Received: 13 September 2023 | Accepted: 18 October 2023

DOI: 10.1111/ajes.12553

ORIGINAL ARTICLE

WILEY

Economic equity and people with disabilities: Development and characterization of a novel index

Bhavneet Walia[1] | **Katherine McDonald**[1] | **Joy Hammel**[2] | **Lex Frieden**[3,4] | **Michael Morris**[5] | **Barry Whaley**[5] | **Vinh Nguyen**[4]

[1]Falk College, Syracuse University, Syracuse, New York, USA

[2]Wade Meyer Endowed Chair, Occupational Therapy, College of Applied Health Sciences, University of Illinois at Chicago, Chicago, Illinois, USA

[3]Department of Biomedical Informatics and Rehabilitation, University of Texas, Health Science Center at Houston, Houston, Texas, USA

[4]Independent Living Research Utilization (ILRU), TIRR Memorial Hermann Hospital, Houston, Texas, USA

[5]Burton Blatt Institute, Syracuse University, Syracuse, New York, USA

Correspondence
Bhavneet Walia, Falk College, Syracuse University, Syracuse, NY, USA.
Email: bwalia@syr.edu

Funding information
National Institutes of Health

Abstract

Here, we develop two new social indices: the ADA PARC Absolute Economic Opportunity Index and the ADA PARC Relative Economic Opportunity Index. These indices allow us novel examinations of economic equity between people with and without disabilities within a U.S. state and between people with disabilities in different states using aggregations of multiple component economic indicators. These represent the first efforts to offer U.S. indices of this focus, an important development given the distinct economic needs of people with disabilities and the value in accounting for distinct national policies. The indices rely on U.S. Census and other data on economic opportunity by population. These indices provide comprehensive insight into economic disparities between people with and without disabilities and among people with disabilities in the United States. We find that state/territory values for the two indices are moderately positively correlated, suggesting that relative and absolute economic opportunity

for people with disabilities arise from both common and distinct processes. Policy implications for low economic opportunity states are discussed.

INTRODUCTION

Access to financial assets or wealth is necessary for meeting basic needs, a human right unfulfilled for many around the world. An important societal precondition for broad access to meeting basic needs is the realization of economic equity. Klasen (2008) defines economic equity as "fairness, equality of opportunities, and low inequality in critical aspects of well-being" and provides evidence that economic equity improves not only broad-based economic outcomes but also economic efficiency overall, where economic efficiency represents the state in which economic resources are allocated to their highest valued use. Rather than an equity-efficiency tradeoff, Klasen concludes that equity is foundational to both broad-based economic outcome and economic efficiency. When people—and populations—experience economic inequity, they are forced to make impossible choices to meet some basic needs and not others. As a result, they may choose to privilege their children's access to food over their own (Attree, 2005; Dobson et al., 1994), take on overwhelming debt (Lea, 2021), and rely on non-mainstream financial resources such as high-interest rate loans (Marston & Shevellar, 2014); these latter forced choices further exacerbate financial challenges. Not surprisingly, individuals who experience financial challenges are subsequently more likely to experience poor mental and physical health (Klasen, 2008; Rantakeisu & Jönsson, 2003), including one's sense of well-being (Sleskova et al., 2006). Prolonged financial stress can lead to depression, anxiety, and alcohol dependency, at times creating a vicious cycle and leading to long-term and/or permanent mental health problems and cascading physical health concerns (Ohrnberger et al., 2017; Peirce et al., 1996; Viseu et al., 2018).

Despite U.S. anti-discrimination law establishing that people with disabilities have the right to equal opportunities to economic self-sufficiency, people with disabilities experience higher rates of poverty than people without disabilities. Morris and Zaidi (2020) find that the poverty rate is 24% among households in which at least one member has a disability compared to approximately 11% for households without members with disabilities. Similarly, United for ALICE (Asset Limited, Income Constrained, Employed) estimates that more than half of people with disabilities live in households that are either below the poverty line or struggling to afford essentials (United for ALICE, 2022). Further complicating this disparity, people with disabilities require more financial assets to achieve the same standard of living as people without disabilities. Although households with members with disabilities earn less income and are more likely to live below the poverty line, they may require ~29% more household income to maintain a similar lifestyle to households without family members with disabilities (Morris & Zaidi, 2020). That is, households with a disabled member tend to need more financial assets but have fewer.

Accounting for these additional costs, Morris and Zaidi (2020) further find that the adjusted poverty rate for households with disability is 35%, or more than three times the rate for households without disability. Typical costs include costs for personal assistance services, health care—where out-of-pocket costs for people with disabilities are more than twice as high as for those without disabilities—ordering things when in-person options are not accessible, building a wheelchair ramp, acquiring and maintaining service animals, buying a more expensive car in order to accommodate a wheelchair, purchasing food for special diets, or paying more for

housing in order to find a place that is accessible. Of note, many of these cost-of-living differences have been exacerbated as a result of the COVID-19 pandemic. These necessary costs suggest standard measures of cost of living are incomplete for people with disabilities. Yet, in the United States, asset and means tests that are used to establish eligibility for government benefits do not consider these additional costs and can limit savings, wealth acquisition, and building among people with disabilities (see, e.g., Batavia & Beaulaurier, 2001).

Although stand-alone indicators of economic disparities are informative, we can gain new insights from examining disparities across multiple indicators simultaneously, both within and across populations defined by disability status and geographies; indices provide concise values generated by evaluating multiple important components at the same time. That is, indices consolidate relevant components into a single metric scale. For example, an index developed in India illustrates the economic disparities between people with and without disabilities (Mishra & Gupta, 2006).

Here, we develop two new social indices: the ADA PARC Absolute Economic Opportunity Index and the ADA PARC Relative Economic Opportunity Index. These indices will allow us novel examinations of economic equity between people with and without disabilities within a U.S. state and between people with disabilities in different states using multiple indicators. These represent the first efforts to offer U.S. indices of this focus, an important development due to the need to account for distinct national policies. These indices can provide comprehensive insight into economic disparities between people with and without disabilities and among people with disabilities in the United States. Specifically, we seek to answer the following central research questions: (1) How can we use available economic well-being data to compare how people with disabilities in a state are doing economically compared to people with disabilities in other states? (2) How can we use available economic well-being data to compare how people with disabilities in a state are doing economically relative to people without disabilities in the same state? When developing an index, there are natural challenges, including (1) finding relevant components, (2) scaling various components, and (3) developing a rating scale. We also address these challenges herein.

