

## Estimated Error Margins for the American Human Development Index<sup>1</sup>

### Standard Error and Margin of Error Basics for the American Human Development Index

Most of the data used in the the American Human Development Index are drawn from surveys taken among a small sample of the overall U.S. population. Some amount of sampling error is inherent in any data drawn from a sample and this error has an impact on the kinds of conclusions that we can draw from analyzing the data. With the exception of life expectancy at birth, data for the indicators that go into the Human Development Index come from the American Community Survey (ACS). Pretabulated estimates from the ACS are supplied with margins of error calculated using a 90% confidence level. This means that if the statistic in question were to be estimated from 10 different randomly drawn samples of the same population, we could expect the point estimate to fall within the confidence interval (the estimate +/- the margin of error) 9 out of those 10 times. Life expectancy estimates, though derived from a different source, have a small amount of error associated with them as well. Since these sources of error are all known, we can aggregate them to construct an estimated standard error, margin of error, and confidence interval for each score on the American HD Index. This document describes the methodology used to do this. This document does not however elaborate on the methods used to calculate the American HD Index itself and interested readers are encouraged to view this alongside the Methodological Notes from *The Measure of America 2010-2011: Mapping Risks and Resilience*, either from the print edition or available on-line at: <http://www.measureofamerica.org/the-measure-of-america-2010-2011-book/extracts/>. Tables containing estimates standard errors and error margins for American HD Index values by state, congressional district, and metropolitan areas follow the text, starting on page 5.

Basic methods for aggregating standard errors were taken from the recommendations of the U.S. Census Bureau, presented in its *Accuracy of the Data 2008* document, which are based on Taylor series expansions. The two most common operations performed were those for estimating the standard error of the sum of two estimates and the standard error of a proportion. Standard errors of each estimate were calculated from the error margins supplied by the ACS simply by dividing the given error margin by 1.645. The standard error of a sum could then be estimated using the following formula in which  $X$  and  $Y$  are the estimates being summed and  $SE(X)$  and  $SE(Y)$  are their standard errors:

$$SE(X + Y) = \sqrt{[SE(X)]^2 + [SE(Y)]^2}$$

The standard error of a proportion was estimated using the following formula in which  $P = X/Y$  and  $SE(X)$  and  $SE(Y)$  are the standard errors of  $X$  and  $Y$ :

$$SE(P) = \left(\frac{1}{Y}\right) \sqrt{[SE(X)]^2 - \frac{X^2}{Y^2} [SE(Y)]^2}$$

<sup>1</sup> Special thanks to our Senior Statistical Advisor Neil Bennett and to David Low for their assistance in developing and applying the methodology for estimating standard errors for the American HD Index.

## Estimating Standard Errors for the American Human Development Index

### *Health Index*

Standard errors could then be estimated for the Health, Education, and Income Indices and for the overall American HD Index. The standard error for the Health Index was calculated using the following formula, in which *Max* and *Min* are the goalposts for the Health Index and *LIE* is life expectancy at birth:

$$SE(Health) = 10 \left( \left( \frac{1}{(Max - Min)} \right) SE(LIE) \right)$$

### *Education Index*

The Education Index is the weighted average of the Attainment and Enrollment indices. The standard error of the Attainment Index was calculated as follows, in which *Max* and *Min* are the goalposts for the Attainment Index and *AttainmentSum* is the sum of the proportion of the adult population that has attained educational degrees of different levels:

$$SE(Attainment) = 10 \left( \left( \frac{1}{(Max - Min)} \right) SE(AttainmentSum)^2 \right)$$

The standard error of the Enrollment Index is calculated as below, in which *Max* and *Min* are the goalposts of the Enrollment Index and *EnrollmentRatio* is the gross enrollment ratio:

$$SE(Enrollment) = 10 \left( \left( \frac{1}{(Max - Min)} \right) SE(EnrollmentRatio)^2 \right)$$

Then, the standard error for the weighted Education Index was calculated as follows, in which *SE(Attainment)* and *SE(Enrollment)* are the standard errors of the Attainment and Enrollment indices:

$$SE(Education) = \sqrt{\left( \left( \frac{4}{9} \right) (SE(Attainment))^2 \right) + \left( \left( \frac{1}{9} \right) (SE(Enrollment))^2 \right)}$$

### ***Income Index***

The standard error of the Income Index was estimated using the following formula in which *Max* and *Min* are the inflation-adjusted goalposts of the Income Index and  $y_1$  are the median personal earnings for any population:

$$SE(Income) = 10 \left( \left( \frac{1}{(\log(Max) - \log(Min))} \right) \left( \frac{1}{y_1} \right) SE(y_1) \right)$$

### ***Overall American HD Index***

Finally, the standard errors for the Health, Education, and Income indices were aggregated to give an estimated standard error for the HD Index as a whole:

$$SE(HDIndex) = \frac{1}{3} \left( \sqrt{SE(Health)^2 + SE(Education)^2 + SE(Income)^2} \right)$$

The estimated margin of error for the American HD Index, at 90% confidence, can then be calculated by multiplying this final standard error for the overall Index by 1.645.

