.079  
## Xcb6v2.l2 0.005 -0.090 0.064 -0.028 0.008 -0.028 0.075 -0.117 0.096  
## Xcb6v2.l3 0.027 0.065 -0.075 0.067 -0.003 -0.008 -0.042 0.074 -0.116  
## Xcb6v2.l4 0.021 0.007 -0.021 -0.026 0.033 -0.003 0.044 0.003 0.022  
## Xcb6v2.l5 0.030 -0.024 0.051 -0.060 -0.002 0.040 -0.019 0.008 0.036  
## Xcb6v3.l1 -0.050 -0.077 0.013 0.013 0.058 -0.055 -0.090 0.052 -0.023  
## Xcb6v3.l2 -0.024 0.093 -0.083 0.013 0.024 0.040 0.056 -0.082 0.062  
## Xcb6v3.l3 -0.029 -0.044 0.088 -0.077 -0.016 -0.010 -0.034 0.046 -0.081  
## Xcb6v3.l4 -0.292 -0.020 0.053 0.041 -0.054 0.004 0.029 0.030 -0.006  
## Xcb6v3.l5 -0.019 0.011 -0.045 0.062 0.030 -0.044 -0.007 -0.025 0.050  
## Xs(NumDate)Fx1 0.006 0.005 -0.008 -0.006 0.015 0.005 0.000 0.014 0.001  
## Xc12.4 Xc12.5 Xc13.1 Xc13.2 Xc13.3 Xc13.4 Xc13.5 Xc21.1 Xc21.2  
## Xcb1v1.l1   
## Xcb1v1.l2   
## Xcb1v1.l3   
## Xcb1v1.l4   
## Xcb1v1.l5   
## Xcb1v2.l1   
## Xcb1v2.l2   
## Xcb1v2.l3   
## Xcb1v2.l4   
## Xcb1v2.l5 -0.051   
## Xcb1v3.l1 0.097 -0.043   
## Xcb1v3.l2 0.095 -0.071 -0.602   
## Xcb1v3.l3 0.057 0.161 0.289 -0.599   
## Xcb1v3.l4 -0.519 0.048 -0.176 -0.227 -0.053   
## Xcb1v3.l5 -0.003 -0.530 0.056 0.200 -0.368 -0.017   
## Xcb2v1.l1 0.070 0.017 -0.265 0.145 -0.034 0.073 -0.023   
## Xcb2v1.l2 0.017 -0.076 0.158 -0.271 0.151 0.101 -0.025 -0.620   
## Xcb2v1.l3 0.034 0.114 -0.064 0.144 -0.262 0.010 0.116 0.297 -0.615  
## Xcb2v1.l4 -0.095 -0.032 0.069 0.116 0.019 -0.280 -0.012 -0.319 -0.294  
## Xcb2v1.l5 0.052 -0.118 -0.048 -0.073 0.114 -0.013 -0.252 0.119 0.184  
## Xcb2v2.l1 0.046 -0.004 0.139 -0.099 0.055 -0.023 -0.022 -0.281 0.201  
## Xcb2v2.l2 0.137 -0.076 -0.064 0.130 -0.093 -0.035 0.049 0.159 -0.260  
## Xcb2v2.l3 0.038 0.151 0.033 -0.068 0.142 -0.035 -0.068 -0.091 0.160  
## Xcb2v2.l4 -0.331 0.022 -0.060 -0.018 -0.015 0.156 0.011 0.119 0.030  
## Xcb2v2.l5 0.012 -0.344 0.016 0.014 -0.033 -0.015 0.136 -0.035 -0.031  
## Xcb2v3.l1 0.072 -0.004 -0.322 0.220 -0.081 0.041 0.003 0.753 -0.481  
## Xcb2v3.l2 -0.002 -0.033 0.157 -0.335 0.231 0.114 -0.069 -0.469 0.747  
## Xcb2v3.l3 -0.001 0.054 -0.062 0.153 -0.332 0.045 0.171 0.239 -0.474  
## Xcb2v3.l4 -0.022 -0.013 0.125 0.109 -0.018 -0.348 -0.022 -0.268 -0.191  
## Xcb2v3.l5 0.057 -0.037 -0.078 -0.045 0.113 -0.029 -0.323 0.114 0.130  
## Xcb4v1.l1 -0.041 0.007 -0.147 0.110 -0.088 0.055 0.009 -0.454 0.225  
## Xcb4v1.l2 0.048 0.010 0.107 -0.144 0.096 0.029 -0.061 0.320 -0.458  
## Xcb4v1.l3 0.028 -0.019 -0.051 0.111 -0.136 0.001 0.068 -0.153 0.315  
## Xcb4v1.l4 -0.068 0.002 0.028 0.011 0.048 -0.095 0.018 0.087 0.168  
## Xcb4v1.l5 -0.027 -0.054 -0.021 -0.010 0.055 0.014 -0.092 -0.007 -0.136  
## Xcb4v2.l1 0.054 -0.016 0.033 -0.010 0.015 -0.030 0.015 0.200 -0.127  
## Xcb4v2.l2 0.013 -0.026 -0.039 0.028 -0.012 0.006 0.007 -0.128 0.194  
## Xcb4v2.l3 0.016 0.043 0.019 -0.036 0.034 -0.004 -0.004 0.061 -0.125  
## Xcb4v2.l4 -0.107 0.015 0.005 -0.003 -0.022 0.010 -0.012 -0.060 -0.046  
## Xcb4v2.l5 0.011 -0.109 -0.004 0.005 -0.023 -0.012 0.022 0.015 0.040  
## Xcb4v3.l1 -0.032 0.014 -0.084 0.049 -0.051 0.055 -0.001 -0.325 0.166  
## Xcb4v3.l2 0.047 0.001 0.082 -0.073 0.041 -0.008 -0.027 0.226 -0.327  
## Xcb4v3.l3 0.023 -0.008 -0.056 0.080 -0.071 0.002 0.027 -0.105 0.220  
## Xcb4v3.l4 -0.072 -0.008 0.008 -0.007 0.049 -0.047 0.009 0.067 0.111  
## Xcb4v3.l5 -0.024 -0.058 0.009 -0.024 0.040 0.021 -0.032 -0.014 -0.091  
## Xcb5v1.l1 0.022 -0.029 -0.055 0.037 0.003 -0.020 -0.020 0.053 -0.051  
## Xcb5v1.l2 0.041 -0.005 0.012 -0.056 0.040 0.029 0.000 -0.035 0.057  
## Xcb5v1.l3 0.009 0.041 -0.005 0.008 -0.061 0.018 0.019 0.040 -0.040  
## Xcb5v1.l4 -0.075 0.017 0.026 0.024 -0.031 -0.082 0.006 -0.037 -0.003  
## Xcb5v1.l5 0.011 -0.064 -0.007 0.000 0.021 -0.011 -0.086 -0.032 0.028  
## Xcb5v2.l1 -0.009 -0.009 0.041 -0.027 -0.009 0.018 0.024 -0.038 0.015  
## Xcb5v2.l2 0.005 -0.002 -0.002 0.042 -0.032 -0.027 -0.001 0.040 -0.033  
## Xcb5v2.l3 0.013 0.015 -0.010 0.007 0.037 -0.020 -0.023 -0.047 0.035  
## Xcb5v2.l4 -0.028 0.000 -0.019 -0.030 0.039 0.071 -0.009 0.019 0.008  
## Xcb5v2.l5 -0.030 -0.006 0.015 -0.007 -0.019 0.008 0.064 0.039 -0.044  
## Xcb5v3.l1 0.026 -0.016 -0.050 0.043 0.006 -0.029 -0.025 0.035 -0.019  
## Xcb5v3.l2 0.010 -0.005 0.003 -0.056 0.051 0.032 -0.002 -0.030 0.040  
## Xcb5v3.l3 -0.002 0.016 0.006 -0.002 -0.052 0.025 0.033 0.030 -0.030  
## Xcb5v3.l4 -0.031 0.014 0.029 0.032 -0.050 -0.060 0.008 -0.015 -0.018  
## Xcb5v3.l5 0.021 -0.034 -0.016 0.005 0.027 -0.016 -0.083 -0.028 0.035  
## Xcb6v1.l1 0.006 0.005 -0.016 0.003 0.000 0.021 -0.029 0.085 -0.050  
## Xcb6v1.l2 0.008 0.003 0.037 -0.014 0.009 -0.013 0.019 -0.088 0.086  
## Xcb6v1.l3 0.001 -0.008 -0.031 0.033 -0.014 -0.003 -0.002 0.082 -0.086  
## Xcb6v1.l4 -0.043 -0.014 -0.005 -0.001 0.005 0.029 -0.004 -0.025 -0.009  
## Xcb6v1.l5 -0.007 -0.005 0.013 -0.034 0.038 0.019 -0.010 -0.038 0.060  
## Xcb6v2.l1 0.025 0.020 0.060 -0.034 0.009 -0.023 0.035 -0.043 0.017  
## Xcb6v2.l2 0.019 -0.048 -0.050 0.061 -0.044 -0.012 -0.006 0.053 -0.041  
## Xcb6v2.l3 0.024 0.067 0.030 -0.044 0.064 -0.017 -0.033 -0.056 0.053  
## Xcb6v2.l4 -0.086 0.001 -0.014 -0.024 0.006 0.051 0.004 0.009 0.003  
## Xcb6v2.l5 -0.017 -0.066 0.000 