|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | DDS | DAS | DSS | K10 | EQ-5D | MO | SC | UA | PD | AD |
| DASS depression | 1.00 |  |  |  |  |  |  |  |  |  |
| DASS anxiety | 0.63 | 1.00 |  |  |  |  |  |  |  |  |
| DASS stress | 0.65 | 0.73 | 1.00 |  |  |  |  |  |  |  |
| K-10 | 0.76 | 0.69 | 0.68 | 1.00 |  |  |  |  |  |  |
| EQ-5D-5L\* | -0.51 | -0.50 | -0.43 | -0.57 | 1.00 |  |  |  |  |  |
| MO | 0.21 | 0.25 | 0.19 | 0.23 | -0.62 | 1.00 |  |  |  |  |
| SC | 0.29 | 0.31 | 0.22 | 0.31 | -0.51 | 0.47 | 1.00 |  |  |  |
| UA | 0.35 | 0.35 | 0.26 | 0.37 | -0.72 | 0.57 | 0.50 | 1.00 |  |  |
| PD | 0.20 | 0.27 | 0.21 | 0.25 | -0.69 | 0.56 | 0.35 | 0.48 | 1.00 |  |
| AD | 0.61 | 0.51 | 0.50 | 0.65 | -0.74 | 0.21 | 0.27 | 0.39 | 0.25 | 1.00 |

Appendix Table A1 Spearman's rank correlations between the source and target instruments.

Note. All correlation coefficients are significant at p<0.0001. DDS=DASS Depression Scale; DAS=DASS Anxiety Scale; DSS=DASS Stress Scale; MO=Mobility; SC=Self-care; UA=Usual activities; PD=Pain/discomfort; AD=Anxiety/depression. \*Based on English value set.

Appendix Table A2a Exploratory factor analysis – Structure matrix

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Factor | | | |
|  |
| **DASS-21 items** | Depression | Anxiety | stress | Physical |
| 1. I found it hard to wind down. | 0.309 | 0.491 | 0.573 |  |
| 2. I was aware of dryness of my mouth. |  | 0.373 | 0.366 | 0.392 |
| 3. I couldn't seem to experience any positive feeling at all. | 0.757 | 0.543 | 0.507 | 0.320 |
| 4. I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion). | 0.411 | 0.576 | 0.420 | 0.380 |
| 5. I found it difficult to work up the initiative to do things. | 0.605 | 0.438 | 0.495 | 0.333 |
| 6. I tended to over-react to situations. | 0.490 | 0.478 | 0.708 |  |
| 7. I experienced trembling (e.g., in the hands). | 0.461 | 0.672 | 0.491 | 0.334 |
| 8. I felt that I was using a lot of nervous energy. | 0.462 | 0.720 | 0.608 |  |
| 9. I was worried about situations in which I might panic and make a fool of myself. | 0.489 | 0.692 | 0.548 |  |
| 10. I felt that I had nothing to look forward to. | 0.840 | 0.551 | 0.511 |  |
| 11. I found myself getting agitated. | 0.551 | 0.615 | 0.777 |  |
| 12. I found it difficult to relax. | 0.556 | 0.655 | 0.737 |  |
| 13. I felt down-hearted and blue. | 0.802 | 0.544 | 0.602 |  |
| 14. I was intolerant of anything that kept me from getting on with what I was doing. | 0.453 | 0.488 | 0.629 |  |
| 15. I felt I was close to panic. | 0.549 | 0.783 | 0.631 | 0.308 |
| 16. I was unable to become enthusiastic about anything. | 0.810 | 0.526 | 0.543 | 0.344 |
| 17. I felt I wasn't worth much as a person. | 0.826 | 0.551 | 0.546 |  |
| 18. I felt that I was rather touchy. | 0.570 | 0.565 | 0.717 |  |
| 19. I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat). | 0.474 | 0.672 | 0.486 | 0.333 |
| 20.I felt scared without any good reason. | 0.584 | 0.781 | 0.542 |  |
| 21. I felt that life was meaningless. | 0.839 | 0.568 | 0.475 |  |
| EQ-5D items |  |  |  |  |
| 1. Mobility |  |  |  | 0.820 |
| 2. Self-care |  | 0.309 |  | 0.606 |
| 3. Usual activities | 0.384 | 0.356 |  | 0.764 |
| 4. Pain / discomfort |  |  |  | 0.686 |
| 5. Anxiety / depression | 0.640 | 0.552 | 0.503 | 0.394 |

Note. Loadings below 0.30 not shown. Rotation Method: Promax with Kaiser Normalization.