METHODS

We developed the Absolute Opportunity Index (AOI) and the Relative Opportunity Index (ROI) using a set of five national-level indicators from 2019. That is, both indicators are based solely on 2019 data with the plan that they will be updated (on the ADA PARC website) at 5-year increments. Each indicator describes an aspect of purchasing power, and therefore of economic well-being, for the population of interest (people with disabilities) and also for the reference population (people without disabilities) in each state. These indicators are (1) Employment–population ratio, (2) Median cost-of-living adjusted individual income, (3) Median cost-of-living adjusted household income, (4) Percentage not in poverty, 18–64 years old, and (5) Supplemental Nutrition Assistance Program (SNAP) benefits per household living in poverty. The first two variables measure opportunities to be employed and individual earnings from employment. The third variable measures earnings at the household level. The fourth variable measures the percentage of people earning a sufficient income to qualify as living above the poverty level. The final variable measures SNAP benefits coverage for a group of people as per the level of need for that group. This last variable represents as per need quotient variable because high SNAP benefit levels for a group are desirable only if they address a need. For example, SNAP benefits

are positive from an economic well-being perspective if they are responsive to the needs of low-income individuals within the population (i.e., if they truly have a "Robin Hood redistributive effect"; see, e.g., Grossman, 1995 for a discussion of these effects).

We use data for the first four indicators from the 2019 U.S. Census American Community Survey (ACS) state/territory-level data (U.S. Census Bureau ACS, 2019). We obtained state-level SNAP data for 2019 from the U.S. Department of Agriculture. We use state/territory-level data as data for the five categorical levels are not available at a more granular level (e.g., county or geocode level). Furthermore, we use the Year 2019 because this represents the latest year for which data are available across all five category indicators. All variables possess a *more is better* scale orientation. Such a consistent orientation is achieved through careful variable selection or, as indicated, through variable transformation. For example, the unemployment rate of a group does not possess a *more is better* orientation, but employment–population ratio does. Similarly, the poverty rate does not possess such an orientation, but percentage not in poverty does (Table 1).

We selected these variables because of their relevance to economic well-being. In groundbreaking work on economic well-being index construction, Mullis (1992) reports income, which typically includes government benefits that raise purchasing power, and poverty rate as the leading indicators. Our indicators 1, 2, 3, and 5 collectively capture market income, government transfer income/benefits, and poverty avoidance. Furthermore, the use of an unweighted average percentile rank index is well-established in the indexing literature (see, e.g., Bornmann & Marx, 2013; Smith, 1993, Townsend & Pitchford, 2012). The index is unweighted to avoid arbitrary value judgments (see, e.g., Decancq & Lugo, 2013). An average percentile rank index represents a semi-parametric methodology by which to aggregate a set of rankings across multiple categories. It first establishes an order statistic—percentile rank—for each state/territory in each attribute, which generates a non-parametric statistic for each category. It then averages all percentile ranks for each state/territory—which represents a parametric step—to obtain an average rank percentile for each state/territory as an aggregated, semi-parametric statistic. An average rank percentile represents a central or typical rank percentile for a state/territory across all constituent categories.

ADA PARC absolute economic opportunity index

ADA PARC AEOI estimates the typical rank level of economic well-being within a U.S. state's population of people with disabilities compared to that of other U.S. state populations of people with disabilities. It is an index of absolute opportunity in the sense that it asks where people with disabilities in a given state/territory typically fall in terms of dimensions of absolute economic well-being compared to people with disabilities in other states/territory (i.e., within the same group).

More specifically, AEOI measures how a state is doing in terms of average percentile rank of people with disabilities within the state across the five absolute indicators compared to people with disabilities in the other U.S. states. For each category, a set of 51 indicator variable values (50 states plus D.C.; Puerto Rico was left out due to data omissions) are percentile ranked from 0 (lowest or worst) to 100 (highest or best). For each given state or territory, we then average the five indicator percentile values to obtain the state's average percentile rank or AEOI value. The following two formulas and examples are displayed to further clarify each step of the calculation. First, the percentile rank of state i in category j is given as:

$$\text{Percentile}_{i,j} = \frac{52 - \text{Rank}_{i,j}}{51} \bullet 100$$

TABLE 1 AOI and ROI values by state/territory.

State/territory	AOI value	AOI quartile	ROI value	ROI quartile	PWD population	ADA region
District of Columbia	0.384313726	Q2	0.156862745	Q1	79,695	R3
Kentucky	0.133333333	Q1	0.2	Q1	762,404	R4
Rhode Island	0.478431372	Q2	0.219607843	Q1	139,446	R1
Maine	0.352941177	Q1	0.22745098	Q1	210,930	R1
New Hampshire	0.62745098	Q3	0.250980392	Q1	170,461	R1
Arkansas	0.101960784	Q1	0.278431373	Q1	510,910	R6
Missouri	0.28627451	Q1	0.282352941	Q1	872,438	R7
Michigan	0.301960784	Q1	0.305882353	Q1	1,401,370	R5
Ohio	0.349019608	Q1	0.305882353	Q1	1,605,634	R5
Massachusetts	0.698039216	Q4	0.325490196	Q1	784,593	R1
Iowa	0.388235294	Q2	0.329411765	Q1	361,691	R7
Minnesota	0.631372549	Q3	0.337254902	Q1	597,169	R5
Vermont	0.419607843	Q2	0.349019608	Q1	89,692	R1
New York	0.51372549	Q2	0.356862745	Q2	2,226,016	R2
Pennsylvania	0.482352941	Q2	0.356862745	Q2	1,759,043	R3
Alabama	0.278431373	Q1	0.384313725	Q2	781,503	R4
Indiana	0.360784314	Q2	0.392156863	Q2	897,234	R5
Tennessee	0.333333333	Q1	0.415686275	Q2	1,015,603	R4
Mississippi	0.129411765	Q1	0.427450981	Q2	478,427	R4
Wisconsin	0.556862745	Q3	0.431372549	Q2	671,635	R5
Louisiana	0.196078431	Q1	0.443137255	Q2	695,791	R6
Illinois	0.560784314	Q3	0.454901961	Q2	1,388,097	R5
West Virginia	0.231372549	Q1	0.458823529	Q2	349,430	R3
South Carolina	0.28627451	Q1	0.482352941	Q2	715,960	R4
Connecticut	0.768627451	Q4	0.48627451	Q2	393,932	R1
Kansas	0.435294118	Q2	0.501960784	Q2	371,131	R7
New Mexico	0.203921569	Q1	0.501960784	Q2	315,698	R6
Idaho	0.356862745	Q2	0.521568627	Q3	229,669	R10
New Jersey	0.8	Q4	0.537254902	Q3	906,929	R2
South Dakota	0.454901961	Q2	0.549019608	Q3	102,221	R8
North Carolina	0.42745098	Q2	0.552941177	Q3	1,352,783	R4
North Dakota	0.615686274	Q3	0.568627451	Q3	81,266	R8
Wyoming	0.596078431	Q3	0.584313726	Q3	74,788	R8
Oregon	0.584313726	Q3	0.592156863	Q3	587,093	R10
Virginia	0.745098039	Q4	0.596078431	Q3	968,651	R3
Oklahoma	0.423529412	Q2	0.635294118	Q3	618,197	R6
Delaware	0.631372549	Q3	0.647058824	Q3	119,310	R3