0.023 -0.047 -0.004 0.047 0.026 -0.048  
## Xcb6v3.l1 0.028 -0.019 -0.049 0.019 0.002 0.029 -0.029 0.089 -0.074  
## Xcb6v3.l2 0.009 -0.006 0.056 -0.051 0.013 0.014 0.020 -0.061 0.093  
## Xcb6v3.l3 0.028 0.043 -0.030 0.057 -0.050 -0.009 -0.011 0.035 -0.064  
## Xcb6v3.l4 -0.088 -0.001 -0.004 0.022 0.026 -0.022 0.004 -0.029 -0.015  
## Xcb6v3.l5 -0.003 -0.063 0.006 -0.026 0.038 0.024 -0.033 0.023 0.011  
## Xs(NumDate)Fx1 -0.012 -0.006 0.020 0.001 -0.005 0.015 -0.006 -0.010 -0.001  
## Xc21.3 Xc21.4 Xc21.5 Xc22.1 Xc22.2 Xc22.3 Xc22.4 Xc22.5 Xc23.1  
## Xcb1v1.l1   
## Xcb1v1.l2   
## Xcb1v1.l3   
## Xcb1v1.l4   
## Xcb1v1.l5   
## Xcb1v2.l1   
## Xcb1v2.l2   
## Xcb1v2.l3   
## Xcb1v2.l4   
## Xcb1v2.l5   
## Xcb1v3.l1   
## Xcb1v3.l2   
## Xcb1v3.l3   
## Xcb1v3.l4   
## Xcb1v3.l5   
## Xcb2v1.l1   
## Xcb2v1.l2   
## Xcb2v1.l3   
## Xcb2v1.l4 -0.161   
## Xcb2v1.l5 -0.426 -0.034   
## Xcb2v2.l1 -0.137 0.083 0.004   
## Xcb2v2.l2 0.191 0.048 -0.098 -0.616   
## Xcb2v2.l3 -0.270 0.081 0.118 0.266 -0.609   
## Xcb2v2.l4 0.030 -0.256 -0.030 -0.286 -0.317 -0.116   
## Xcb2v2.l5 0.068 0.076 -0.260 0.144 0.163 -0.390 -0.099   
## Xcb2v3.l1 0.256 -0.243 0.066 -0.461 0.301 -0.186 0.160 -0.034   
## Xcb2v3.l2 -0.473 -0.199 0.166 0.305 -0.433 0.302 0.062 -0.100 -0.643  
## Xcb2v3.l3 0.753 -0.124 -0.329 -0.193 0.293 -0.435 0.077 0.171 0.340  
## Xcb2v3.l4 -0.128 0.757 -0.037 0.166 0.067 0.085 -0.416 0.076 -0.337  
## Xcb2v3.l5 -0.302 -0.063 0.743 -0.048 -0.110 0.177 0.039 -0.401 0.142  
## Xcb4v1.l1 -0.088 0.189 -0.073 0.123 -0.083 0.051 -0.038 0.014 -0.295  
## Xcb4v1.l2 0.226 0.133 -0.024 -0.090 0.123 -0.089 -0.005 0.022 0.204  
## Xcb4v1.l3 -0.475 0.043 0.148 0.070 -0.090 0.136 -0.019 -0.036 -0.119  
## Xcb4v1.l4 0.114 -0.478 -0.014 -0.039 -0.014 -0.023 0.093 -0.021 0.074  
## Xcb4v1.l5 0.216 0.011 -0.494 -0.014 0.044 -0.055 0.031 0.136 0.013  
## Xcb4v2.l1 0.078 -0.071 0.011 -0.482 0.273 -0.110 0.153 -0.076 0.271  
## Xcb4v2.l2 -0.119 -0.044 0.047 0.316 -0.490 0.277 0.147 -0.053 -0.179  
## Xcb4v2.l3 0.194 -0.033 -0.071 -0.148 0.306 -0.490 0.058 0.155 0.118  
## Xcb4v2.l4 -0.031 0.192 0.026 0.116 0.172 0.074 -0.519 0.028 -0.098  
## Xcb4v2.l5 -0.061 -0.037 0.194 -0.022 -0.109 0.194 0.030 -0.501 0.006  
## Xcb4v3.l1 -0.074 0.134 -0.038 0.239 -0.137 0.077 -0.093 0.030 -0.472  
## Xcb4v3.l2 0.164 0.091 -0.028 -0.171 0.233 -0.141 -0.038 0.033 0.310  
## Xcb4v3.l3 -0.334 0.031 0.101 0.101 -0.159 0.235 -0.036 -0.070 -0.166  
## Xcb4v3.l4 0.083 -0.347 0.001 -0.058 -0.057 -0.044 0.218 -0.014 0.131  
## Xcb4v3.l5 0.131 0.026 -0.355 -0.002 0.074 -0.097 -0.011 0.229 -0.023  
## Xcb5v1.l1 0.030 -0.010 0.010 -0.042 0.046 -0.058 0.029 -0.005 0.051  
## Xcb5v1.l2 -0.054 -0.004 0.021 0.056 -0.034 0.051 -0.041 -0.011 -0.040  
## Xcb5v1.l3 0.066 -0.037 -0.026 -0.071 0.056 -0.048 0.027 0.011 0.050  
## Xcb5v1.l4 -0.002 0.024 -0.020 0.021 -0.033 0.013 0.034 -0.009 -0.037  
## Xcb5v1.l5 -0.066 0.046 0.031 0.048 -0.035 0.049 -0.031 0.012 -0.029  
## Xcb5v2.l1 0.001 0.022 -0.035 0.075 -0.082 0.092 -0.038 -0.011 -0.057  
## Xcb5v2.l2 0.021 -0.010 0.015 -0.091 0.069 -0.101 0.066 0.019 0.068  
## Xcb5v2.l3 -0.040 0.028 -0.002 0.127 -0.094 0.103 -0.072 -0.031 -0.080  
## Xcb5v2.l4 -0.002 -0.017 0.014 -0.047 0.048 -0.019 -0.028 0.021 0.027  
## Xcb5v2.l5 0.057 -0.029 -0.026 -0.077 0.058 -0.066 0.047 0.002 0.039  
## Xcb5v3.l1 -0.007 -0.007 0.034 -0.060 0.058 -0.052 0.028 -0.012 0.073  
## Xcb5v3.l2 -0.027 -0.005 -0.006 0.075 -0.059 0.075 -0.044 0.003 -0.090  
## Xcb5v3.l3 0.043 -0.022 -0.010 -0.103 0.073 -0.083 0.063 0.013 0.101  
## Xcb5v3.l4 0.012 0.018 -0.022 0.034 -0.023 0.003 0.021 -0.013 -0.026  
## Xcb5v3.l5 -0.059 0.030 0.029 0.072 -0.055 0.062 -0.039 -0.007 -0.058  
## Xcb6v1.l1 0.033 -0.037 0.032 -0.026 0.052 -0.024 -0.037 0.010 -0.061  
## Xcb6v1.l2 -0.070 0.019 0.001 -0.010 -0.034 0.055 0.018 -0.029 0.002  
## Xcb6v1.l3 0.103 -0.037 -0.036 0.009 -0.002 -0.046 0.016 0.041 0.023  
## Xcb6v1.l4 -0.007 0.037 0.010 0.033 -0.002 -0.025 -0.015 0.019 0.029  
## Xcb6v1.l5 -0.077 0.006 0.095 -0.029 0.031 -0.018 -0.009 -0.082 -0.041  
## Xcb6v2.l1 -0.007 0.023 -0.022 -0.034 -0.020 0.052 0.022 -0.071 -0.054  
## Xcb6v2.l2 0.028 -0.014 0.007 0.049 -0.047 -0.003 0.015 0.048 0.047  
## Xcb6v2.l3 -0.050 0.014 0.014 -0.033 0.041 -0.041 0.008 -0.030 -0.048  
## Xcb6v2.l4 0.006 -0.013 0.008 -0.017 0.057 -0.016 -0.058 0.020 0.024  
## Xcb6v2.l5 0.052 -0.007 -0.040 0.044 -0.056 0.051 0.012 -0.073 0.007  
## Xcb6v3.l1 0.046 -0.016 0.005 0.015 0.008 0.007 -0.032 0.002 -0.027  
## Xcb6v3.l2 -0.075 -0.013 0.032 -0.023 0.005 0.006 0.012 -0.003 0.004  
## Xcb6v3.l3 0.091 -0.013 -0.060 0.016 -0.019 0.000 0.007 0.002 0.001  
## Xcb6v3.l4 -0.003 0.052 -0.001 0.009 -0.002 -0.017 0.012 0.012 0.012  
## Xcb6v3.l5 -0.038 -0.014 0.078 -0.002 0.021 -0.018 -0.013 -0.020 0.000  
## Xs(NumDate)Fx1 0.009 -0.012 0.012 0.011 -0.004 -0.011 0.028 -0.013 -0.021  
## Xc23.2 Xc23.3 Xc23.4 Xc23.5 Xc41.1 Xc41.2 Xc41.3 Xc41.4 Xc41.5  
## Xcb1v1.l1   
## Xcb1v1.l2   
## Xcb1v1.l3   
## Xcb1v1.l4   
## Xcb1v1.l5   
## Xcb1v2.l1   
## Xcb1v2.l2   
## Xcb1v2.l3   
## Xcb1v2.l4   
## Xcb1v2.l5   
## Xcb1v3.l1   
## Xcb1v3.l2   
## Xcb1v3.l3   
## Xcb1v3.l4   