Appendix Table A2b Exploratory factor analysis – Structure matrix

Note. Loadings below .30 not shown. Rotation Method: Promax with Kaiser Normalization.

|  |  |  |  |
| --- | --- | --- | --- |
| **K-10 Items** | Factor | | |
| Depression | Anxiety | Physical |
| 1. In the past 4 weeks, about how often did you feel tired for no good reason? | 0.535 | 0.403 | 0.333 |
| 2. In the past 4 weeks, about how often did you feel nervous? | 0.611 | 0.711 |  |
| 3. In the past 4 weeks, about how often did you feel so nervous that nothing could calm you down? | 0.635 | 0.763 |  |
| 4. In the past 4 weeks, about how often did you feel hopeless? | 0.858 | 0.607 | 0.308 |
| 5. In the past 4 weeks, about how often did you feel restless or fidgety? | 0.568 | 0.812 |  |
| 6. In the past 4 weeks, about how often did you feel so restless that you could not sit still? | 0.494 | 0.808 |  |
| 7. In the past 4 weeks, about how often did you feel depressed? | 0.876 | 0.538 | 0.363 |
| 8. In the past 4 weeks, about how often did you feel that everything was an effort? | 0.749 | 0.540 | 0.363 |
| 9. In the past 4 weeks, about how often did you feel so sad that nothing could cheer you up? | 0.826 | 0.613 | 0.334 |
| 10. In the past 4 weeks, about how often did you feel worthless? | 0.833 | 0.553 | 0.308 |
| EQ-5D items |  |  |  |
| 1. Mobility |  |  | 0.831 |
| 2. Self-care | 0.316 |  | 0.613 |
| 3. Usual activities | 0.422 |  | 0.763 |
| 4. Pain / discomfort |  |  | 0.676 |
| 5. Anxiety / depression | 0.709 | 0.496 | 0.387 |

Appendix Table 3a Comparison of model performance based on adjusted-r2, normalized RMSE and MAE applying DASS-21 as source instrument