(Continues)

TABLE 1 (Continued)

State/territory	AOI value	AOI quartile	ROI value	ROI quartile	PWD population	ADA region
California	0.654901961	Q3	0.650980392	Q3	4,101,034	R9
Georgia	0.545098039	Q3	0.666666667	Q3	1,261,925	R4
Arizona	0.51372549	Q2	0.670588235	Q3	903,268	R9
Maryland	0.850980392	Q4	0.682352941	Q4	652,374	R3
Nebraska	0.698039216	Q4	0.68627451	Q4	218,839	R7
Colorado	0.780392157	Q4	0.694117647	Q4	584,424	R8
Washington	0.819607843	Q4	0.745098039	Q4	924,708	R10
Florida	0.560784314	Q3	0.760784314	Q4	2,768,155	R4
Montana	0.552941176	Q3	0.77254902	Q4	141,245	R8
Utah	0.705882353	Q4	0.776470588	Q4	294,637	R8
Texas	0.694117647	Q4	0.803921568	Q4	3,187,623	R6
Nevada	0.705882353	Q4	0.839215686	Q4	369,238	R9
Hawaii	0.917647059	Q4	0.874509804	Q4	153,915	R9
Alaska	0.898039216	Q4	0.929411765	Q4	86,874	R10

If a fictional State i in the data were ranked 7th of the 51 states/territory for indicator j, for example, then $\text{Percentile}_{i,j} = \frac{52-7}{51} \bullet 100 = 88.2$. In this case, State i is in the 88.2 percentile of state/territory outcomes for category indicator j. Once all 51×5 or 255 state/territory category indicator percentiles are calculated for a year, the average percentile rank of any state/territory can be calculated, where that calculation provides the comprehensive AEOI value for that state/territory in that year. That is, the overall AEOI value for state i in a given year equals:

$$\text{AOI}_i = \frac{\text{Percentile}_{i,1} + \text{Percentile}_{i,2} + \text{Percentile}_{i,3} + \text{Percentile}_{i,4} + \text{Percentile}_{i,5}}{5}$$

Let us reconsider the fictional State i, which has a percentile value of 88.2 for indicator j. Let us assume this state has the following five percentile values, where each corresponds to a possible percentile value from among a set of 51 states/territory: {88.2, 62.7, 47.1, 60.8, 49.0}. In this case, $\text{AEOI}_i = \frac{88.2+62.7+47.1+60.8+49.0}{5} = 61.6$. The interpretation of this AEOI value is that, across the 5 indicators, the average position of State i in the people with disabilities economic well-being distribution is at the 61.6th percentile. In rank terms, this corresponds to somewhere between the 20th and 21st rank positions of the 51 states/territory as State i's average rank position. This estimate suggests that people with disabilities in that state enjoy greater comprehensive economic well-being than people with disabilities in approximately three-fifths of other states/territory.

Relative economic opportunity index

Although the AEOI compares the absolute economic well-being outcomes of people with disabilities within (people with disabilities) population but across state, the Relative Economic Opportunity Index (REOI) first takes the difference between people with disabilities and people without disability

economic well-being outcomes by state and then compares those differenced outcomes across state. It does this for each of the five constituent categories, forming a difference-based percentile rank for each state/territory and category. It is called a relative measure because of this differencing approach across populations. In the economics literature, there is evidence in favor of the relative income hypothesis, which states that it is not only our absolute economic prosperity but also our relative economic prosperity that influences our overall sense of well-being (see, e.g., Sanders, 2010).

REOI measures a state's (territory's) economic well-being of people with disabilities relative to people without disability compared to other states/territory. That is, for a given category and state/territory, the people with disabilities value for that category indicator are differenced from the people without disabilities value. Like the category indicators themselves, this difference has a *more is better* orientation from the perspective of economic well-being among people with disabilities. It is potentially confusing initially to think of these indicator differences as having such an orientation, given that most of the differences are negative. However, the *more is better* orientation simply says that a 10 percentage point deficit (−10) for people with disabilities (e.g., in employment population ratio) is *better* than a 20 percentage point deficit (−20). That is, it is the case that both $-10 > -20$, and −10 also represent a *better* outcome from the perspective of people with disabilities. That is, having a deficit of 10 is preferred to having a deficit of 20.

Once the differences are obtained for a given category across all 51 states/territory, these differences are ranked in descending order (i.e., such that the highest value is ranked first), and 51 rank percentile values are obtained for each category, where the rank percentiles are assigned from rank values according to the same formula as in the AOI calculation. Once all 51×5 or 255 rank percentiles are obtained for a year, the 5 rank percentiles for each state/territory are averaged as in the AOI calculation to obtain an average rank percentile of economic well-being differences among people with/people without disabilities. This average rank percentile of differences is called the REOI.

Distinctions between AEOI and REOI

The AEOI and REOI measure distinct aspects of economic well-being. The AEOI is a state report card measure-type. It simply examines whether people with disabilities in that state are faring well economically, in the sense of the absolute or primitive economic well-being category indicators, compared to people with disabilities in other states. On the other hand, the REOI is more a measure of how people with disabilities in a state experience economic well-being relative to that of another reference group.

Both absolute indicators and relative indicators of economic well-being have been shown to matter in theoretical and empirical economic well-being literature (see, e.g., Alpizar et al., 2005; Alvarez-Cuadrado & Van Long, 2011; Duesenberry, 1949). Absolute indicators relate to an individual's ability to meet one's basic and high-level material needs, whereas relative indicators relate to an individual's relative standing within their community and observable world (Ball & Chernova, 2008). Using survey-experimental methods, Alpizar et al. (2005) estimate that 45% of one's utility or well-being increase from a small income increase is from improvements in relative income standing, and the remaining 55% is from improvements in purchasing power (i.e., absolute income increase). That is, a little over half of well-being gained from a small income increase derives from the additional purchasing power, whereas almost half derives from knowing that one's income standing relative to those in one's community has improved in expectation. It is clear from the literature that both of these dimensions are important, and we therefore examine

their inter-relationships. We also characterize states/territory across the two indices. Of particular interest, we seek to examine which states are doing well (or poorly) across both measures. From a policy perspective, such states/territory can potentially provide strong examples of effective (or ineffective) policy and market characteristics impacting people with disabilities.