## Xcb1v3.l5   
## Xcb2v1.l1   
## Xcb2v1.l2   
## Xcb2v1.l3   
## Xcb2v1.l4   
## Xcb2v1.l5   
## Xcb2v2.l1   
## Xcb2v2.l2   
## Xcb2v2.l3   
## Xcb2v2.l4   
## Xcb2v2.l5   
## Xcb2v3.l1   
## Xcb2v3.l2   
## Xcb2v3.l3 -0.647   
## Xcb2v3.l4 -0.243 -0.147   
## Xcb2v3.l5 0.203 -0.428 -0.098   
## Xcb4v1.l1 0.157 -0.068 0.122 -0.051   
## Xcb4v1.l2 -0.293 0.165 0.065 -0.017 -0.601   
## Xcb4v1.l3 0.199 -0.315 0.055 0.098 0.252 -0.585   
## Xcb4v1.l4 0.092 0.065 -0.324 0.000 -0.277 -0.345 -0.141   
## Xcb4v1.l5 -0.103 0.144 -0.001 -0.316 0.101 0.171 -0.389 -0.034   
## Xcb4v2.l1 -0.174 0.095 -0.094 0.044 -0.381 0.263 -0.154 0.105 -0.010  
## Xcb4v2.l2 0.257 -0.171 -0.041 0.045 0.231 -0.364 0.258 0.080 -0.096  
## Xcb4v2.l3 -0.171 0.255 -0.065 -0.102 -0.132 0.222 -0.374 0.089 0.162  
## Xcb4v2.l4 -0.055 -0.035 0.269 -0.013 0.144 0.072 0.044 -0.337 -0.014  
## Xcb4v2.l5 0.080 -0.108 -0.031 0.227 -0.041 -0.068 0.117 0.050 -0.367  
## Xcb4v3.l1 0.279 -0.126 0.164 -0.076 0.729 -0.444 0.209 -0.206 0.046  
## Xcb4v3.l2 -0.475 0.282 0.117 -0.061 -0.447 0.731 -0.435 -0.231 0.143  
## Xcb4v3.l3 0.298 -0.478 0.083 0.162 0.200 -0.435 0.735 -0.111 -0.280  
## Xcb4v3.l4 0.140 0.069 -0.503 0.031 -0.214 -0.224 -0.118 0.744 -0.019  
## Xcb4v3.l5 -0.129 0.193 0.039 -0.495 0.073 0.125 -0.258 -0.047 0.737  
## Xcb5v1.l1 -0.057 0.051 -0.020 -0.003 -0.143 0.071 -0.030 0.057 -0.042  
## Xcb5v1.l2 0.048 -0.062 0.021 0.025 0.108 -0.140 0.067 0.035 -0.018  
## Xcb5v1.l3 -0.044 0.064 -0.037 -0.035 -0.052 0.109 -0.142 0.001 0.038  
## Xcb5v1.l4 0.018 -0.006 0.003 -0.002 0.021 0.043 0.032 -0.141 0.033  
## Xcb5v1.l5 0.026 -0.055 0.045 0.019 -0.003 -0.038 0.094 -0.019 -0.109  
## Xcb5v2.l1 0.043 -0.041 0.042 -0.031 0.119 -0.072 0.038 -0.041 0.014  
## Xcb5v2.l2 -0.044 0.056 -0.050 0.004 -0.092 0.120 -0.070 -0.023 0.024  
## Xcb5v2.l3 0.065 -0.057 0.034 0.023 0.051 -0.092 0.122 -0.007 -0.044  
## Xcb5v2.l4 -0.024 0.001 0.023 -0.002 -0.023 -0.028 -0.024 0.104 -0.010  
## Xcb5v2.l5 -0.054 0.069 -0.029 -0.004 0.003 0.032 -0.069 0.008 0.082  
## Xcb5v3.l1 -0.053 0.036 -0.044 0.045 -0.112 0.065 -0.030 0.037 -0.021  
## Xcb5v3.l2 0.074 -0.079 0.048 -0.006 0.082 -0.113 0.063 0.026 -0.022  
## Xcb5v3.l3 -0.090 0.090 -0.047 -0.035 -0.039 0.082 -0.115 0.005 0.042  
## Xcb5v3.l4 0.009 0.012 -0.022 0.000 0.018 0.031 0.019 -0.106 0.020  
## Xcb5v3.l5 0.077 -0.102 0.039 0.027 -0.010 -0.025 0.065 -0.010 -0.083  
## Xcb6v1.l1 0.049 -0.024 0.006 0.021 -0.092 0.070 -0.047 0.027 -0.018  
## Xcb6v1.l2 -0.054 0.022 0.050 -0.031 0.083 -0.092 0.083 -0.014 -0.014  
## Xcb6v1.l3 0.004 -0.037 -0.003 0.011 -0.082 0.082 -0.104 0.045 0.047  
## Xcb6v1.l4 0.022 0.018 -0.115 0.021 0.040 0.002 0.000 -0.036 -0.009  
## Xcb6v1.l5 0.040 -0.028 0.005 -0.028 0.031 -0.045 0.061 -0.005 -0.084  
## Xcb6v2.l1 0.044 -0.032 0.018 -0.015 -0.001 0.010 0.011 -0.023 -0.010  
## Xcb6v2.l2 -0.050 0.052 -0.015 -0.012 -0.037 0.001 0.005 0.030 -0.007  
## Xcb6v2.l3 0.048 -0.058 0.020 0.032 0.047 -0.037 0.010 -0.005 0.022  
## Xcb6v2.l4 -0.009 -0.002 -0.013 0.005 0.013 0.014 -0.028 -0.028 0.008  
## Xcb6v2.l5 -0.027 0.040 -0.008 -0.031 -0.045 0.031 -0.023 0.012 -0.032  
## Xcb6v3.l1 0.009 -0.003 0.011 -0.002 -0.004 -0.002 -0.022 0.031 -0.016  
## Xcb6v3.l2 -0.016 -0.002 0.017 -0.001 0.051 0.002 0.009 -0.056 0.008  
## Xcb6v3.l3 0.003 -0.012 0.003 -0.015 -0.071 0.045 -0.007 0.021 -0.009  
## Xcb6v3.l4 0.007 0.012 -0.063 0.012 -0.004 -0.029 0.010 0.059 -0.003  
## Xcb6v3.l5 0.007 -0.010 -0.005 -0.003 0.047 -0.039 0.039 -0.011 0.038  
## Xs(NumDate)Fx1 -0.007 0.016 -0.013 0.037 0.000 0.007 0.000 -0.011 -0.007  
## Xc42.1 Xc42.2 Xc42.3 Xc42.4 Xc42.5 Xc43.1 Xc43.2 Xc43.3 Xc43.4  
## Xcb1v1.l1   
## Xcb1v1.l2   
## Xcb1v1.l3   
## Xcb1v1.l4   
## Xcb1v1.l5   
## Xcb1v2.l1   
## Xcb1v2.l2   
## Xcb1v2.l3   
## Xcb1v2.l4   
## Xcb1v2.l5   
## Xcb1v3.l1   
## Xcb1v3.l2   
## Xcb1v3.l3   
## Xcb1v3.l4   
## Xcb1v3.l5   
## Xcb2v1.l1   
## Xcb2v1.l2   
## Xcb2v1.l3   
## Xcb2v1.l4   
## Xcb2v1.l5   
## Xcb2v2.l1   
## Xcb2v2.l2   
## Xcb2v2.l3   
## Xcb2v2.l4   
## Xcb2v2.l5   
## Xcb2v3.l1   
## Xcb2v3.l2   
## Xcb2v3.l3   
## Xcb2v3.l4   
## Xcb2v3.l5   
## Xcb4v1.l1   
## Xcb4v1.l2   
## Xcb4v1.l3   
## Xcb4v1.l4   
## Xcb4v1.l5   
## Xcb4v2.l1   
## Xcb4v2.l2 -0.638   
## Xcb4v2.l3 0.325 -0.632   
## Xcb4v2.l4 -0.285 -0.263 -0.149   
## Xcb4v2.l5 0.081 0.193 -0.376 -0.069   
## Xcb4v3.l1 -0.571 0.364 -0.221 0.204 -0.033   
## Xcb4v3.l2 0.384 -0.547 0.349 0.109 -0.121 -0.634   
## Xcb4v3.l3 -0.221 0.373 -0.547 0.082 0.199 0.330 -0.620   
## Xcb4v3.l4 0.173 0.104 0.128 -0.523 0.049 -0.298 -0.253 -0.168   
## Xcb4v3.l5 -0.044 -0.125 0.212 0.035 -0.515 0.069 0.201 -0.360 -0.067  
## Xcb5v1.l1 0.086 -0.061 0.031 -0.023 0.008 -0.118 0.067 -0.031 0.039  
## Xcb5v1.l2 -0.060 0.095 -0.061 -0.025 0.020 0.088 -0.126 0.067 0.029  
## Xcb5v1.l3 0.036 -0.066 0.110 -0.015 -0.031 -0.045 0.090 -0.135 0.006  
## Xcb5v1.l4 -0.028 -0.022 -0.018 0.087 -0.011 0.014 0.035 0.018 -0.125  
## Xcb5v1.l5 -0.011 0.029 -0.055 0.024 0.095 0.004 -0.034 0.069 -0.015  
## Xcb5v2.l1 -0.111 0.082 -0.055 0.040 -0.007 0.122 -0.071 0.037 -0.047  
## Xcb5v2.l2 0.091 -0.113 0.090 -0.004 -0.018 -0.104 