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Netherland | | | Spain | | | Canada | | | China | | | Japan |  |  | Korea |  |  |  | Uruguay |  |
| Model | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE |
|  |  |  |  |  |  |  |  |  |  | Full-sample | | |  |  |  |  |  |  |  |  |  |
| OLS | 0.3495 | 0.1148 | 0.1523 | 0.3462 | 0.1061 | 0.1406 | 0.3380 | 0.1327 | 0.1762 | 0.3179 | 0.1203 | 0.1591 | 0.3250 | 0.1138 | 0.1491 | 0.3244 | 0.1111 | 0.1474 | 0.3116 | 0.0996 | 0.1392 |
| GLM | 0.3520 | 0.1142 | 0.1522 | 0.3442 | 0.1060 | 0.1410 | 0.3428 | 0.1317 | 0.1756 | 0.3066 | 0.1202 | 0.1604 | 0.3195 | 0.1134 | 0.1499 | 0.3267 | 0.1102 | 0.1471 | 0.3136 | 0.0991 | 0.1393 |
| BB | 0.3550 | 0.1162 | 0.1523 | 0.3489 | 0.1074 | 0.1420 | 0.3444 | 0.1387 | 0.1770 | 0.3206 | 0.1220 | 0.1592 | 0.3245 | **1.1101** | **0.1467** | 0.3283 | 0.1100 | 0.1472 | 0.3202 | 0.1000 | 0.1384 |
| FRM | **0.3554** | 0.1141 | **0.1517** | **0.3506** | 0.1053 | **0.1398** | **0.3456** | 0.1317 | **0.1751** | **0.3218** | 0.1196 | **0.1586** | **0.3262** | 0.1133 | 0.1490 | **0.3293** | 0.1102 | **0.1469** | **0.3203** | 0.0985 | **0.1383** |
| MM | 0.3492 | 0.1116 | 0.1549 | 0.3462 | **0.1050** | 0.1416 | 0.3346 | 0.1287 | 0.1802 | 0.3179 | **0.1170** | 0.1618 | 0.3250 | 0.1121 | 0.1502 | 0.3241 | **0.1089** | 0.1493 | 0.3108 | 0.0961 | 0.1444 |
| CLAD | 0.3476 | **0.1114** | 0.1560 | 0.3426 | 0.1051 | 0.1420 | 0.3359 | **0.1280** | 0.1816 | 0.3136 | **0.1170** | 0.1634 | 0.3211 | 0.1122 | 0.1513 | 0.3233 | **0.1089** | 0.1520 | 0.3082 | **0.0958** | 0.1434 |
|  |  |  |  |  |  |  |  |  |  | Cross-validation | |  |  |  |  |  |  |  |  |  |  |
| OLS | 0.3477 | 0.1151 | 0.1523 | 0.3427 | 0.1065 | 0.1402 | 0.3308 | 0.1340 | 0.1764 | 0.3170 | 0.1209 | 0.1594 | 0.3125 | 0.1166 | 0.1496 | 0.3209 | 0.1111 | 0.1472 | **0.3432** | 0.1380 | 0.1391 |
| GLM | 0.3389 | 0.1147 | **0.1522** | 0.3370 | 0.1063 | 0.1410 | 0.3387 | 0.1331 | **0.1757** | 0.3112 | 0.1202 | 0.1635 | 0.3185 | 0.1147 | 0.1525 | 0.3278 | 0.1105 | 0.1478 | 0.3085 | 0.0988 | 0.1393 |
| BB | 0.3514 | 0.1169 | 0.1543 | 0.3461 | 0.1078 | 0.1434 | 0.3413 | 0.1391 | 0.1788 | 0.3211 | 0.1222 | 0.1598 | 0.3255 | **0.1124** | **0.1474** | **0.3305** | 0.1109 | 0.1481 | 0.3206 | 0.1008 | 0.1391 |
| FRM | **0.3580** | 0.1141 | **0.1522** | **0.3526** | 0.1052 | **0.1401** | **0.3461** | 0.1315 | 0.1758 | **0.3232** | 0.1197 | **0.1590** | **0.3289** | 0.1131 | 0.1494 | 0.3273 | 0.1100 | **0.1470** | 0.3187 | 0.0986 | **0.1387** |
| MM | 0.3499 | **0.1114** | 0.1553 | 0.3475 | **0.1050** | 0.1419 | 0.3405 | **0.1281** | 0.1807 | 0.3156 | **0.1172** | 0.1617 | 0.3231 | **0.1124** | 0.1499 | 0.3230 | 0.1098 | 0.1489 | 0.3060 | 0.0964 | 0.1441 |
| CLAD | 0.3440 | 0.1118 | 0.1538 | 0.3295 | 0.1070 | 0.1421 | 0.3184 | 0.1299 | 0.1813 | 0.3194 | 0.1193 | 0.1655 | 0.3135 | 0.1125 | 0.1533 | 0.3102 | **0.1090** | 0.1508 | 0.3079 | **0.0961** | 0.1447 |

Note: NRMSE=normalized root mean squared error; NMAE=normalized mean absolute error; adj. r2=square of correlation coefficient between predicted and observed EQ-5D-5L penalized for number of predictors. *OLS*=ordinary least square; *GLM*=generalized linear model; *BB*=binomial beta regression; *FRM*=fractional regression model; *MM*=MM-estimator; *CLAD*=censored least absolute deviation. Best results are in bold type.