RESULTS

AEOI and REOI values and distributions across states/territory

For 2019 state/territory-level data, we obtained 51 AEOI and 51 REOI values for each state's population of people with disabilities. Figures 1A and 1B show a kernel-smoothed density plot for each set of index values. Both indexes are fairly symmetrically distributed and bell-shaped but without inflection on the tails (likely due to the truncated nature of percentile data), as shown by the density plots.

The observed bell-shaped distributions indicate that not all of the underlying constituent or category indicators of economic well-being are highly correlated with one another. That is, some of the indicators are explaining distinct outcomes at a state/territory level. If the indicators were highly correlated with one another, we would not expect to observe central tendency in the density plots but rather an approximately continuous uniform distribution, as in the primitive component measure rank data. That is, those who were ranked high (low) in one component would tend to remain ranked high (low) across other components. Descending tails indicate that it is less likely that a state persists as strong (weak) across all component measures.

Relationship between AEOI and REOI across states/territory

The following scatter plot of Figure 2 visually displays the relationship between the two indices for 2019 data. Horizontal and vertical lines at 0.50 (median values for each index) break the

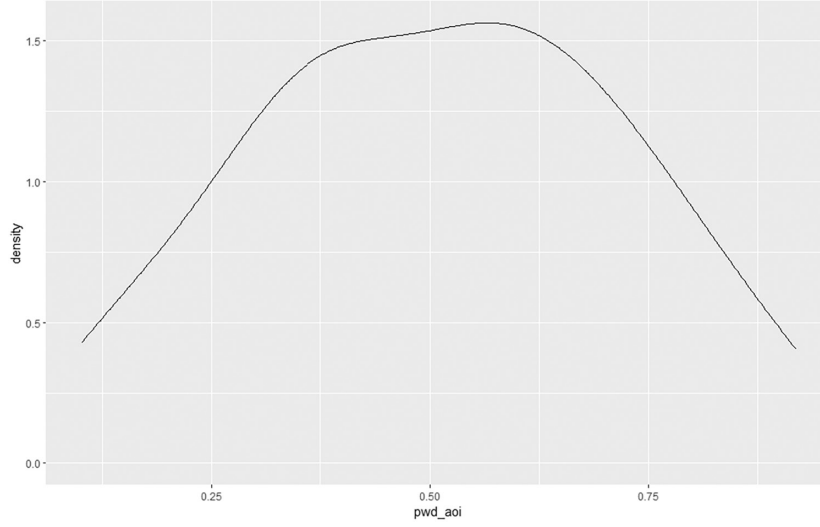


FIGURE 1A Distribution of AEOI values across states/territory.

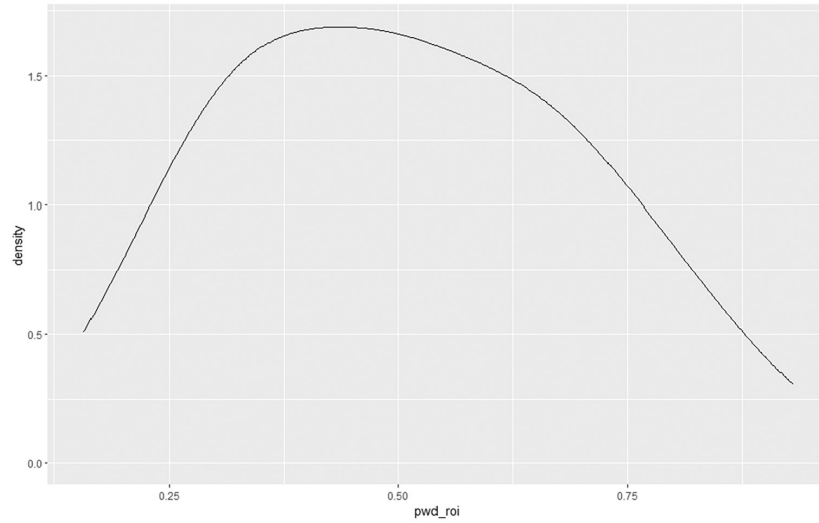


FIGURE 1B Distribution of REOI values across states/territory.

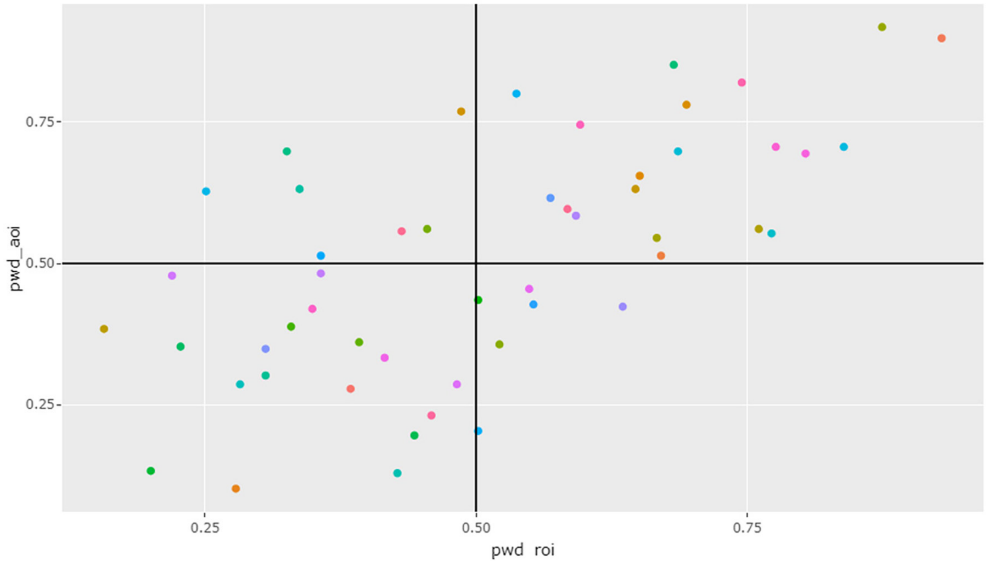


FIGURE 2 Quadrant scatterplot of relationship between AEOI and REOI values across states/territory.

scatter plot into quadrants, where the intersection of the two lines can be interpreted as a hypothetical state territory in which the population of people with disabilities has average economic well-being according to both AEOI and REOI. The upper right quadrant (1) can be interpreted as {Above-average REOI, Above-average AEOI}. The lower right quadrant (2) can be interpreted as {Above-average REOI, Below-average AEOI}. The lower left quadrant (3) can be interpreted as {Below-average REOI, Below-average AEOI}. The upper left quadrant (4) can be interpreted as {Below-average REOI, Above-average AEOI}.