0.133 -0.078 -0.016  
## Xcb5v2.l3 -0.086 0.092 -0.143 0.057 0.028 0.065 -0.104 0.145 -0.014  
## Xcb5v2.l4 0.048 0.005 0.023 -0.083 0.005 -0.014 -0.032 -0.016 0.102  
## Xcb5v2.l5 0.045 -0.048 0.063 -0.026 -0.103 -0.016 0.050 -0.073 0.004  
## Xcb5v3.l1 0.142 -0.103 0.056 -0.045 0.016 -0.128 0.071 -0.030 0.049  
## Xcb5v3.l2 -0.107 0.151 -0.112 -0.019 0.027 0.113 -0.143 0.086 0.013  
## Xcb5v3.l3 0.082 -0.110 0.176 -0.052 -0.055 -0.075 0.114 -0.161 0.023  
## Xcb5v3.l4 -0.048 -0.026 -0.019 0.112 -0.012 0.012 0.039 0.009 -0.110  
## Xcb5v3.l5 -0.026 0.053 -0.083 0.021 0.138 0.028 -0.064 0.091 -0.017  
## Xcb6v1.l1 -0.047 -0.007 0.025 0.035 -0.022 0.186 -0.109 0.041 -0.052  
## Xcb6v1.l2 0.028 -0.050 -0.016 0.055 0.003 -0.091 0.186 -0.086 -0.100  
## Xcb6v1.l3 0.036 0.025 -0.025 -0.055 0.007 -0.005 -0.096 0.162 0.031  
## Xcb6v1.l4 -0.032 0.063 0.018 -0.112 0.007 -0.034 -0.083 -0.044 0.249  
## Xcb6v1.l5 -0.046 -0.008 0.030 0.028 -0.039 0.084 0.001 -0.052 -0.030  
## Xcb6v2.l1 0.272 -0.159 0.046 -0.064 0.086 0.080 -0.050 0.044 -0.039  
## Xcb6v2.l2 -0.176 0.277 -0.170 -0.085 0.036 -0.075 0.085 -0.052 -0.002  
## Xcb6v2.l3 0.075 -0.175 0.263 -0.012 -0.124 0.049 -0.078 0.093 -0.013  
## Xcb6v2.l4 -0.053 -0.105 0.012 0.255 -0.044 -0.011 -0.009 -0.031 0.054  
## Xcb6v2.l5 0.041 0.059 -0.132 -0.024 0.293 -0.015 0.030 -0.045 -0.008  
## Xcb6v3.l1 -0.009 -0.019 0.015 0.025 -0.011 0.167 -0.105 0.038 -0.035  
## Xcb6v3.l2 0.009 -0.001 -0.027 0.015 0.010 -0.070 0.165 -0.086 -0.092  
## Xcb6v3.l3 0.018 0.004 0.016 -0.035 -0.013 -0.009 -0.076 0.147 0.017  
## Xcb6v3.l4 -0.024 0.022 0.012 -0.027 -0.001 -0.042 -0.072 -0.029 0.212  
## Xcb6v3.l5 -0.019 -0.002 0.003 0.016 0.017 0.073 -0.006 -0.030 -0.029  
## Xs(NumDate)Fx1 -0.001 -0.006 0.002 -0.008 -0.001 -0.001 0.006 0.001 -0.018  
## Xc43.5 Xc51.1 Xc51.2 Xc51.3 Xc51.4 Xc51.5 Xc52.1 Xc52.2 Xc52.3  
## Xcb1v1.l1   
## Xcb1v1.l2   
## Xcb1v1.l3   
## Xcb1v1.l4   
## Xcb1v1.l5   
## Xcb1v2.l1   
## Xcb1v2.l2   
## Xcb1v2.l3   
## Xcb1v2.l4   
## Xcb1v2.l5   
## Xcb1v3.l1   
## Xcb1v3.l2   
## Xcb1v3.l3   
## Xcb1v3.l4   
## Xcb1v3.l5   
## Xcb2v1.l1   
## Xcb2v1.l2   
## Xcb2v1.l3   
## Xcb2v1.l4   
## Xcb2v1.l5   
## Xcb2v2.l1   
## Xcb2v2.l2   
## Xcb2v2.l3   
## Xcb2v2.l4   
## Xcb2v2.l5   
## Xcb2v3.l1   
## Xcb2v3.l2   
## Xcb2v3.l3   
## Xcb2v3.l4   
## Xcb2v3.l5   
## Xcb4v1.l1   
## Xcb4v1.l2   
## Xcb4v1.l3   
## Xcb4v1.l4   
## Xcb4v1.l5   
## Xcb4v2.l1   
## Xcb4v2.l2   
## Xcb4v2.l3   
## Xcb4v2.l4   
## Xcb4v2.l5   
## Xcb4v3.l1   
## Xcb4v3.l2   
## Xcb4v3.l3   
## Xcb4v3.l4   
## Xcb4v3.l5   
## Xcb5v1.l1 -0.026   
## Xcb5v1.l2 -0.018 -0.599   
## Xcb5v1.l3 0.031 0.217 -0.594   
## Xcb5v1.l4 0.018 -0.217 -0.352 -0.060   
## Xcb5v1.l5 -0.128 0.187 0.162 -0.438 -0.089   
## Xcb5v2.l1 0.023 -0.681 0.421 -0.135 0.112 -0.133   
## Xcb5v2.l2 0.013 0.378 -0.693 0.420 0.265 -0.115 -0.598   
## Xcb5v2.l3 -0.034 -0.116 0.357 -0.689 0.081 0.291 0.208 -0.585   
## Xcb5v2.l4 -0.001 0.167 0.256 0.015 -0.744 0.086 -0.230 -0.338 -0.088  
## Xcb5v2.l5 0.125 -0.136 -0.078 0.253 0.076 -0.728 0.199 0.145 -0.422  
## Xcb5v3.l1 -0.038 0.793 -0.493 0.181 -0.150 0.140 -0.895 0.532 -0.188  
## Xcb5v3.l2 -0.011 -0.453 0.797 -0.488 -0.287 0.144 0.536 -0.897 0.514  
## Xcb5v3.l3 0.037 0.151 -0.436 0.794 -0.081 -0.353 -0.179 0.529 -0.894  
## Xcb5v3.l4 0.014 -0.187 -0.268 -0.040 0.815 -0.093 0.186 0.297 0.092  
## Xcb5v3.l5 -0.148 0.158 0.097 -0.304 -0.093 0.803 -0.184 -0.131 0.371  
## Xcb6v1.l1 -0.002 0.043 -0.012 0.005 -0.029 0.033 -0.220 0.119 -0.047  
## Xcb6v1.l2 0.047 -0.038 0.025 -0.010 0.008 -0.016 0.171 -0.202 0.126  
## Xcb6v1.l3 -0.086 0.025 -0.027 0.023 -0.012 0.002 -0.106 0.158 -0.200  
## Xcb6v1.l4 -0.013 -0.004 -0.003 -0.009 0.053 -0.009 0.049 0.052 0.017  
## Xcb6v1.l5 0.156 0.003 0.014 -0.022 -0.038 0.043 0.001 -0.078 0.143  
## Xcb6v2.l1 -0.004 -0.222 0.111 -0.025 0.060 -0.086 0.390 -0.210 0.048  
## Xcb6v2.l2 0.019 0.163 -0.219 0.119 0.050 0.005 -0.262 0.391 -0.215  
## Xcb6v2.l3 -0.026 -0.083 0.145 -0.211 0.015 0.051 0.122 -0.251 0.386  
## Xcb6v2.l4 0.010 0.033 0.087 0.006 -0.219 0.039 -0.086 -0.157 -0.019  
## Xcb6v2.l5 0.052 -0.006 -0.070 0.104 0.029 -0.231 0.030 0.103 -0.193  
## Xcb6v3.l1 -0.006 0.383 -0.166 0.041 -0.155 0.148 -0.179 0.064 -0.018  
## Xcb6v3.l2 0.042 -0.304 0.374 -0.180 -0.094 0.002 0.160 -0.171 0.065  
## Xcb6v3.l3 -0.084 0.145 -0.296 0.369 0.007 -0.134 -0.078 0.153 -0.161  
## Xcb6v3.l4 -0.008 -0.033 -0.150 -0.048 0.362 -0.041 -0.006 0.065 0.041  
## Xcb6v3.l5 0.148 0.021 0.141 -0.250 -0.071 0.367 -0.010 -0.074 0.115  
## Xs(NumDate)Fx1 -0.005 -0.007 -0.008 0.001 0.000 0.015 0.010 -0.001 -0.016  
## Xc52.4 Xc52.5 Xc53.1 Xc53.2 Xc53.3 Xc53.4 Xc53.5 Xc61.1 Xc61.2  
## Xcb1v1.l1   
## Xcb1v1.l2   
## Xcb1v1.l3   
## Xcb1v1.l4   
## Xcb1v1.l5   
## Xcb1v2.l1   
## Xcb1v2.l2   
## Xcb1v2.l3   
## Xcb1v2.l4   
## Xcb1v2.l5   
## Xcb1v3.l1   
## Xcb1v3.l2   
## Xcb1v3.l3   
## Xcb1v3.l4   
## Xcb1v3.l5   
## Xcb2v1.l1   
## Xcb2v1.l2   
## Xcb2v1.l3   
## Xcb2v1.l4   
## Xcb2v1.l5   
## Xcb2v2.l1   
## Xcb2v2.l2   
## Xcb2v2.l3   
## Xcb2v2.l4   
## Xcb2v2.l5   
## Xcb2v3.l1   
## Xcb2v3.l2   
## Xcb2v3.l3   
## Xcb2v3.l4   