Appendix Table 3b Comparison of model performance based on adjusted-r2, normalized RMSE and MAE applying K-10 as source instrument

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Netherland | | | Spain | | | Canada | | | China | | | Japan | | | Korea | | | Uruguay |  |  |
| Model | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE | adj r2 | NMAE | NRMSE | adj r2 | NMAE | RMSE |
|  |  |  |  |  |  |  |  |  |  | Full-sample | |  | | |  |  |  |  |  |  |  |
| OLS | 0.3566 | 0.1120 | 0.1517 | 0.3450 | 0.1047 | 0.1408 | 0.3393 | 0.1300 | **0.1760** | 0.3122 | 0.1194 | 0.1598 | **0.3145** | 0.1141 | 0.1503 | 0.3274 | 0.1095 | 0.1471 | 0.3156 | 0.0980 | 0.1388 |
| GLM | 0.3587 | 0.1113 | 0.1513 | 0.3414 | 0.1048 | 0.1412 | 0.3372 | 0.1289 | 0.1767 | 0.3042 | 0.1192 | 0.1608 | 0.3097 | 0.1139 | 0.1509 | 0.3272 | 0.1083 | 0.1472 | 0.3156 | 0.0975 | 0.1388 |
| BB | 0.3631 | 0.1134 | 0.1513 | 0.3480 | 0.1052 | 0.1403 | 0.3475 | 0.1359 | 0.1768 | **0.3132** | 0.1223 | 0.1601 | 0.3139 | **0.1114** | **0.1477** | **0.3331** | 0.1081 | 0.1465 | 0.3253 | 0.0988 | 0.1382 |
| FRM | **0.3634** | 0.1107 | **0.1508** | **0.3484** | 0.1040 | **0.1400** | **0.3481** | 0.1282 | 0.1748 | **0.3132** | 0.1190 | **0.1597** | 0.3140 | 0.1135 | 0.1504 | **0.3331** | 0.1081 | **0.1464** | **0.3269** | 0.0966 | **0.1378** |
| MM | 0.3561 | **0.1099** | 0.1545 | 0.3450 | 0.1037 | 0.1418 | 0.3390 | **0.1267** | 0.1804 | 0.3122 | 0.1166 | 0.1630 | **0.3145** | 0.1125 | 0.1515 | 0.3271 | **0.1076** | 0.1490 | 0.3156 | 0.0945 | 0.1441 |
| CLAD | 0.3501 | 0.1101 | 0.1559 | 0.3450 | **0.1036** | 0.1418 | 0.3388 | 0.1268 | 0.1816 | 0.3121 | **0.1165** | 0.1633 | 0.3132 | 0.1124 | 0.1521 | 0.3274 | 0.1077 | 0.1510 | 0.3154 | **0.0944** | 0.1432 |
|  |  |  |  |  |  |  |  |  |  | Cross-validation | | | | | | | | | | | |
| OLS | 0.3535 | 0.1115 | 0.1517 | 0.3462 | 0.1042 | 0.1405 | 0.3381 | 0.1314 | 0.1762 | 0.3127 | 0.1193 | 0.1609 | 0.3124 | 0.1151 | 0.1507 | 0.3259 | 0.1099 | 0.1481 | **0.3373** | 0.0989 | 0.1385 |
| GLM | 0.3573 | 0.1119 | **0.1511** | 0.3352 | 0.1045 | 0.1430 | 0.3286 | 0.1285 | 0.1765 | 0.3021 | 0.1246 | 0.1616 | 0.3143 | 0.1144 | 0.1554 | 0.3263 | 0.1093 | 0.1476 | 0.3180 | 0.0989 | 0.1385 |
| BB | 0.3596 | 0.1151 | 0.1512 | **0.3478** | 0.1061 | 0.1437 | 0.3441 | 0.1360 | 0.1796 | 0.3066 | 0.1236 | 0.1602 | 0.3145 | **0.1125** | **0.1477** | 0.3323 | **0.1077** | 0.1466 | 0.3220 | 0.0985 | 0.1384 |
| FRM | **0.3673** | 0.1135 | **0.1511** | 0.3469 | 0.1052 | **0.1403** | **0.3483** | 0.1283 | **0.1755** | **0.3160** | 0.1201 | **0.1593** | 0.3129 | 0.1134 | 0.1505 | **0.3327** | 0.1089 | **0.1464** | 0.3237 | 0.0971 | **0.1379** |
| MM | 0.3586 | **0.1103** | 0.1554 | 0.3469 | **0.1034** | 0.1412 | 0.3364 | **0.1264** | 0.1804 | 0.3100 | **0.1165** | 0.1629 | **0.3158** | 0.1126 | 0.1525 | 0.3261 | **0.1077** | 0.1489 | 0.3141 | 0.0947 | 0.1439 |
| CLAD | 0.3548 | 0.1109 | 0.1550 | 0.3379 | 0.1042 | 0.1409 | 0.3368 | 0.1267 | 0.1830 | 0.3130 | 0.1168 | 0.1661 | 0.3123 | 0.1126 | 0.1516 | 0.3275 | 0.1081 | 0.1504 | 0.3169 | **0.0945** | 0.1439 |