### **Using Standard Errors to Test the Statistical Significance of a Difference**

To test the statistical significance of the difference between any two estimates, the following formula is used to estimate the z-score of that difference. If  $Z > 1.645$  or  $Z < -1.645$  then we consider the difference between the two estimates to be significant at a 90% confidence level.

$$Z = \frac{Est_1 - Est_2}{\sqrt{(SE_1)^2 - (SE_2)^2}}$$

### **Limitations of The Data**

It should be noted that these standard errors are only rough estimates for a variety of reasons. Data from the ACS come with an estimated margin of error at a 90% confidence level which we divide by 1.645 to obtain the standard error. ACS error margins are rounded to only one significant digit in most cases, meaning that the standard errors that we have to work with for these estimates have somewhat limited precision to begin with. Second, many of the methods employed to estimate standard errors for the HD Index assume that variables in the Index do not co-vary and that population estimates are normally distributed and indeed these assumptions may not always be fully met. As a result, standard error and error margin estimates for the American HD Index calculated for states,

congressional districts, and metropolitan areas should be considered rough approximations of the sampling error inherent in each value on the index. At 90% confidence, the average margin of error for American HD Index scores across all states for the entire population was +/- 0.09 and the average across all congressional districts was +/- 0.3. Interested readers are encouraged to make use of these standard errors and error margins for making comparisons between HD Index scores.

**Sources:**

U.S. Census Bureau. *2008 ACS Accuracy of the Data*. Available at:  
[http://www.census.gov/acs/www/Downloads/data\\_documentation/Accuracy/accuracy2008.pdf](http://www.census.gov/acs/www/Downloads/data_documentation/Accuracy/accuracy2008.pdf)

## Standard Errors and Error Margins for the American HD Index

### HD Index By State, 2010-2011: Standard Errors and Error Margins

| State                | HD Index Value | Standard Error | Error Margin* (+/-) |
|----------------------|----------------|----------------|---------------------|
| <b>United States</b> | <b>5.17</b>    | <b>0.009</b>   | <b>0.014</b>        |
| Alabama              | 4.09           | 0.039          | 0.064               |
| Alaska               | 5.27           | 0.089          | 0.147               |
| Arizona              | 5.11           | 0.057          | 0.093               |
| Arkansas             | 3.87           | 0.073          | 0.120               |
| California           | 5.56           | 0.014          | 0.022               |
| Colorado             | 5.65           | 0.035          | 0.057               |
| Connecticut          | 6.30           | 0.041          | 0.068               |
| Delaware             | 5.33           | 0.081          | 0.133               |
| District of Columbia | 6.21           | 0.108          | 0.178               |
| Florida              | 5.07           | 0.027          | 0.044               |
| Georgia              | 4.86           | 0.042          | 0.068               |
| Hawaii               | 5.73           | 0.067          | 0.111               |
| Idaho                | 4.65           | 0.070          | 0.115               |
| Illinois             | 5.39           | 0.021          | 0.034               |
| Indiana              | 4.74           | 0.045          | 0.073               |
| Iowa                 | 5.06           | 0.041          | 0.067               |
| Kansas               | 5.06           | 0.064          | 0.105               |
| Kentucky             | 4.23           | 0.041          | 0.068               |
| Louisiana            | 4.07           | 0.046          | 0.075               |
| Maine                | 4.89           | 0.059          | 0.096               |
| Maryland             | 5.96           | 0.042          | 0.069               |
| Massachusetts        | 6.24           | 0.032          | 0.052               |
| Michigan             | 4.99           | 0.029          | 0.047               |
| Minnesota            | 5.74           | 0.028          | 0.045               |
| Mississippi          | 3.93           | 0.066          | 0.109               |
| Missouri             | 4.68           | 0.032          | 0.053               |
| Montana              | 4.49           | 0.095          | 0.156               |
| Nebraska             | 5.05           | 0.052          | 0.086               |
| Nevada               | 4.78           | 0.045          | 0.075               |
| New Hampshire        | 5.73           | 0.062          | 0.102               |
| New Jersey           | 6.16           | 0.048          | 0.079               |
| New Mexico           | 4.56           | 0.083          | 0.137               |
| New York             | 5.77           | 0.018          | 0.029               |
| North Carolina       | 4.64           | 0.031          | 0.050               |
| North Dakota         | 4.92           | 0.096          | 0.158               |
| Ohio                 | 4.87           | 0.032          | 0.052               |

|                |      |       |       |
|----------------|------|-------|-------|
| Oklahoma       | 4.15 | 0.044 | 0.072 |
| Oregon         | 5.03 | 0.052 | 0.086 |
| Pennsylvania   | 5.12 | 0.020 | 0.033 |
| Rhode Island   | 5.56 | 0.070 | 0.116 |
| South Carolina | 4.36 | 0.041 | 0.068 |
| South Dakota   | 4.82 | 0.086 | 0.142 |
| Tennessee      | 4.33 | 0.035 | 0.058 |
| Texas          | 4.67 | 0.018 | 0.030 |
| Utah           | 5.08 | 0.059 | 0.097 |
| Vermont        | 5.27 | 0.086 | 0.141 |
| Virginia       | 5.53 | 0.039 | 0.065 |
| Washington     | 5.53 | 0.031 | 0.050 |
| West Virginia  | 3.85 | 0.086 | 0.142 |
| Wisconsin      | 5.23 | 0.040 | 0.066 |
| Wyoming        | 4.80 | 0.156 | 0.256 |