A count-based or non-parametric method of assessing positive correlation is to count the number of sample points in quadrants 1 and 3 compared to the number in quadrants 2 and 4.

For quadrants 1 and 3, both data points are positively related with respect to index averages (i.e., either both above or both below index average). For quadrants 2 and 4, data points are negatively related with respect to index averages. Of the 51 data points, 38 are located in either quadrant 1 or 3 (74.5%), while 13 are located in quadrant 2 or 4 (25.5%). This indicates a moderate to strong positive association between AEOI and REOI in 2019. One can also assess the overall shape of the scatter of data points. This scatter moves along the Cartesian plane from southwest to the northeast with some noise, further indicating a positive association. Figure 3 provides a scatter plot of the same data, but with a best-fit trend line and 95% confidence interval bands around the trend line. This visualization approach helps us visualize the trend relationship between AEOI and REOI across states/territory.

The best-fit line indicates a positive association between state-level AEOI and REOI in 2019 with some noise. The residual standard error between the trend line and data point is 0.16, indicating that the typical observed state/territory AEOI data point is about 16 percentile points displaced from where it is predicted to be based on the same state's REOI value. This further indicates that the relative status and absolute status of people with disability follow somewhat distinct processes.

We further considered the strength of this association parametrically by measuring the Pearson correlation coefficient between AEOI and REOI. This coefficient equals +0.647, which additionally suggests a moderately strong, positive correlation between the two indices. While these indices are related, they also partly represent *distinct* aspects of economic well-being among people with disabilities. Conceptually, this result suggests that states with above-average absolute economic well-being outcomes (AEOI) are more likely to also have above-average relative economic well-being outcomes (REOI). Moreover, this suggests that above-average absolute economic well-being among people with disabilities does not occur as a trickle down from above-average absolute economic well-being among people without disability. If people with disabilities AEOI

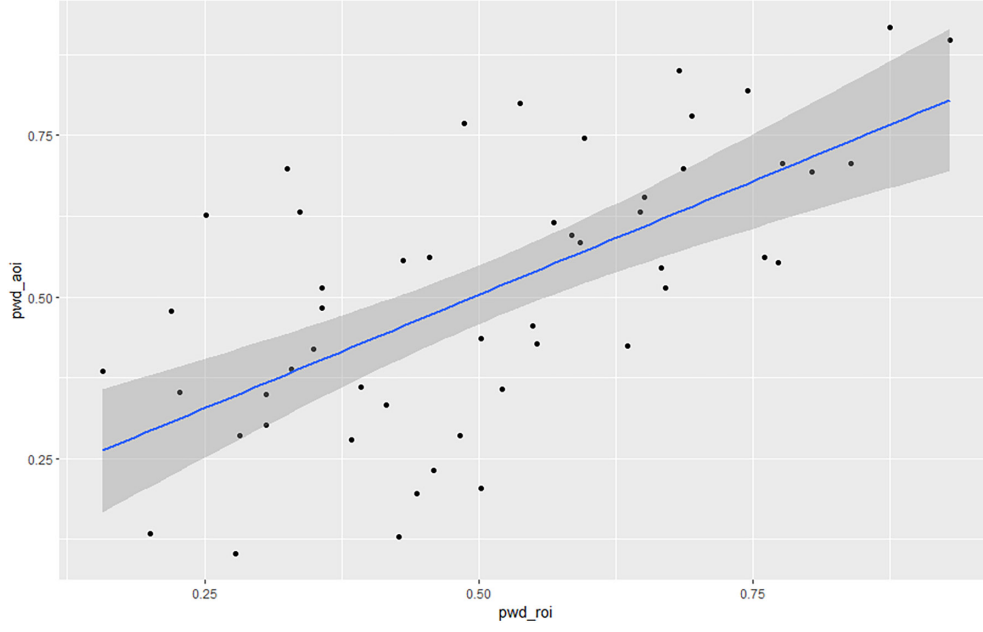


FIGURE 3 Scatterplot and trendline of relationship between AEOI and REOI values across states/territory.

were driven by such a trickle-down effect, we would expect the REOI ranking of a state to decrease as the AEOI ranking increases. That is, we would expect a prominent trickle-down effect to *increase* absolute economic well-being for people with disabilities while still exacerbating economic differences *between* people with and without disabilities within the state/territory. That is, a trickle-down effect is a secondary effect that is, by definition, weaker than the primary effect upon which it depends such that it is expected to have negative relative effects. After all, a trickle is distinct from a waterfall. Therefore, trickle-down dependent populations see their absolute economic well-being rise at the same time that their relative economic well-being diminishes.

To demonstrate this effect, consider a deterministic economy in which economic well-being among people with disabilities trickles down from economic well-being of people without disabilities. For simplicity, let us only focus upon the income trickle-down effect. Let us assume that each person without disability individually earns $50,000, and each person with disabilities individually earns $30,000 in this economy. Furthermore, let us assume that the trickle effect is 10%. That is, if people without disability enjoy a 20% increase in income, then people with disabilities will enjoy an income increase equal to 2% (10% of 20%). In this example, the income difference will be $20,000 before the income changes and $24,400 after the income changes. The absolute income level of people with disabilities has increased, while the relative income level has decreased in both difference and proportion terms.

In the case of the real-world AEOI/REOI data, however, people with disabilities that are doing better in the absolute also tend to be doing better in the relative. Hence, we can conclude that such outcomes are not derivative of the successes of people without disability in the same state/territory. Rather, there may be something in the policy and market opportunity settings of these states that enable people with disabilities to obtain favorable absolute and relative economic well-being. The flip side of this finding is that the states/territory that feature the lowest AEOI scores tend also feature the lowest REOI scores. In these states/territory, people with disabilities tend to have the lowest absolute and relative economic well-being estimates. In these states, people with disabilities may suffer from adverse policy and market opportunity settings.

State findings

As discussed in the previous section, we observe a fairly strong, positive correlation between the AEOI and REOI measures. To this point, we find that Alaska and Hawaii rank 2nd and 1st, respectively, in AEOI, while ranking 1st and 2nd, respectively, in REOI. Let us consider the AEOI values at a more granular level. Alaska ranks in the 82nd percentile in employment–population ratio of people with disabilities, in the 96th percentile in median cost-of-living adjusted individual income of people with disabilities, in the 96th percentile in median cost-of-living adjusted household income of people with disabilities, in the 98th percentile in percentage not in poverty 18–64 years old, and in the 76th percentile in SNAP benefits per household living in poverty. These values average to an overall AEOI percentile value of 90, which ranks second among the 51 AEOI values obtained. Alaskans with disabilities enjoy absolute economic opportunities that are in the highest quartile across all five indicators compared to their peers in other states/territory.