## Xcb2v3.l5   
## Xcb4v1.l1   
## Xcb4v1.l2   
## Xcb4v1.l3   
## Xcb4v1.l4   
## Xcb4v1.l5   
## Xcb4v2.l1   
## Xcb4v2.l2   
## Xcb4v2.l3   
## Xcb4v2.l4   
## Xcb4v2.l5   
## Xcb4v3.l1   
## Xcb4v3.l2   
## Xcb4v3.l3   
## Xcb4v3.l4   
## Xcb4v3.l5   
## Xcb5v1.l1   
## Xcb5v1.l2   
## Xcb5v1.l3   
## Xcb5v1.l4   
## Xcb5v1.l5   
## Xcb5v2.l1   
## Xcb5v2.l2   
## Xcb5v2.l3   
## Xcb5v2.l4   
## Xcb5v2.l5 -0.114   
## Xcb5v3.l1 0.207 -0.171   
## Xcb5v3.l2 0.309 -0.135 -0.594   
## Xcb5v3.l3 0.064 0.380 0.204 -0.584   
## Xcb5v3.l4 -0.908 0.112 -0.215 -0.336 -0.085   
## Xcb5v3.l5 0.125 -0.896 0.198 0.155 -0.427 -0.136   
## Xcb6v1.l1 0.079 -0.081 0.212 -0.105 0.033 -0.073 0.082   
## Xcb6v1.l2 0.023 -0.002 -0.158 0.190 -0.106 -0.029 -0.008 -0.637   
## Xcb6v1.l3 0.038 0.075 0.092 -0.138 0.183 -0.034 -0.054 0.284 -0.651  
## Xcb6v1.l4 -0.191 0.028 -0.043 -0.061 -0.019 0.201 -0.038 -0.264 -0.309  
## Xcb6v1.l5 0.032 -0.177 0.005 0.066 -0.114 -0.042 0.186 0.165 0.203  
## Xcb6v2.l1 -0.100 0.125 -0.164 0.086 -0.013 0.032 -0.064 -0.106 0.046  
## Xcb6v2.l2 -0.117 0.015 0.113 -0.166 0.090 0.048 -0.002 0.052 -0.119  
## Xcb6v2.l3 -0.035 -0.126 -0.049 0.103 -0.155 0.005 0.049 0.013 0.058  
## Xcb6v2.l4 0.374 -0.064 0.024 0.069 -0.004 -0.165 0.041 0.003 0.082  
## Xcb6v2.l5 -0.029 0.392 -0.014 -0.049 0.080 0.030 -0.167 -0.056 -0.022  
## Xcb6v3.l1 0.090 -0.082 0.317 -0.133 0.031 -0.126 0.123 0.731 -0.450  
## Xcb6v3.l2 0.034 0.016 -0.252 0.308 -0.137 -0.075 -0.009 -0.476 0.721  
## Xcb6v3.l3 -0.017 0.043 0.121 -0.240 0.298 0.002 -0.086 0.223 -0.481  
## Xcb6v3.l4 -0.183 0.027 -0.024 -0.124 -0.049 0.312 -0.049 -0.178 -0.220  
## Xcb6v3.l5 0.057 -0.158 0.017 0.111 -0.187 -0.065 0.298 0.103 0.148  
## Xs(NumDate)Fx1 0.037 -0.032 -0.015 0.002 0.016 -0.029 0.035 -0.001 0.006  
## Xc61.3 Xc61.4 Xc61.5 Xc62.1 Xc62.2 Xc62.3 Xc62.4 Xc62.5 Xc63.1  
## Xcb1v1.l1   
## Xcb1v1.l2   
## Xcb1v1.l3   
## Xcb1v1.l4   
## Xcb1v1.l5   
## Xcb1v2.l1   
## Xcb1v2.l2   
## Xcb1v2.l3   
## Xcb1v2.l4   
## Xcb1v2.l5   
## Xcb1v3.l1   
## Xcb1v3.l2   
## Xcb1v3.l3   
## Xcb1v3.l4   
## Xcb1v3.l5   
## Xcb2v1.l1   
## Xcb2v1.l2   
## Xcb2v1.l3   
## Xcb2v1.l4   
## Xcb2v1.l5   
## Xcb2v2.l1   
## Xcb2v2.l2   
## Xcb2v2.l3   
## Xcb2v2.l4   
## Xcb2v2.l5   
## Xcb2v3.l1   
## Xcb2v3.l2   
## Xcb2v3.l3   
## Xcb2v3.l4   
## Xcb2v3.l5   
## Xcb4v1.l1   
## Xcb4v1.l2   
## Xcb4v1.l3   
## Xcb4v1.l4   
## Xcb4v1.l5   
## Xcb4v2.l1   
## Xcb4v2.l2   
## Xcb4v2.l3   
## Xcb4v2.l4   
## Xcb4v2.l5   
## Xcb4v3.l1   
## Xcb4v3.l2   
## Xcb4v3.l3   
## Xcb4v3.l4   
## Xcb4v3.l5   
## Xcb5v1.l1   
## Xcb5v1.l2   
## Xcb5v1.l3   
## Xcb5v1.l4   
## Xcb5v1.l5   
## Xcb5v2.l1   
## Xcb5v2.l2   
## Xcb5v2.l3   
## Xcb5v2.l4   
## Xcb5v2.l5   
## Xcb5v3.l1   
## Xcb5v3.l2   
## Xcb5v3.l3   
## Xcb5v3.l4   
## Xcb5v3.l5   
## Xcb6v1.l1   
## Xcb6v1.l2   
## Xcb6v1.l3   
## Xcb6v1.l4 -0.077   
## Xcb6v1.l5 -0.514 -0.064   
## Xcb6v2.l1 0.032 -0.004 -0.052   
## Xcb6v2.l2 0.046 0.085 -0.011 -0.591   
## Xcb6v2.l3 -0.103 -0.048 0.073 0.191 -0.602   
## Xcb6v2.l4 -0.026 -0.164 0.038 -0.246 -0.389 -0.039   
## Xcb6v2.l5 0.058 0.009 -0.180 0.223 0.161 -0.456 -0.104   
## Xcb6v3.l1 0.195 -0.201 0.147 -0.156 0.072 0.006 0.026 -0.083   
## Xcb6v3.l2 -0.461 -0.208 0.126 0.097 -0.161 0.074 0.077 -0.015 -0.605  
## Xcb6v3.l3 0.724 -0.055 -0.345 -0.003 0.095 -0.137 -0.045 0.064 0.217  
## Xcb6v3.l4 -0.051 0.710 -0.073 -0.007 0.086 -0.040 -0.187 0.032 -0.233  
## Xcb6v3.l5 -0.350 -0.047 0.706 -0.055 -0.033 0.093 0.043 -0.203 0.207  
## Xs(NumDate)Fx1 0.005 -0.025 0.006 0.001 -0.005 -0.005 0.015 -0.010 -0.003  
## Xc63.2 Xc63.3 Xc63.4 Xc63.5  
## Xcb1v1.l1   
## Xcb1v1.l2   
## Xcb1v1.l3   
## Xcb1v1.l4   
## Xcb1v1.l5   
## Xcb1v2.l1   
## Xcb1v2.l2   
## Xcb1v2.l3   
## Xcb1v2.l4   
## Xcb1v2.l5   
## Xcb1v3.l1   
## Xcb1v3.l2   
## Xcb1v3.l3   
## Xcb1v3.l4   
## Xcb1v3.l5   
## Xcb2v1.l1   
## Xcb2v1.l2   
## Xcb2v1.l3   
## Xcb2v1.l4   
## Xcb2v1.l5   
## Xcb2v2.l1   
## Xcb2v2.l2   
## Xcb2v2.l3   
## Xcb2v2.l4   
## Xcb2v2.l5   
## Xcb2v3.l1   
## Xcb2v3.l2   
## Xcb2v3.l3   
## Xcb2v3.l4   
## Xcb2v3.l5   
## Xcb4v1.l1   
## Xcb4v1.l2   
## Xcb4v1.l3   
## Xcb4v1.l4   
## Xcb4v1.l5   
## Xcb4v2.l1   
## Xcb4v2.l2   
## Xcb4v2.l3   
## Xcb4v2.l4   
## Xcb4v2.l5   
## Xcb4v3.l1   
## Xcb4v3.l2   
## Xcb4v3.l3   
## Xcb4v3.l4   
## Xcb4v3.l5   
## Xcb5v1.l1   
## Xcb5v1.l2   
## Xcb5v1.l3   
## Xcb5v1.l4   
## Xcb5v1.l5   
## Xcb5v2.l1   
## Xcb5v2.l2   
## Xcb5v2.l3   
## Xcb5v2.l4   
## Xcb5v2.l5   
## Xcb5v3.l1   
## Xcb5v3.l2   
## Xcb5v3.l3   
## Xcb5v3.l4   
## Xcb5v3.l5   
## Xcb6v1.l1   
## Xcb6v1.l2   
## Xcb6v1.l3   
## Xcb6v1.l4   
## Xcb6v1.l5   
## Xcb6v2.l1   
## Xcb6v2.l2   
## Xcb6v2.l3   
## Xcb6v2.l4   
## Xcb6v2.l5   
## Xcb6v3.l1   
## Xcb6v3.l2   
## Xcb6v3.l3 -0.623   
## Xcb6v3.l4 -0.359 -0.029   
## Xcb6v3.l5 0.180 -0.486 -0.105   
## Xs(NumDate)Fx1 0.002 0.001 -0.006 0.005  
##   
## Standardized Within-Group Residuals:  
## Min Q1 Med Q3 Max   
## -1.5296928 -0.4521492 -0.2317115 0.1917924 26.1176478   
##   
## Number of Observations: 21311  
## Number of Groups:   
## g country\_region %in% g   
## 1 123