#### HD Index By Congressional District, 2010-2011: Standard Errors and Error Margins

| State                | Congressional District Number | HD Index Value | Standard Error | Error Margin* (+/-) |
|----------------------|-------------------------------|----------------|----------------|---------------------|
| <b>United States</b> |                               | <b>5.17</b>    | <b>0.009</b>   | <b>0.014</b>        |
| Alabama              | 1                             | 4.07           | 0.122          | 0.201               |
| Alabama              | 2                             | 3.95           | 0.146          | 0.241               |
| Alabama              | 3                             | 3.61           | 0.157          | 0.258               |
| Alabama              | 4                             | 3.37           | 0.126          | 0.208               |
| Alabama              | 5                             | 4.56           | 0.131          | 0.215               |
| Alabama              | 6                             | 5.30           | 0.168          | 0.276               |
| Alabama              | 7                             | 3.46           | 0.164          | 0.270               |
| Alaska               |                               | 5.27           | 0.089          | 0.147               |
| Arizona              | 1                             | 4.26           | 0.167          | 0.275               |
| Arizona              | 2                             | 5.07           | 0.183          | 0.302               |
| Arizona              | 3                             | 5.66           | 0.242          | 0.398               |
| Arizona              | 4                             | 3.70           | 0.212          | 0.349               |
| Arizona              | 5                             | 6.31           | 0.325          | 0.534               |
| Arizona              | 6                             | 5.56           | 0.214          | 0.352               |
| Arizona              | 7                             | 4.38           | 0.179          | 0.294               |
| Arizona              | 8                             | 5.57           | 0.191          | 0.315               |
| Arkansas             | 1                             | 3.39           | 0.110          | 0.180               |
| Arkansas             | 2                             | 4.39           | 0.128          | 0.211               |
| Arkansas             | 3                             | 4.06           | 0.134          | 0.220               |
| Arkansas             | 4                             | 3.50           | 0.101          | 0.166               |

|            |    |      |       |       |
|------------|----|------|-------|-------|
| California | 1  | 4.93 | 0.154 | 0.253 |
| California | 2  | 4.11 | 0.163 | 0.268 |
| California | 3  | 5.96 | 0.197 | 0.324 |
| California | 4  | 5.76 | 0.195 | 0.321 |
| California | 5  | 5.14 | 0.243 | 0.400 |
| California | 6  | 6.54 | 0.126 | 0.208 |
| California | 7  | 5.69 | 0.257 | 0.423 |
| California | 8  | 7.47 | 0.282 | 0.465 |
| California | 9  | 6.59 | 0.271 | 0.447 |
| California | 10 | 6.71 | 0.236 | 0.388 |
| California | 11 | 5.97 | 0.213 | 0.351 |
| California | 12 | 7.44 | 0.209 | 0.343 |
| California | 13 | 6.43 | 0.227 | 0.373 |
| California | 14 | 8.11 | 0.339 | 0.557 |
| California | 15 | 7.60 | 0.295 | 0.486 |
| California | 16 | 6.27 | 0.252 | 0.414 |
| California | 17 | 5.09 | 0.172 | 0.283 |
| California | 18 | 3.73 | 0.201 | 0.331 |
| California | 19 | 4.79 | 0.219 | 0.361 |
| California | 20 | 2.60 | 0.234 | 0.385 |
| California | 21 | 4.13 | 0.189 | 0.311 |
| California | 22 | 4.80 | 0.204 | 0.335 |
| California | 23 | 4.90 | 0.225 | 0.371 |
| California | 24 | 6.56 | 0.208 | 0.343 |
| California | 25 | 5.37 | 0.229 | 0.376 |
| California | 26 | 6.42 | 0.310 | 0.509 |
| California | 27 | 5.56 | 0.287 | 0.473 |
| California | 28 | 4.80 | 0.269 | 0.442 |
| California | 29 | 6.36 | 0.416 | 0.684 |
| California | 30 | 7.71 | 0.383 | 0.630 |
| California | 31 | 3.78 | 0.296 | 0.488 |
| California | 32 | 4.55 | 0.313 | 0.515 |
| California | 33 | 5.23 | 0.328 | 0.540 |
| California | 34 | 3.69 | 0.249 | 0.410 |
| California | 35 | 4.45 | 0.265 | 0.435 |
| California | 36 | 6.72 | 0.354 | 0.582 |
| California | 37 | 4.64 | 0.280 | 0.460 |
| California | 38 | 4.59 | 0.244 | 0.401 |
| California | 39 | 4.82 | 0.288 | 0.474 |
| California | 40 | 5.99 | 0.252 | 0.414 |
| California | 41 | 4.84 | 0.230 | 0.378 |

|                         |    |      |       |       |
|-------------------------|----|------|-------|-------|
| California              | 42 | 6.87 | 0.289 | 0.475 |
| California              | 43 | 3.80 | 0.224 | 0.369 |
| California              | 44 | 5.31 | 0.208 | 0.342 |
| California              | 45 | 4.67 | 0.204 | 0.335 |
| California              | 46 | 7.17 | 0.371 | 0.610 |
| California              | 47 | 4.11 | 0.247 | 0.407 |
| California              | 48 | 7.66 | 0.310 | 0.510 |
| California              | 49 | 4.78 | 0.282 | 0.463 |
| California              | 50 | 6.79 | 0.295 | 0.485 |
| California              | 51 | 4.90 | 0.241 | 0.397 |
| California              | 52 | 6.12 | 0.270 | 0.443 |
| California              | 53 | 6.11 | 0.273 | 0.449 |
| Colorado                | 1  | 5.41 | 0.124 | 0.205 |
| Colorado                | 2  | 6.09 | 0.174 | 0.286 |
| Colorado                | 3  | 4.73 | 0.114 | 0.188 |
| Colorado                | 4  | 5.45 | 0.152 | 0.250 |
| Colorado                | 5  | 5.51 | 0.158 | 0.260 |
| Colorado                | 6  | 7.11 | 0.135 | 0.222 |
| Colorado                | 7  | 4.98 | 0.215 | 0.354 |
| Connecticut             | 1  | 6.18 | 0.177 | 0.291 |
| Connecticut             | 2  | 6.18 | 0.128 | 0.211 |
| Connecticut             | 3  | 6.15 | 0.178 | 0.293 |
| Connecticut             | 4  | 7.06 | 0.164 | 0.270 |
| Connecticut             | 5  | 6.09 | 0.219 | 0.360 |
| Delaware                |    | 5.33 | 0.081 | 0.133 |
| District of<br>Columbia |    | 6.21 | 0.108 | 0.178 |
| Florida                 | 1  | 4.27 | 0.134 | 0.221 |
| Florida                 | 2  | 4.66 | 0.125 | 0.206 |
| Florida                 | 3  | 3.86 | 0.310 | 0.510 |
| Florida                 | 4  | 4.77 | 0.177 | 0.291 |
| Florida                 | 5  | 4.46 | 0.190 | 0.313 |
| Florida                 | 6  | 4.99 | 0.186 | 0.306 |
| Florida                 | 7  | 5.38 | 0.226 | 0.371 |
| Florida                 | 8  | 5.33 | 0.220 | 0.361 |
| Florida                 | 9  | 5.37 | 0.212 | 0.349 |
| Florida                 | 10 | 5.29 | 0.235 | 0.387 |
| Florida                 | 11 | 4.68 | 0.232 | 0.382 |
| Florida                 | 12 | 4.56 | 0.195 | 0.320 |
| Florida                 | 13 | 5.30 | 0.186 | 0.306 |
| Florida                 | 14 | 5.52 | 0.177 | 0.292 |