Hawaii ranks in the 71st percentile in employment–population ratio of people with disabilities, in the 98th percentile in median cost-of-living adjusted individual income of people with disabilities, in the 94th percentile in median cost-of-living adjusted household income of people with disabilities, in the 96th percentile in percentage not in poverty 18–64 years old, and at the 100th percentile in SNAP benefits per household living in poverty. These values average to

an overall AEOI percentile value of 92, which ranks first among the 51 AEOI values obtained. Hawaiians with disabilities enjoy absolute economic opportunities that are in the highest quartile, and even the highest decile, across four of the five indicators compared to their peers in other states/territory.

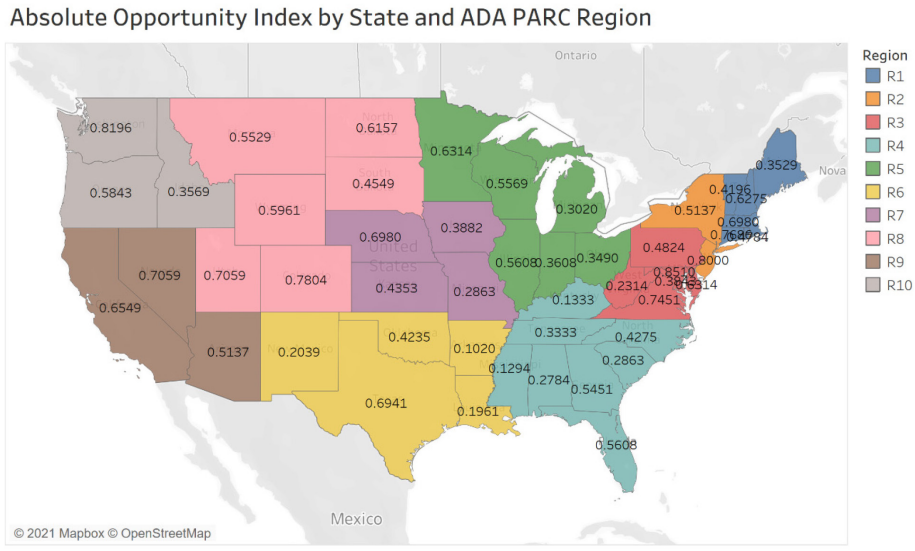
We can also discuss the REOI values for Alaska and Hawaii. In terms of difference from people without disability in the same state, Alaskans with disabilities rank in the 92nd percentile in employment–population ratio difference, in the 94th percentile in median cost-of-living adjusted individual income difference, in the 96th percentile in median cost-of-living adjusted household income difference, in the 98th percentile in percentage not in poverty 18–64 years old difference, and in the 84th percentile in SNAP benefits per household living in poverty difference. These percentiles average to an REOI value for Alaska of 93. Compared to people without disability in their state, the relative economic opportunities of Alaskans with disabilities rank in the top quartile for each category compared to the relative economic opportunity of people with disabilities in other states/territory.

In terms of difference from people without disability in the same state, Hawaiian people with disabilities rank in the 73rd percentile in employment–population ratio difference, in the 100th percentile in median cost-of-living adjusted individual income difference, in the 75th percentile in median cost-of-living adjusted household income difference, in the 90th percentile in percentage not in poverty 18–64 years old difference, and in the 100th percentile in SNAP benefits per household living in poverty difference. These percentiles average to an REOI value for Hawaii of 87. Compared to people without disability in their State, the relative economic opportunity of Hawaiians with disabilities ranks in the top quartile for four of the five categories compared to the relative economic opportunities of people with disabilities in other states/territory.

At the other end of the spectrum, Arkansas ranks 51st in AEOI and 46th in REOI, while Kentucky ranks 50th in AOI and 49th in REOI. Arkansas' AEOI component values are all in the bottom quintile and average to an overall AEOI percentile value of 10. Four of the state's ROI component values are below average, and these values average to an overall REOI percentile value of 28. Kentucky's AEOI component values are all below average, with four being in the bottom quintile. Kentucky's overall AEOI averaged percentile value is 13. Four of the state's REOI component values are below average, and these values average to an overall REOI averaged percentile value of 20. People with disabilities in these states tend to experience low economic opportunity for nearly all of the component indicators. Furthermore, this is the case for both absolute and relative economic opportunity (i.e., compared to people with disabilities in other states and also in terms of relative differences from people without disability in their own state).

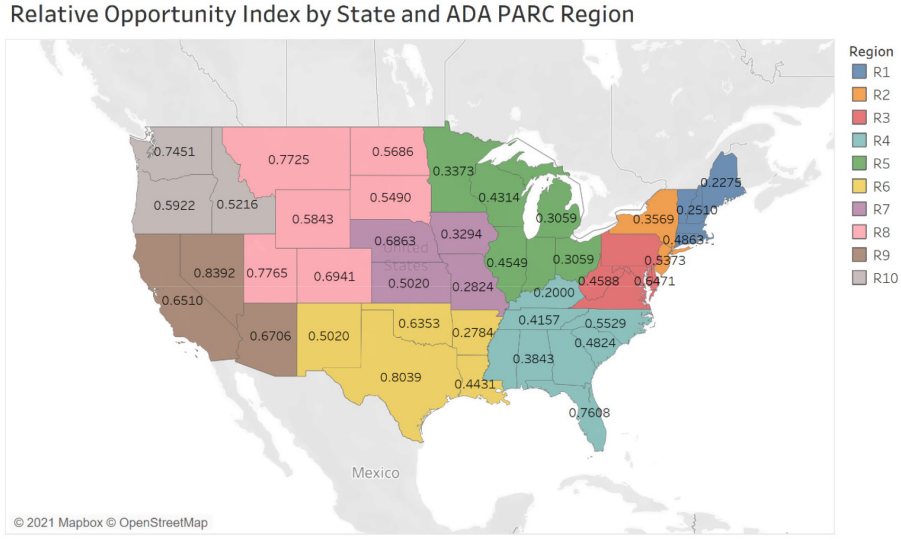
Overall, we find from these case studies that the component indicators of absolute and relative economic opportunity are clustered for states at the extreme ends of the distribution. Rather than being somewhat different from other states, these states tend to be systematically different across all categories. In the sample more broadly, there are states that rate strongly across the board and other states that rate poorly across the board. We can obtain a broader view of state/territory AEOI and REOI comparisons in Figures 4A and 4B. These plots are color-coded by ADA PARC Region, where the ADA PARC regions map onto U.S. Census sub-region districts. Note that Alaska (Region 10, AEOI: 90, REOI: 93) and Hawaii (region 9, AEOI: 92, REOI: 87) are not included in the map (a) because their values are listed in the text case study and (b) so as not to distort the continental map size.