Note: NRMSE=normalized root mean squared error; NMAE=normalized mean absolute error; adj. r2=square of correlation coefficient between predicted and observed EQ-5D-5L penalized for number of predictors. *OLS*=ordinary least square; *GLM*=generalized linear model; *BB*=binomial beta regression; *FRM*=fractional regression model; *MM*=MM-estimator; *CLAD*=censored least absolute deviation. Best results are in bold type. Best results are in bold type.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Netherland | Spain | Canada | Japan | Korea | China | Uruguay |
| Variables |  |  | DASS-21 |  |  |  |  |
| DASS-D | -0.0255\* | -0.0209\* | -0.0248\* | -0.0212\* | -0.0184\* | -0.0230\* | -0.0237\* |
|  | (0.0026) | (0.0024) | (0.0028) | (0.0031) | (0.0022) | (0.0029) | (0.0029) |
| DASS-A | -0.0304\* | -0.0287\* | -0.0332\* | -0.0252\* | -0.0257\* | -0.0334\* | -0.0336\* |
|  | (0.0034) | (0.0031) | (0.0036) | (0.0034) | (0.0028) | (0.0037) | (0.0037) |
| Age | -0.0108\* | -0.0127\* | -0.0128\* | -0.0114\* | -0.0101\* | -0.0156\* | -0.0132\* |
|  | (0.0019) | (0.0018) | (0.0021) | (0.0019) | (0.0016) | (0.0022) | (0.0022) |
| Constant | -0.0097 | 2.2779\* | 2.3638\* | 2.0769\* | 2.0728\* | 2.6891\* | 3.1697\* |
|  | (0.1114) | (0.0906) | (0.1050) | (0.1031) | (0.0808) | (0.1122) | (0.1137) |
|  |  |  | K-10 |  |  |  |  |
| K-10 | -0.0661\* | -0.0576\* | -0.0678\* | -0.0488\* | -0.0514\* | -0.0653\* | -0.0685\* |
|  | (0.0032) | (0.0030) | (0.0034) | (0.0042) | (0.0026) | (0.0037) | (0.0037) |
| Age | -0.0116\* | -0.0133\* | -0.0136\* | -0.0119\* | -0.0106\* | -0.0162\* | -0.0138\* |
|  | (0.0019) | (0.0017) | (0.0020) | (0.0020) | (0.0016) | (0.0022) | (0.0022) |
| Constant | 3.3664\* | 3.1672\* | 3.4205\* | 2.7373\* | 2.8700\* | 3.7019\* | 4.2620\* |
|  | (0.1280) | (0.1184) | (0.1371) | (0.1409) | (0.1032) | (0.1479) | (0.1470) |

Appendix Table A4 Best fitting regression results predicting EQ-5D-5L utility values from DASS-21 subscales and K-10a

Note. DASS-D=Depression subscale; DASS-A=Anxiety subscale. Robust standard errors in parentheses. \*Coefficients significant at p<0.001.

a Fractional regression model (FRM) is the best fitting model in all countries except Japanese where beta binomial is the preferred model.

Appendix Figure 1 Binned scatter of observed vs predicted English EQ-5D-5L value set. C:\Users\thk023\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\1YX0GWKK\Figure_1 (002).tiffNote. OLS=ordinary least square; GLM=generalized linear model; BB=binomial beta regression; FRM=fractional regression model; MM=MM-estimator; CLAD=censored least absolute deviation.