|          |    |      |       |       |
|----------|----|------|-------|-------|
| Florida  | 15 | 5.03 | 0.175 | 0.287 |
| Florida  | 16 | 4.79 | 0.235 | 0.386 |
| Florida  | 17 | 4.43 | 0.274 | 0.451 |
| Florida  | 18 | 5.13 | 0.334 | 0.550 |
| Florida  | 19 | 5.91 | 0.320 | 0.527 |
| Florida  | 20 | 6.25 | 0.309 | 0.508 |
| Florida  | 21 | 5.20 | 0.320 | 0.527 |
| Florida  | 22 | 6.31 | 0.379 | 0.624 |
| Florida  | 23 | 4.32 | 0.298 | 0.491 |
| Florida  | 24 | 5.55 | 0.248 | 0.408 |
| Florida  | 25 | 5.34 | 0.298 | 0.490 |
| Georgia  | 1  | 3.93 | 0.161 | 0.265 |
| Georgia  | 2  | 3.55 | 0.155 | 0.254 |
| Georgia  | 3  | 4.90 | 0.127 | 0.209 |
| Georgia  | 4  | 5.10 | 0.241 | 0.397 |
| Georgia  | 5  | 5.82 | 0.312 | 0.513 |
| Georgia  | 6  | 6.79 | 0.198 | 0.326 |
| Georgia  | 7  | 5.76 | 0.163 | 0.267 |
| Georgia  | 8  | 4.06 | 0.163 | 0.268 |
| Georgia  | 9  | 4.32 | 0.126 | 0.208 |
| Georgia  | 10 | 4.48 | 0.150 | 0.247 |
| Georgia  | 11 | 4.81 | 0.135 | 0.222 |
| Georgia  | 12 | 3.66 | 0.168 | 0.277 |
| Georgia  | 13 | 5.18 | 0.203 | 0.333 |
| Hawaii   | 1  | 6.07 | 0.190 | 0.313 |
| Hawaii   | 2  | 5.41 | 0.165 | 0.271 |
| Idaho    | 1  | 4.75 | 0.118 | 0.195 |
| Idaho    | 2  | 4.53 | 0.138 | 0.227 |
| Illinois | 1  | 4.81 | 0.290 | 0.477 |
| Illinois | 2  | 5.27 | 0.252 | 0.414 |
| Illinois | 3  | 5.18 | 0.232 | 0.381 |
| Illinois | 4  | 3.80 | 0.238 | 0.391 |
| Illinois | 5  | 5.89 | 0.304 | 0.501 |
| Illinois | 6  | 6.29 | 0.226 | 0.372 |
| Illinois | 7  | 5.76 | 0.295 | 0.485 |
| Illinois | 8  | 6.08 | 0.203 | 0.333 |
| Illinois | 9  | 6.32 | 0.338 | 0.556 |
| Illinois | 10 | 6.56 | 0.266 | 0.438 |
| Illinois | 11 | 4.97 | 0.180 | 0.295 |
| Illinois | 12 | 4.64 | 0.131 | 0.216 |
| Illinois | 13 | 6.84 | 0.200 | 0.329 |