summary(fit1$gam)

##   
## Family: Tweedie(1.656)   
## Link function: log   
##   
## Formula:  
## IncCaseNumber ~ s(NumDate)  
##   
## Parametric coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.2864 0.2182 15.06 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Approximate significance of smooth terms:  
## edf Ref.df F p-value   
## s(NumDate) 8.85 8.85 1930 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## R-sq.(adj) = 0.00779   
## Scale est. = 9.281 n = 21311

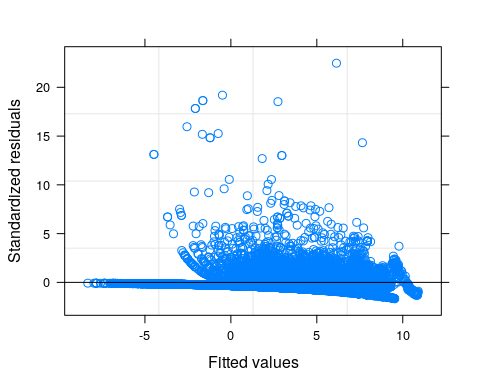
summary(fit2$gam)

##   
## Family: Tweedie(1.656)   
## Link function: log   
##   
## Formula:  
## IncCaseNumber ~ s(NumDate) + s(retail\_and\_recreation\_percent\_change\_from\_baseline) +   
## s(grocery\_and\_pharmacy\_percent\_change\_from\_baseline) + s(transit\_stations\_percent\_change\_from\_baseline) +   
## s(workplaces\_percent\_change\_from\_baseline + residential\_percent\_change\_from\_baseline)  
##   
## Parametric coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.1366 0.1947 16.11 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Approximate significance of smooth terms:  
## edf Ref.df F  
## s(NumDate) 8.967 8.967 964.80  
## s(retail\_and\_recreation\_percent\_change\_from\_baseline) 8.110 8.110 142.59  
## s(grocery\_and\_pharmacy\_percent\_change\_from\_baseline) 7.854 7.854 108.20  
## s(transit\_stations\_percent\_change\_from\_baseline) 6.436 6.436 40.26  
## s(workplaces\_percent\_change\_from\_baseline) 6.663 6.663 52.27  
## p-value   
## s(NumDate) <2e-16 \*\*\*  
## s(retail\_and\_recreation\_percent\_change\_from\_baseline) <2e-16 \*\*\*  
## s(grocery\_and\_pharmacy\_percent\_change\_from\_baseline) <2e-16 \*\*\*  
## s(transit\_stations\_percent\_change\_from\_baseline) <2e-16 \*\*\*  
## s(workplaces\_percent\_change\_from\_baseline) <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## R-sq.(adj) = 0.00929   
## Scale est. = 8.4852 n = 21311