Figures 4A and 4B provide a geographic representation of the moderately high, positive correlation observed between AEOI and REOI (+0.647). One also observes ADA PARC regions that feature a great deal of variation in AEOI and REOI values within the region. For example, Texas



Map based on Longitude (generated) and Latitude (generated). Color shows details about Region. The marks are labeled by sum of Pwd Aoi. Details are shown for State. The data is filtered on Pwd Aoi, which ranges from 0.101960784 to 0.917647059.

FIGURE 4A Absolute economic opportunity index by state and ADA PARC region.



Map based on Longitude (generated) and Latitude (generated). Color shows details about Region. The marks are labeled by sum of Pwd Roi. Details are shown for State. The view is filtered on sum of Pwd Roi, which includes everything.

FIGURE 4B Relative economic opportunity index by state and ADA PARC region.

is something of a positive outlier in Region 6 across both measures, as is Nebraska in Region 7. In these cases, we are controlling for region of country. Therefore, positive outcomes for people with disability may point to differences in governance (e.g., employer incentives) in these cases. Other regions (e.g., Regions 5, 8, and 10) demonstrate fairly consistent AEOI and REOI values across

states in the region. While outcomes are mixed among Eastern states, outcomes among Western and Southwestern states are disproportionately above average.

DISCUSSION

Economic Equity is a marker of a just society, as is the ability of all individuals within a society to readily meet their basic economic needs. In the economic development literature, Abrar-Ul-Haq et al. (2016) define these as food, shelter, clothing, and health care. Individuals who fail or struggle to meet such basic needs experience poor mental and physical health. In this study, we created two new indices of economic equity to compare people with disabilities to those without disability within geographic areas and to compare people with disabilities across geographic areas.

Our findings demonstrate the value of each novel index and evidence of significant economic inequities among people with disabilities. These indices break new ground in understanding the distributions of economic opportunity for people with disabilities, and how these distributions might change from state to state and from region to region. Furthermore, the indices consider how people with disabilities fare in comparison with those around them without disability *and* to people with disabilities in other states. As such, we are able to measure how states rank in terms of absolute standards of economic opportunity for people with disabilities. We are also able to measure how states rank in terms of economic well-being for people with disabilities relative to the economic well-being for people without disability living in the same state. The former index considers a state's performance in providing people with disabilities adequate economic opportunity. The latter index considers a state's performance in not leaving people with disabilities behind when the state enjoys economic growth.

We find a moderate correlation coefficient between the two measures, suggesting that the two measures have distinct and similar elements. This study constructs and analyzes two economic opportunity indexes for people with disabilities, the Absolute Economic Opportunity Index and the Relative Economic Opportunity Index. The analysis suggests states that provide high absolute standards of economic well-being to people with disabilities are expected to offer moderate-to-high relative standards of economic well-being to this same population. This correlation value also suggests that state of residence can have a twofold effect on people with disabilities. In many cases, the same states perform well or poorly in both measures. Therefore, people with disabilities are disproportionately in either a high absolute opportunity or high relative opportunity situation, or they are in a low absolute opportunity and low relative opportunity situation. We can think of the latter outcome as a situation of "double jeopardy." If a person with disability faces low relative economic opportunity, they are also likely to face low absolute economic opportunity and vice versa. As people with disabilities are also more likely bound to a particular living region (see, e.g., Speare et al., 1991), this "double jeopardy" feature suggests that people with disabilities in the United States face a high degree of variation in economic outcome across state and that the downside of this variation may often be unavoidable to the individual.

This study has limitations that merit noting. For the general population, researchers have been able to estimate economic opportunity down to the Census tract level (Chetty et al., 2020). Currently, such specificity is not available for people with disabilities specifically. In this study, we are able to characterize economic opportunity for people with disabilities at the state level, but for no smaller geographic unit. There is also a lack of consistent state-level data on the value

of economic transfers that go specifically to people with disabilities. If available in the future, such data would shed additional light upon the economic equity among people with disabilities in the United States.

These findings carry important implications for social policy. The observed similarities and differences merit a deeper analysis of state-level policy differences in a subsequent study that focuses less on methodology and more on forces that influence outcomes. The concluding section discusses policy implications stemming from the analysis.

CONCLUSION AND POLICY IMPLICATIONS

This study has constructed two novel measures of economic opportunity for people with disabilities: the Absolute Economic Opportunity Index and the Relative Economic Opportunity Index. We have also presented values for each index for each U.S. State/territory in the data and have further characterized state-level heterogeneity across the country. While the two measures are positively correlated with moderate strength, they are disparate enough to pick up slightly different dimensions of economic opportunity for people with disabilities. Ideally, the measures should be used in unison to identify, for example, states or territories in which people with disabilities possess systemically low economic opportunity across measure and time (i.e., persistently low absolute opportunity and relative opportunity across a number of years). For such states, an examination of policies related to the economic opportunity of people with disabilities should be undertaken. For example, the policies of these states and territories can be compared to those of states or territories with consistently high index values.

Upon characterizing the economic opportunities of people with disabilities across state, there are two basic groups of policy levers to address geographic inequities: (1) state utilization of federal program and funding support and (2) state-initiated policy supports. In the first group, a state could expand access to healthcare benefits under the Affordable Care Act (ACA) to a larger group of adults with incomes up to 138% of the federal poverty level and receive an enhanced federal matching rate (FMAP) for the expanded populations. As of September 2022, 39 states/territory (including D.C.) have adopted and implemented the expansion, while 12 states have not. Among these 12 states are all of ADA Region 4 (i.e., the Southeastern region), which holds generally low REOI and AEOI scores. A state could also expand an existing HCBS waiver or seek approval of a new waiver from CMS to expand coverage among people with disabilities and provide employment-related supports and services.

In the second group of policy levers, there could be a state Earned Income Tax Credit to complement the federal EITC to help lift individuals and families out of poverty. Other state law and policy initiatives to compare state efforts include state supplements to SSI beneficiaries, employer tax incentives to hire workers with disabilities and/or cover costs of architectural and communication barriers, state laws on family and medical leave, a preference and expedited methods of hiring individuals with disabilities into the public workforce, and supplier diversity initiatives to purchase goods and services from disability-owned small businesses. These and other potential policies could influence the economic well-being of people with disabilities, in addition to market sector conditions that compare high and low performing states.