|           |    |      |       |       |
|-----------|----|------|-------|-------|
| Illinois  | 14 | 5.56 | 0.106 | 0.174 |
| Illinois  | 15 | 5.04 | 0.135 | 0.222 |
| Illinois  | 16 | 5.22 | 0.117 | 0.193 |
| Illinois  | 17 | 4.32 | 0.154 | 0.253 |
| Illinois  | 18 | 4.98 | 0.235 | 0.387 |
| Illinois  | 19 | 4.76 | 0.168 | 0.276 |
| Indiana   | 1  | 4.82 | 0.095 | 0.157 |
| Indiana   | 2  | 4.49 | 0.126 | 0.207 |
| Indiana   | 3  | 4.79 | 0.125 | 0.206 |
| Indiana   | 4  | 5.18 | 0.162 | 0.266 |
| Indiana   | 5  | 5.75 | 0.155 | 0.255 |
| Indiana   | 6  | 4.42 | 0.130 | 0.213 |
| Indiana   | 7  | 4.22 | 0.153 | 0.251 |
| Indiana   | 8  | 4.30 | 0.115 | 0.189 |
| Indiana   | 9  | 4.65 | 0.113 | 0.186 |
| Iowa      | 1  | 5.03 | 0.099 | 0.163 |
| Iowa      | 2  | 5.35 | 0.097 | 0.160 |
| Iowa      | 3  | 5.47 | 0.089 | 0.147 |
| Iowa      | 4  | 4.85 | 0.107 | 0.176 |
| Iowa      | 5  | 4.62 | 0.090 | 0.148 |
| Kansas    | 1  | 4.39 | 0.099 | 0.163 |
| Kansas    | 2  | 4.79 | 0.118 | 0.194 |
| Kansas    | 3  | 6.22 | 0.143 | 0.235 |
| Kansas    | 4  | 4.91 | 0.134 | 0.220 |
| Kentucky  | 1  | 3.50 | 0.139 | 0.229 |
| Kentucky  | 2  | 4.27 | 0.128 | 0.211 |
| Kentucky  | 3  | 5.10 | 0.112 | 0.184 |
| Kentucky  | 4  | 4.67 | 0.128 | 0.210 |
| Kentucky  | 5  | 2.82 | 0.127 | 0.210 |
| Kentucky  | 6  | 4.84 | 0.132 | 0.217 |
| Louisiana | 1  | 4.79 | 0.149 | 0.246 |
| Louisiana | 2  | 3.68 | 0.221 | 0.364 |
| Louisiana | 3  | 3.94 | 0.168 | 0.277 |
| Louisiana | 4  | 3.99 | 0.109 | 0.179 |
| Louisiana | 5  | 3.52 | 0.173 | 0.284 |
| Louisiana | 6  | 4.54 | 0.186 | 0.307 |
| Louisiana | 7  | 3.87 | 0.135 | 0.222 |
| Maine     | 1  | 5.37 | 0.156 | 0.256 |
| Maine     | 2  | 4.40 | 0.115 | 0.190 |
| Maryland  | 1  | 5.57 | 0.156 | 0.257 |
| Maryland  | 2  | 5.24 | 0.193 | 0.318 |

|               |    |      |       |       |
|---------------|----|------|-------|-------|
| Maryland      | 3  | 6.14 | 0.210 | 0.345 |
| Maryland      | 4  | 6.28 | 0.219 | 0.360 |
| Maryland      | 5  | 6.14 | 0.156 | 0.257 |
| Maryland      | 6  | 5.66 | 0.142 | 0.234 |
| Maryland      | 7  | 5.22 | 0.205 | 0.337 |
| Maryland      | 8  | 7.57 | 0.193 | 0.317 |
| Massachusetts | 1  | 5.52 | 0.177 | 0.291 |
| Massachusetts | 2  | 5.53 | 0.212 | 0.349 |
| Massachusetts | 3  | 6.14 | 0.217 | 0.357 |
| Massachusetts | 4  | 6.29 | 0.237 | 0.389 |
| Massachusetts | 5  | 6.45 | 0.251 | 0.413 |
| Massachusetts | 6  | 6.52 | 0.219 | 0.360 |
| Massachusetts | 7  | 6.81 | 0.270 | 0.444 |
| Massachusetts | 8  | 6.22 | 0.212 | 0.349 |
| Massachusetts | 9  | 6.56 | 0.292 | 0.480 |
| Massachusetts | 10 | 6.40 | 0.185 | 0.304 |
| Michigan      | 1  | 4.15 | 0.100 | 0.164 |
| Michigan      | 2  | 4.63 | 0.136 | 0.224 |
| Michigan      | 3  | 5.15 | 0.127 | 0.209 |
| Michigan      | 4  | 4.36 | 0.127 | 0.209 |
| Michigan      | 5  | 4.47 | 0.134 | 0.221 |
| Michigan      | 6  | 4.72 | 0.126 | 0.207 |
| Michigan      | 7  | 4.93 | 0.132 | 0.217 |
| Michigan      | 8  | 5.62 | 0.164 | 0.270 |
| Michigan      | 9  | 6.75 | 0.206 | 0.339 |
| Michigan      | 10 | 5.31 | 0.132 | 0.217 |
| Michigan      | 11 | 5.73 | 0.236 | 0.388 |
| Michigan      | 12 | 5.40 | 0.236 | 0.388 |
| Michigan      | 13 | 3.95 | 0.313 | 0.514 |
| Michigan      | 14 | 4.13 | 0.289 | 0.476 |
| Michigan      | 15 | 5.36 | 0.207 | 0.340 |
| Minnesota     | 1  | 5.34 | 0.103 | 0.169 |
| Minnesota     | 2  | 6.25 | 0.100 | 0.164 |
| Minnesota     | 3  | 6.69 | 0.173 | 0.284 |
| Minnesota     | 4  | 6.06 | 0.116 | 0.190 |
| Minnesota     | 5  | 6.09 | 0.198 | 0.326 |
| Minnesota     | 6  | 5.99 | 0.124 | 0.204 |
| Minnesota     | 7  | 4.65 | 0.092 | 0.151 |
| Minnesota     | 8  | 4.73 | 0.103 | 0.169 |
| Mississippi   | 1  | 3.99 | 0.101 | 0.166 |
| Mississippi   | 2  | 3.34 | 0.147 | 0.242 |