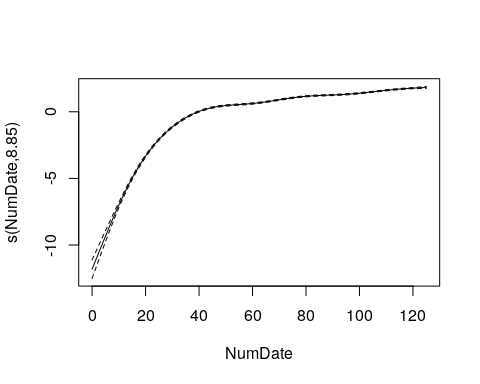
summary(fitcb$gam)

##   
## Family: Tweedie(1.656)   
## Link function: log   
##   
## Formula:  
## IncCaseNumber ~ s(NumDate) + cb1 + cb2 + cb4 + cb5 + cb6  
##   
## Parametric coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 5.02097 0.45929 10.932 < 2e-16 \*\*\*  
## cb1v1.l1 0.37486 0.37218 1.007 0.313844   
## cb1v1.l2 -0.25501 0.36182 -0.705 0.480936   
## cb1v1.l3 0.14325 0.34750 0.412 0.680171   
## cb1v1.l4 1.78336 0.25651 6.952 3.70e-12 \*\*\*  
## cb1v1.l5 -1.16022 0.32616 -3.557 0.000376 \*\*\*  
## cb1v2.l1 0.94467 0.36610 2.580 0.009877 \*\*   
## cb1v2.l2 0.64631 0.36002 1.795 0.072638 .   
## cb1v2.l3 -0.64301 0.34678 -1.854 0.063720 .   
## cb1v2.l4 0.88152 0.24384 3.615 0.000301 \*\*\*  
## cb1v2.l5 -2.08204 0.30493 -6.828 8.85e-12 \*\*\*  
## cb1v3.l1 -1.01595 0.48874 -2.079 0.037658 \*   
## cb1v3.l2 -0.47463 0.47830 -0.992 0.321046   
## cb1v3.l3 -1.34291 0.45965 -2.922 0.003486 \*\*   
## cb1v3.l4 2.87059 0.33049 8.686 < 2e-16 \*\*\*  
## cb1v3.l5 -2.24728 0.41121 -5.465 4.68e-08 \*\*\*  
## cb2v1.l1 -0.19336 0.42569 -0.454 0.649664   
## cb2v1.l2 0.11129 0.40312 0.276 0.782491   
## cb2v1.l3 0.59179 0.39339 1.504 0.132515   
## cb2v1.l4 -1.77323 0.27471 -6.455 1.11e-10 \*\*\*  
## cb2v1.l5 2.71376 0.33027 8.217 < 2e-16 \*\*\*  
## cb2v2.l1 -0.42769 0.33003 -1.296 0.195020   
## cb2v2.l2 -0.36221 0.31280 -1.158 0.246897   
## cb2v2.l3 -0.23565 0.29480 -0.799 0.424100   
## cb2v2.l4 0.71847 0.21097 3.405 0.000662 \*\*\*  
## cb2v2.l5 0.14422 0.25955 0.556 0.578441   
## cb2v3.l1 -0.13309 0.51501 -0.258 0.796082   
## cb2v3.l2 0.28777 0.47611 0.604 0.545570   
## cb2v3.l3 1.65404 0.45209 3.659 0.000254 \*\*\*  
## cb2v3.l4 -4.60325 0.31509 -14.609 < 2e-16 \*\*\*  
## cb2v3.l5 4.74375 0.37408 12.681 < 2e-16 \*\*\*  
## cb4v1.l1 -0.46557 0.44257 -1.052 0.292823   
## cb4v1.l2 -0.51557 0.43079 -1.197 0.231397   
## cb4v1.l3 -0.33734 0.41717 -0.809 0.418724   
## cb4v1.l4 -1.23164 0.29593 -4.162 3.17e-05 \*\*\*  
## cb4v1.l5 0.28138 0.35039 0.803 0.421959   
## cb4v2.l1 -0.01728 0.38360 -0.045 0.964068   
## cb4v2.l2 0.26641 0.36884 0.722 0.470114   
## cb4v2.l3 0.95394 0.35586 2.681 0.007353 \*\*   
## cb4v2.l4 0.14627 0.24478 0.598 0.550154   
## cb4v2.l5 1.22186 0.30587 3.995 6.50e-05 \*\*\*  
## cb4v3.l1 -0.38479 0.58197 -0.661 0.508498   
## cb4v3.l2 -0.64022 0.55258 -1.159 0.246636   
## cb4v3.l3 -0.58718 0.53262 -1.102 0.270286   
## cb4v3.l4 -0.58348 0.37879 -1.540 0.123478   
## cb4v3.l5 -0.33732 0.44486 -0.758 0.448301   
## cb5v1.l1 -0.55033 0.49525 -1.111 0.266487   
## cb5v1.l2 0.43591 0.48621 0.897 0.369971   
## cb5v1.l3 0.68376 0.46118 1.483 0.138186   
## cb5v1.l4 -1.56423 0.33798 -4.628 3.71e-06 \*\*\*  
## cb5v1.l5 0.02859 0.40990 0.070 0.944392   
## cb5v2.l1 0.36231 0.59023 0.614 0.539324   
## cb5v2.l2 -0.35016 0.57029 -0.614 0.539216   
## cb5v2.l3 -1.44865 0.54593 -2.654 0.007971 \*\*   
## cb5v2.l4 3.12406 0.40288 7.754 9.28e-15 \*\*\*  
## cb5v2.l5 -0.93245 0.50259 -1.855 0.063566 .   
## cb5v3.l1 -0.47546 1.19741 -0.397 0.691316   
## cb5v3.l2 1.08099 1.16164 0.931 0.352087   
## cb5v3.l3 2.91750 1.11240 2.623 0.008729 \*\*   
## cb5v3.l4 -7.78232 0.83566 -9.313 < 2e-16 \*\*\*  
## cb5v3.l5 2.91029 1.03196 2.820 0.004804 \*\*   
## cb6v1.l1 -0.05301 0.45783 -0.116 0.907816   
## cb6v1.l2 0.13950 0.44637 0.313 0.754649   
## cb6v1.l3 -0.33096 0.42599 -0.777 0.437213   
## cb6v1.l4 -0.01081 0.28609 -0.038 0.969845   
## cb6v1.l5 0.35809 0.36194 0.989 0.322508   
## cb6v2.l1 -0.06736 0.33371 -0.202 0.840040   
## cb6v2.l2 0.26218 0.32564 0.805 0.420757   
## cb6v2.l3 -0.31023 0.30843 -1.006 0.314507   
## cb6v2.l4 0.52968 0.21172 2.502 0.012363 \*   
## cb6v2.l5 -0.66860 0.28418 -2.353 0.018645 \*   
## cb6v3.l1 -0.46321 0.43401 -1.067 0.285854   
## cb6v3.l2 0.62281 0.42379 1.470 0.141677   
## cb6v3.l3 -0.69376 0.40089 -1.731 0.083544 .   
## cb6v3.l4 0.01649 0.27641 0.060 0.952438   
## cb6v3.l5 -0.01086 0.36454 -0.030 0.976238   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Approximate significance of smooth terms:  
## edf Ref.df F p-value   
## s(NumDate) 8.974 8.974 622.6 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## R-sq.(adj) = 0.00876   
## Scale est. = 8.6135 n = 21311

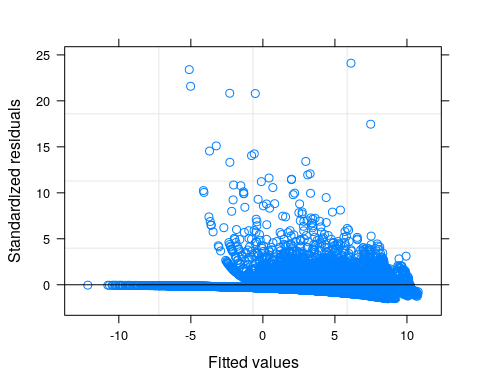
plot(fit1$lme)