A limitation of the present research, as with almost all index-related research, is that external validation is difficult. One potential approach for future research is to observe whether people with disabilities who are also mobile with respect to location of residence tend to move from

states or territories with low economic opportunity to states or territories with high economic opportunity, as in the Tiebout (1956) Hypothesis of regional economic analysis. While people with disabilities tend to be less mobile with respect to residential decisions, it may be that a meaningful subset of people with disabilities (e.g., those near a state border or those with a strong family support structure) tend to be mobile.

This research approach can be extended to understand economic opportunities for populations in general. Indeed, families that do not contain people with disabilities may be limited from moving regions for various other reasons (e.g., family ties, legal restrictions on residence, or illiquid land holdings or other assets). For these populations, as well, it is potentially important to identify and address the root causes of inequities in economic opportunity.

FUNDING INFORMATION

U.S. Department of Health and Human Services, National Institutes of Health.

CONFLICT OF INTEREST STATEMENT

The authors have nothing to declare.

ORCID

Katherine McDonald https://orcid.org/0000-0003-1195-7978
Barry Whaley https://orcid.org/0009-0002-5023-7199

REFERENCES

Abrar-Ul-Haq, M., Jali, M. R., & Islam, G. (2016). A role of household empowerment to alleviating poverty incidence and participatory poverty: Qualitative insights from the literature. *International Journal of Economic Perspectives*, *10*(4), 645–654.

Alpizar, F., Carlsson, F., & Johansson-Stenman, O. (2005). How much do we care about absolute versus relative income and consumption?. *Journal of Economic Behavior & Organization*, *56*(3), 405–421.

Alvarez-Cuadrado, F., & Van Long, N. (2005). The relative income hypothesis. Journal of Economic Dynamics and Control. *35*(9), 1489–1501.

Attree, P. (2005). Low-income mothers, nutrition and health: A systematic review of qualitative evidence. *Maternal & Child Nutrition*, *1*(4), 227–240.

Ball, R., & Chernova, K. (2008). Absolute income, relative income, and happiness. *Social Indicators Research*, *88*(3), 497–529.

Batavia, A. I., & Beaulaurier, R. L. (2001). The financial vulnerability of people with disabilities: Assessing poverty risks. J. Soc. & Soc. *Welfare*, *28*, 139.

Bornmann, L., & Marx, W. (2013). How good is research really? Measuring the citation impact of publications with percentiles increases correct assessments and fair comparisons. *EMBO Reports*, *14*(3), 226–230.

Chetty, R., Hendren, N., Jones, M. R., & Porter, S. R. (2020). Race and economic opportunity in the United States: An intergenerational perspective. *The Quarterly Journal of Economics*, *135*(2), 711–783.

Decancq, K., & Lugo, M. A. (2013). Weights in multidimensional indices of wellbeing: An overview. *Econometric Reviews*, *32*(1), 7–34.

Dobson, B., Beardsworth, A., Keil, T., & Walker, R. (1994). *Diet, choice and poverty*. Family Policy Studies Centre.

Duesenberry, J. S. (1949). Income, saving and the theory of consumer behavior.

Grossman, H. I. (1995). Robin Hood and the redistribution of property income. *European Journal of Political Economy*, *11*(3), 399–410.

Klasen, S. (2008). The efficiency of equity. *Review of Political Economy*, *20*(2), 257–274.

Lea, S. E. (2021). Debt and overindebtedness: Psychological evidence and its policy implications. *Social Issues and Policy Review*, 15(1), 146–179.

Marston, G., & Shevellar, L. (2014). In the shadow of the welfare state: The role of payday lending in poverty survival in Australia. *Journal of Social Policy*, *43*(1), 155–172.

Mishra, A. K., & Gupta, R. (2006). Disability index: A measure of deprivation among disabled. *Economic and Political Weekly*, 23, 4026–4029.

Morris, Z. A., & Zaidi, A. (2020). Estimating the extra costs of disability in European countries: Implications for poverty measurement and disability-related decommodification. *Journal of European Social Policy*, *30*(3), 339–354.

Mullis, R. J. (1992). Measures of economic well-being as predictors of psychological well-being. *Social Indicators Research*, *26*(2), 119–135.

Ohrnberger, J., Fichera, E., & Sutton, M. (2017). The relationship between physical and mental health: A mediation analysis. *Social Science & Medicine*, *195*, 42–49.

Peirce, R. S., Frone, M. R., Russell, M., & Cooper, M. L. (1996). Financial stress, social support, and alcohol involvement: A longitudinal test of the buffering hypothesis in a general population survey. *Health Psychology*, *15*(1), 38–47.

Rantakeisu, U., & Jönsson, L. R. (2003). Unemployment and mental health among white-collar workers—A question of work involvement and financial situation? *International Journal of Social Welfare*, *12*(1), 31–41.

Sanders, S. (2010). A model of the relative income hypothesis. *The Journal of Economic Education*, *41*(3), 292–305.

Sleskova, M., Salonna, F., Geckova, A. M., Nagyova, I., Stewart, R. E., van Dijk, J. P., & Groothoff, J. W. (2006). Does parental unemployment affect adolescents' health? *Journal of Adolescent Health*, *38*(5), 527–535.

Smith, J. J. (1993). Using ANTHOPAC 3.5 and a spreadsheet to compute a free-list salience index. *CAM*, *5*(3), 1–3.

Speare, A., Jr., Avery, R., & Lawton, L. (1991). Disability, residential mobility, and changes in living arrangements. *Journal of Gerontology*, *46*(3), S133–S142.

Tiebout, C. M. (1956). A pure theory of local expenditures. *Journal of Political Economy*, *64*(5), 416–424.

Townsend, E., & Pitchford, N. J. (2012). Baby knows best? The impact of weaning style on food preferences and body mass index in early childhood in a case–controlled sample. *BMJ Open*, *2*(1), e000298.

U.S. Census Bureau. (2019). Income and poverty in the United States: 2018 (ACS-29). https://www.census.gov/library/publications/2019/demo/p60-266.html

United for ALICE. (2022). *Financial hardship among people with disabilities*. USDA SNAP DATA. https://www.unitedforalice.org/focus-disabilities

Viseu, J., Leal, R., de Jesus, S. N., Pinto, P., Pechorro, P., & Greenglass, E. (2018). Relationship between economic stress factors and stress, anxiety, and depression: Moderating role of social support. *Psychiatry research*, *268*, 102–107.

How to cite this article: Walia, B., McDonald, K., Hammel, J., Frieden, L., Morris, M., Whaley, B., & Nguyen, V. (2023). Economic equity and people with disabilities: Development and characterization of a novel index. *American Journal of Economics and Sociology*, *00*, 1–17. https://doi.org/10.1111/ajes.12553