|               |    |      |       |       |
|---------------|----|------|-------|-------|
| Mississippi   | 3  | 4.23 | 0.147 | 0.242 |
| Mississippi   | 4  | 4.04 | 0.135 | 0.222 |
| Missouri      | 1  | 4.87 | 0.198 | 0.326 |
| Missouri      | 2  | 6.24 | 0.147 | 0.242 |
| Missouri      | 3  | 5.19 | 0.185 | 0.304 |
| Missouri      | 4  | 4.09 | 0.167 | 0.274 |
| Missouri      | 5  | 4.87 | 0.121 | 0.200 |
| Missouri      | 6  | 5.12 | 0.098 | 0.162 |
| Missouri      | 7  | 4.22 | 0.108 | 0.178 |
| Missouri      | 8  | 3.24 | 0.119 | 0.196 |
| Missouri      | 9  | 4.51 | 0.146 | 0.240 |
| Montana       |    | 4.49 | 0.095 | 0.156 |
| Nebraska      | 1  | 5.13 | 0.102 | 0.168 |
| Nebraska      | 2  | 5.56 | 0.101 | 0.166 |
| Nebraska      | 3  | 4.44 | 0.113 | 0.186 |
| Nevada        | 1  | 4.26 | 0.185 | 0.304 |
| Nevada        | 2  | 4.76 | 0.117 | 0.193 |
| Nevada        | 3  | 5.28 | 0.202 | 0.333 |
| New Hampshire | 1  | 5.74 | 0.154 | 0.253 |
| New Hampshire | 2  | 5.74 | 0.140 | 0.230 |
| New Jersey    | 1  | 5.34 | 0.168 | 0.276 |
| New Jersey    | 2  | 5.14 | 0.122 | 0.200 |
| New Jersey    | 3  | 6.16 | 0.199 | 0.328 |
| New Jersey    | 4  | 5.95 | 0.188 | 0.309 |
| New Jersey    | 5  | 7.11 | 0.198 | 0.326 |
| New Jersey    | 6  | 6.10 | 0.198 | 0.326 |
| New Jersey    | 7  | 7.31 | 0.205 | 0.338 |
| New Jersey    | 8  | 5.76 | 0.179 | 0.295 |
| New Jersey    | 9  | 6.47 | 0.231 | 0.380 |
| New Jersey    | 10 | 5.13 | 0.186 | 0.306 |
| New Jersey    | 11 | 7.33 | 0.144 | 0.237 |
| New Jersey    | 12 | 7.28 | 0.218 | 0.359 |
| New Jersey    | 13 | 5.15 | 0.237 | 0.389 |
| New Mexico    | 1  | 5.18 | 0.144 | 0.237 |
| New Mexico    | 2  | 3.95 | 0.138 | 0.228 |
| New Mexico    | 3  | 4.50 | 0.163 | 0.269 |
| New York      | 1  | 6.41 | 0.249 | 0.410 |
| New York      | 2  | 6.33 | 0.236 | 0.388 |
| New York      | 3  | 6.79 | 0.255 | 0.420 |
| New York      | 4  | 6.57 | 0.241 | 0.397 |
| New York      | 5  | 6.30 | 0.345 | 0.568 |

|                |    |      |       |       |
|----------------|----|------|-------|-------|
| New York       | 6  | 5.90 | 0.208 | 0.341 |
| New York       | 7  | 5.40 | 0.258 | 0.424 |
| New York       | 8  | 7.48 | 0.428 | 0.704 |
| New York       | 9  | 6.57 | 0.295 | 0.485 |
| New York       | 10 | 5.72 | 0.265 | 0.436 |
| New York       | 11 | 5.98 | 0.262 | 0.432 |
| New York       | 12 | 5.08 | 0.273 | 0.448 |
| New York       | 13 | 6.09 | 0.230 | 0.379 |
| New York       | 14 | 8.79 | 0.449 | 0.738 |
| New York       | 15 | 5.87 | 0.257 | 0.423 |
| New York       | 16 | 3.20 | 0.198 | 0.326 |
| New York       | 17 | 6.00 | 0.289 | 0.476 |
| New York       | 18 | 7.12 | 0.213 | 0.350 |
| New York       | 19 | 6.58 | 0.193 | 0.317 |
| New York       | 20 | 5.28 | 0.147 | 0.242 |
| New York       | 21 | 5.57 | 0.118 | 0.194 |
| New York       | 22 | 5.09 | 0.192 | 0.316 |
| New York       | 23 | 4.29 | 0.138 | 0.227 |
| New York       | 24 | 4.56 | 0.133 | 0.219 |
| New York       | 25 | 5.64 | 0.123 | 0.203 |
| New York       | 26 | 5.30 | 0.204 | 0.336 |
| New York       | 27 | 4.89 | 0.195 | 0.320 |
| New York       | 28 | 4.83 | 0.217 | 0.358 |
| New York       | 29 | 5.05 | 0.159 | 0.261 |
| North Carolina | 1  | 3.53 | 0.203 | 0.334 |
| North Carolina | 2  | 4.14 | 0.170 | 0.280 |
| North Carolina | 3  | 4.20 | 0.156 | 0.257 |
| North Carolina | 4  | 6.68 | 0.159 | 0.262 |
| North Carolina | 5  | 4.54 | 0.164 | 0.269 |
| North Carolina | 6  | 4.74 | 0.193 | 0.317 |
| North Carolina | 7  | 4.09 | 0.198 | 0.326 |
| North Carolina | 8  | 4.34 | 0.173 | 0.285 |
| North Carolina | 9  | 5.82 | 0.161 | 0.264 |
| North Carolina | 10 | 4.13 | 0.144 | 0.237 |
| North Carolina | 11 | 4.34 | 0.143 | 0.235 |
| North Carolina | 12 | 4.47 | 0.231 | 0.380 |
| North Carolina | 13 | 4.96 | 0.201 | 0.330 |
| North Dakota   |    | 4.92 | 0.096 | 0.158 |
| Ohio           | 1  | 4.88 | 0.175 | 0.288 |
| Ohio           | 2  | 5.40 | 0.168 | 0.276 |
| Ohio           | 3  | 5.02 | 0.203 | 0.334 |