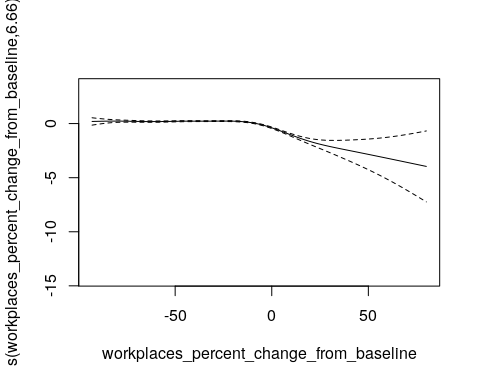
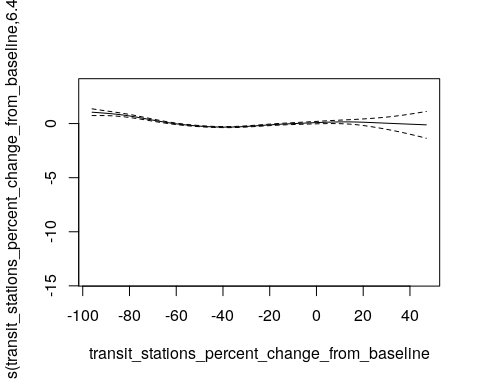
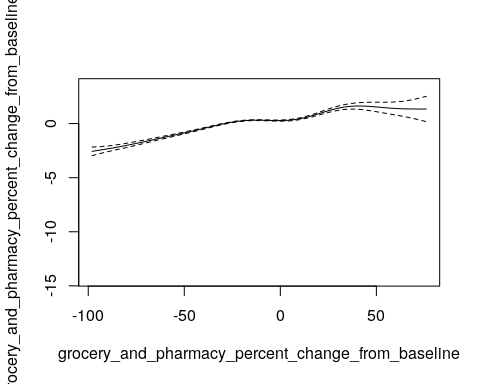
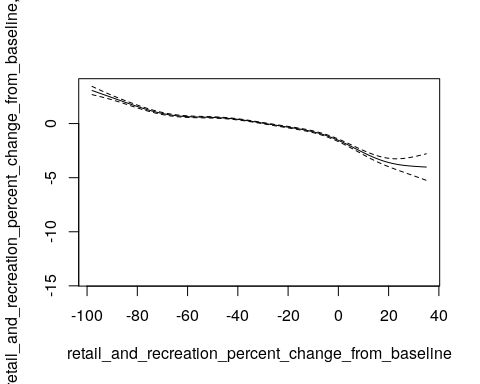
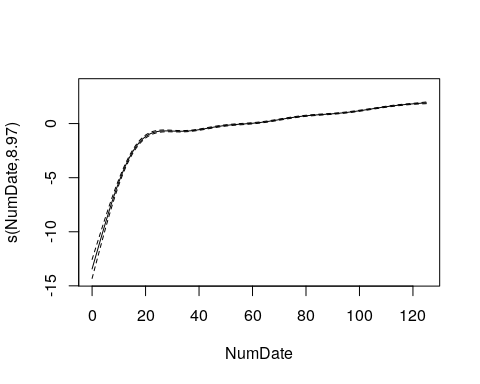
plot(fit1$gam)



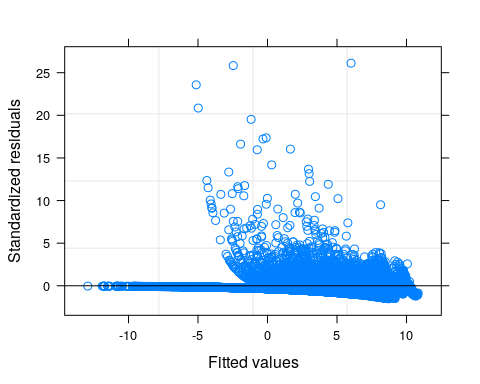
plot(fit2$lme)



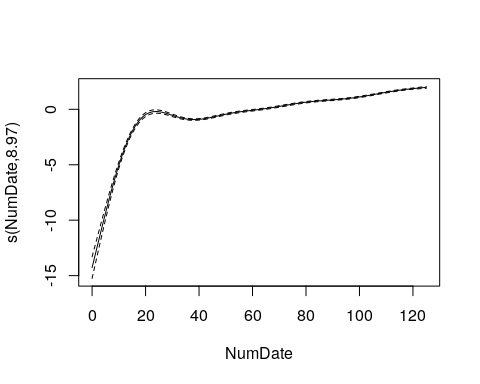
plot(fit2$gam)



plot(fitcb$lme)



plot(fitcb$gam)



#preparing data for the validation  
  
cb1 <- crossbasis(datav$grocery\_and\_pharmacy\_percent\_change\_from\_baseline , lag=14, argvar=list(fun="bs"),arglag=list(df=5), group=datav$country\_region)  
cb2 <- crossbasis(datav$retail\_and\_recreation\_percent\_change\_from\_baseline , lag=14, argvar=list(fun="bs"),arglag=list(df=5), group=datav$country\_region)  
cb4 <- crossbasis(datav$transit\_stations\_percent\_change\_from\_baseline , lag=14, argvar=list(fun="bs"),arglag=list(df=5), group=datav$country\_region)  
cb5 <- crossbasis(datav$workplaces\_percent\_change\_from\_baseline , lag=14, argvar=list(fun="bs"),arglag=list(df=5), group=datav$country\_region)  
cb6 <- crossbasis(datav$residential\_percent\_change\_from\_baseline , lag=14, argvar=list(fun="bs"),arglag=list(df=5), group=datav$country\_region)  
  
dataval<-datav %>%  
 group\_by(country\_region) %>%  
 slice(-c(1:14))  
  
  
pred1<-predict.gam(fit1$gam, dataval, type="response")  
pred2<-predict.gam(fit2$gam, dataval, type="response")  
predcb<-predict.gam(fitcb$gam, datav, type="response")  
predcb<-predcb[!is.na(predcb)]  
  
  
RMSE <- function(pred, obs){  
 sqrt(mean((pred - obs)^2))  
}  
  
  
RMSE(pred1, dataval$IncCaseNumber)

## [1] 6840.163

RMSE(pred2, dataval$IncCaseNumber)

## [1] 6794.985

RMSE(predcb, dataval$IncCaseNumber) #lag distributed is slightly better than contempr.-worst is the without GMD

## [1] 6690.436

dataval$pred1<-pred1  
dataval$pred2<-pred2  
dataval$predcb<-predcb  
  
rmsepercountry1<-dataval %>%  
 group\_by(country\_region) %>%  
 summarise(RMSE(pred1, IncCaseNumber), .groups = 'drop')  
summary(rmsepercountry1)

## country\_region RMSE(pred1, IncCaseNumber)  
## Afghanistan : 1 Min. : 113.2   
## Angola : 1 1st Qu.: 240.9   
## Antigua and Barbuda: 1 Median : 279.6   
## Argentina : 1 Mean : 2111.3   
## Australia : 1 3rd Qu.: 728.2   
## Austria : 1 Max. :58437.4   
## (Other) :117

rmsepercountry2<-dataval %>%  
 group\_by(country\_region) %>%  
 summarise(RMSE(pred2, IncCaseNumber), .groups = 'drop')  
summary(rmsepercountry2)

## country\_region RMSE(pred2, IncCaseNumber)  
## Afghanistan : 1 Min. : 33.0   
## Angola : 1 1st Qu.: 163.7   
## Antigua and Barbuda: 1 Median : 289.9   
## Argentina : 1 Mean : 2062.2   
## Australia : 1 3rd Qu.: 682.2   
## Austria : 1 Max. :57920.9   
## (Other) :117

rmsepercountrycb<-dataval %>%  
 group\_by(country\_region) %>%  
 summarise(RMSE(predcb, IncCaseNumber), .groups = 'drop')  
summary(rmsepercountrycb)

## country\_region RMSE(predcb, IncCaseNumber)  
## Afghanistan : 1 Min. : 12.9   
## Angola : 1 1st Qu.: 217.8   
## Antigua and Barbuda: 1 Median : 412.8   
## Argentina : 1 Mean : 2083.1   
## Australia : 1 3rd Qu.: 732.7   
## Austria : 1 Max. :56784.6   
## (Other) :117

library(forecast)

## Registered S3 method overwritten by 'quantmod':  
## method from  
## as.zoo.data.frame zoo

##   
## Attaching package: 'forecast'

## The following object is masked from 'package:nlme':  
##   
## getResponse

dm.test(pred1-dataval$IncCaseNumber, pred2-dataval$IncCaseNumber)

##   
## Diebold-Mariano Test  
##   
## data: pred1 - dataval$IncCaseNumberpred2 - dataval$IncCaseNumber  
## DM = 13.42, Forecast horizon = 1, Loss function power = 2, p-value <  
## 2.2e-16  
## alternative hypothesis: two.sided

dm.test(predcb-dataval$IncCaseNumber, pred2-dataval$IncCaseNumber)

##   
## Diebold-Mariano Test  
##   
## data: predcb - dataval$IncCaseNumberpred2 - dataval$IncCaseNumber  
## DM = -13.754, Forecast horizon = 1, Loss function power = 2, p-value <  
## 2.2e-16  
## alternative hypothesis: two.sided

dm.test(predcb-dataval$IncCaseNumber, pred1-dataval$IncCaseNumber)

##   
## Diebold-Mariano Test  
##   
## data: predcb - dataval$IncCaseNumberpred1 - dataval$IncCaseNumber  
## DM = -14.2, Forecast horizon = 1, Loss function power = 2, p-value <  
## 2.2e-16  
## alternative hypothesis: two.sided