|              |    |      |       |       |
|--------------|----|------|-------|-------|
| Ohio         | 4  | 4.40 | 0.115 | 0.190 |
| Ohio         | 5  | 4.71 | 0.105 | 0.173 |
| Ohio         | 6  | 4.04 | 0.190 | 0.312 |
| Ohio         | 7  | 4.85 | 0.167 | 0.274 |
| Ohio         | 8  | 4.74 | 0.131 | 0.216 |
| Ohio         | 9  | 4.71 | 0.143 | 0.235 |
| Ohio         | 10 | 4.99 | 0.190 | 0.312 |
| Ohio         | 11 | 4.88 | 0.201 | 0.330 |
| Ohio         | 12 | 5.77 | 0.202 | 0.332 |
| Ohio         | 13 | 5.24 | 0.208 | 0.341 |
| Ohio         | 14 | 5.54 | 0.145 | 0.239 |
| Ohio         | 15 | 5.36 | 0.167 | 0.275 |
| Ohio         | 16 | 4.75 | 0.112 | 0.184 |
| Ohio         | 17 | 4.27 | 0.189 | 0.310 |
| Ohio         | 18 | 3.98 | 0.149 | 0.245 |
| Oklahoma     | 1  | 4.65 | 0.155 | 0.255 |
| Oklahoma     | 2  | 3.33 | 0.131 | 0.215 |
| Oklahoma     | 3  | 3.95 | 0.138 | 0.227 |
| Oklahoma     | 4  | 4.28 | 0.121 | 0.199 |
| Oklahoma     | 5  | 4.39 | 0.113 | 0.186 |
| Oregon       | 1  | 5.89 | 0.110 | 0.180 |
| Oregon       | 2  | 4.26 | 0.127 | 0.208 |
| Oregon       | 3  | 5.30 | 0.147 | 0.242 |
| Oregon       | 4  | 4.60 | 0.152 | 0.250 |
| Oregon       | 5  | 5.07 | 0.157 | 0.259 |
| Pennsylvania | 1  | 3.86 | 0.219 | 0.361 |
| Pennsylvania | 2  | 4.81 | 0.288 | 0.474 |
| Pennsylvania | 3  | 4.40 | 0.125 | 0.206 |
| Pennsylvania | 4  | 5.30 | 0.203 | 0.333 |
| Pennsylvania | 5  | ...  | ...   | ...   |
| Pennsylvania | 6  | 6.23 | 0.200 | 0.329 |
| Pennsylvania | 7  | 6.58 | 0.153 | 0.252 |
| Pennsylvania | 8  | 6.23 | 0.170 | 0.280 |
| Pennsylvania | 9  | 4.29 | 0.129 | 0.212 |
| Pennsylvania | 10 | 4.53 | 0.129 | 0.212 |
| Pennsylvania | 11 | 4.55 | 0.119 | 0.197 |
| Pennsylvania | 12 | 4.22 | 0.189 | 0.311 |
| Pennsylvania | 13 | 5.77 | 0.253 | 0.416 |
| Pennsylvania | 14 | 4.91 | 0.209 | 0.344 |
| Pennsylvania | 15 | 5.47 | 0.099 | 0.163 |
| Pennsylvania | 16 | 5.13 | 0.119 | 0.196 |

|                |    |      |       |       |
|----------------|----|------|-------|-------|
| Pennsylvania   | 17 | 4.94 | 0.107 | 0.176 |
| Pennsylvania   | 18 | 5.64 | 0.230 | 0.378 |
| Pennsylvania   | 19 | 5.38 | 0.088 | 0.145 |
| Rhode Island   | 1  | 5.49 | 0.199 | 0.328 |
| Rhode Island   | 2  | 5.62 | 0.180 | 0.295 |
| South Carolina | 1  | 4.76 | 0.128 | 0.211 |
| South Carolina | 2  | 5.05 | 0.158 | 0.261 |
| South Carolina | 3  | 4.19 | 0.141 | 0.231 |
| South Carolina | 4  | 4.46 | 0.102 | 0.168 |
| South Carolina | 5  | 4.07 | 0.120 | 0.198 |
| South Carolina | 6  | 3.52 | 0.165 | 0.272 |
| South Dakota   |    | 4.82 | 0.086 | 0.142 |
| Tennessee      | 1  | 3.81 | 0.127 | 0.209 |
| Tennessee      | 2  | 4.66 | 0.112 | 0.184 |
| Tennessee      | 3  | 4.13 | 0.156 | 0.257 |
| Tennessee      | 4  | 3.50 | 0.169 | 0.278 |
| Tennessee      | 5  | 5.12 | 0.115 | 0.190 |
| Tennessee      | 6  | 4.30 | 0.096 | 0.158 |
| Tennessee      | 7  | 5.40 | 0.183 | 0.301 |
| Tennessee      | 8  | 3.69 | 0.198 | 0.326 |
| Tennessee      | 9  | 4.08 | 0.192 | 0.315 |
| Texas          | 1  | 3.89 | 0.182 | 0.299 |
| Texas          | 2  | 5.00 | 0.253 | 0.417 |
| Texas          | 3  | 6.19 | 0.192 | 0.317 |
| Texas          | 4  | 4.52 | 0.150 | 0.246 |
| Texas          | 5  | 4.20 | 0.235 | 0.386 |
| Texas          | 6  | 4.89 | 0.212 | 0.349 |
| Texas          | 7  | 6.69 | 0.276 | 0.453 |
| Texas          | 8  | 4.51 | 0.142 | 0.233 |
| Texas          | 9  | 3.99 | 0.245 | 0.402 |
| Texas          | 10 | 5.56 | 0.231 | 0.381 |
| Texas          | 11 | 4.10 | 0.122 | 0.200 |
| Texas          | 12 | 4.55 | 0.199 | 0.327 |
| Texas          | 13 | 3.92 | 0.134 | 0.220 |
| Texas          | 14 | 4.79 | 0.141 | 0.232 |
| Texas          | 15 | 3.74 | 0.203 | 0.333 |
| Texas          | 16 | 4.32 | 0.110 | 0.181 |
| Texas          | 17 | 4.17 | 0.162 | 0.266 |
| Texas          | 18 | 4.10 | 0.215 | 0.354 |
| Texas          | 19 | 4.01 | 0.140 | 0.231 |
| Texas          | 20 | 3.92 | 0.199 | 0.327 |

|               |    |      |       |       |
|---------------|----|------|-------|-------|
| Texas         | 21 | 5.72 | 0.209 | 0.344 |
| Texas         | 22 | 5.96 | 0.230 | 0.378 |
| Texas         | 23 | 4.48 | 0.198 | 0.325 |
| Texas         | 24 | 5.73 | 0.246 | 0.405 |
| Texas         | 25 | 4.93 | 0.186 | 0.306 |
| Texas         | 26 | 5.43 | 0.189 | 0.311 |
| Texas         | 27 | 3.88 | 0.138 | 0.228 |
| Texas         | 28 | 3.78 | 0.173 | 0.284 |
| Texas         | 29 | 3.23 | 0.218 | 0.359 |
| Texas         | 30 | 3.90 | 0.216 | 0.356 |
| Texas         | 31 | 5.11 | 0.089 | 0.146 |
| Texas         | 32 | 4.93 | 0.286 | 0.470 |
| Utah          | 1  | 4.95 | 0.120 | 0.197 |
| Utah          | 2  | 5.53 | 0.181 | 0.297 |
| Utah          | 3  | 4.81 | 0.127 | 0.209 |
| Vermont       |    | 5.27 | 0.086 | 0.141 |
| Virginia      | 1  | 5.65 | 0.169 | 0.278 |
| Virginia      | 2  | 5.27 | 0.147 | 0.242 |
| Virginia      | 3  | 4.24 | 0.172 | 0.283 |
| Virginia      | 4  | 4.69 | 0.136 | 0.223 |
| Virginia      | 5  | 4.27 | 0.158 | 0.260 |
| Virginia      | 6  | 4.72 | 0.130 | 0.214 |
| Virginia      | 7  | 5.79 | 0.150 | 0.247 |
| Virginia      | 8  | 8.30 | 0.196 | 0.323 |
| Virginia      | 9  | 3.50 | 0.129 | 0.211 |
| Virginia      | 10 | 7.12 | 0.176 | 0.290 |
| Virginia      | 11 | 7.51 | 0.201 | 0.331 |
| Washington    | 1  | 6.50 | 0.189 | 0.310 |
| Washington    | 2  | 5.25 | 0.151 | 0.249 |
| Washington    | 3  | 5.27 | 0.112 | 0.184 |
| Washington    | 4  | 4.24 | 0.134 | 0.221 |
| Washington    | 5  | 4.80 | 0.108 | 0.178 |
| Washington    | 6  | 4.80 | 0.210 | 0.346 |
| Washington    | 7  | 6.89 | 0.250 | 0.410 |
| Washington    | 8  | 6.72 | 0.206 | 0.338 |
| Washington    | 9  | 5.25 | 0.200 | 0.330 |
| West Virginia | 1  | 4.15 | 0.149 | 0.244 |
| West Virginia | 2  | 4.16 | 0.125 | 0.205 |
| West Virginia | 3  | 3.16 | 0.136 | 0.223 |
| Wisconsin     | 1  | 5.41 | 0.145 | 0.239 |
| Wisconsin     | 2  | 5.90 | 0.111 | 0.182 |



|           |   |      |       |       |
|-----------|---|------|-------|-------|
| Wisconsin | 3 | 4.86 | 0.082 | 0.135 |
| Wisconsin | 4 | 4.35 | 0.156 | 0.256 |
| Wisconsin | 5 | 6.27 | 0.131 | 0.216 |
| Wisconsin | 6 | 4.97 | 0.127 | 0.208 |
| Wisconsin | 7 | 4.76 | 0.087 | 0.143 |
| Wisconsin | 8 | 5.06 | 0.109 | 0.179 |
| Wyoming   |   | 4.80 | 0.156 | 0.256 |

#### HD Index By Metropolitan Area, 2010-2011: Standard Errors and Error Margins

| Metropolitan Statistical Area | HD Index Value | Standard Error | Error Margin* (+/-) |
|-------------------------------|----------------|----------------|---------------------|
| <b>United States</b>          | <b>5.17</b>    | <b>0.009</b>   | <b>0.014</b>        |
| Atlanta                       | 5.53           | 0.038          | 0.062               |
| Boston                        | 6.55           | 0.043          | 0.071               |
| Chicago                       | 5.61           | 0.044          | 0.072               |
| Dallas                        | 5.11           | 0.030          | 0.049               |
| Houston                       | 5.02           | 0.036          | 0.059               |
| Los Angeles                   | 5.60           | 0.021          | 0.035               |
| Miami                         | 5.46           | 0.064          | 0.106               |
| New York                      | 6.26           | 0.022          | 0.036               |
| Philadelphia                  | 5.70           | 0.030          | 0.049               |
| Washington DC                 | 6.94           | 0.059          | 0.096               |

\* Calculated at a 90% confidence level