

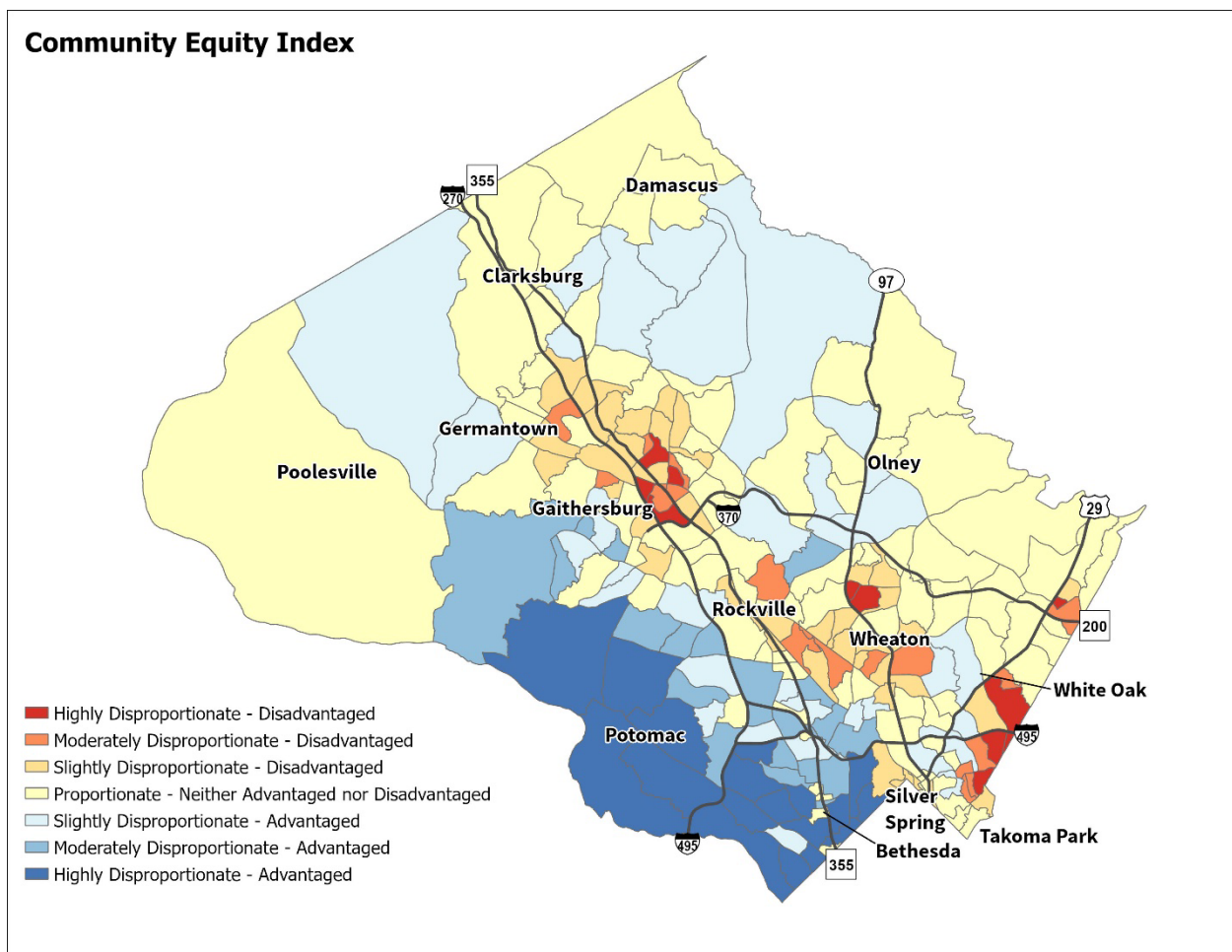
COMMUNITY EQUITY INDEX (CEI) TECHNICAL REPORT

BACKGROUND, METHODOLOGY, AND ANALYSIS

Research and Strategic Projects Division

Montgomery Planning

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1. INTRODUCTION

Montgomery Planning has a commitment to prioritize racial equity and social justice in its work, which is outlined in the department's [Equity Agenda for Planning](#). Part of this commitment has been to research and analyze socio-economic conditions across the county, and to develop [data products](#) that help people understand and visualize inequities. Staff developed [Equity Focus Areas \(EFAs\)](#) in 2021 to help identify census tracts with the most vulnerable populations and released a storymap on [Trends in Racial and Ethnic Change](#) in 2022 that showed changes by race between 1990 and 2020.

As the newest product, the Community Equity Index (CEI) quantifies, categorizes, and maps geographic inequity across the Montgomery County. This report describes the process of developing the CEI, details its methodology, and offers several examples for how it can be used. This is a technical report intended for people who want a deep dive into the background and methodology of the CEI. We expect that most public and professional interaction with the CEI will come through the online [CEI Explorer](#) and the [Montgomery Planning CEI website](#).

BACKGROUND

EQUITY FOCUS AREAS

The Equity Focus Areas (EFAs) project is the main predecessor to the CEI. As part of the [Thrive Montgomery 2050 General Plan Update](#), a group of staff working on equity issues determined a need to identify areas with vulnerable, disadvantaged populations. Based on census tract boundaries, EFAs are parts of Montgomery County that are characterized by high concentrations of lower-income people of color, who may also speak English less than very well. Montgomery Planning developed this tool to identify and map these areas in the county to assess potential racial and social inequities. This includes access to resources and opportunities for employment, transportation, education, health, and government services that support a high quality of life. While other regional equity analyses have been created, the EFAs use Montgomery County's demographics, rather than those of the entire region (like the Metropolitan Washington Council of Governments' [Equity Emphasis Areas](#)), as the benchmarking data.

The EFAs indexed three indicators across all Montgomery County census tracts:

1. percentage of people at or below 80% of area median family income,
2. percentage of people of color, and
3. percentage of people who "speak English less than very well."

The low-income variable comes from the U.S. Department of Housing and Urban Development's Comprehensive Housing Affordability Strategy (CHAS) data¹ from 2018, and the other two come from the U.S. Census department's American Community Survey (ACS). Each indicator percentage was normalized and assigned a score based on its position in the standard deviation of the indicator's distribution. Tracts scoring above a minimum threshold—indicating proportionately high concentrations of the indicators—were designated as EFAs. In 2019, 56

¹ CHAS data tables are custom tabulations of American Community Survey housing data. CHAS data from 2018 were used in the EFAs. At the time of the writing of this report, 2019 CHAS data are the most recent data available so more recent (2021) American Community Survey data are used in the CEI. More information about CHAS data is available here: <https://www.huduser.gov/PORTAL/datasets/cp.html>.

of Montgomery County's 2015 tracts received this designation. For more information about the EFAs and their methodology, see the [EFA storymap](#).

COMMUNITY EQUITY INDEX

While the EFAs were useful in identifying hotspots of vulnerability across the county, we needed a more comprehensive measure that covered the entire county and the entire spectrum of socio-economic conditions. The CEI results from a thorough process of reviewing equity and opportunity indexes from around the world and related academic literature. This process is detailed in Section 2 of this report.

The CEI applies a working definition of equity from the American Planning Association and adopted by Montgomery Planning. Under this definition, equity is “just and fair inclusion into a society in which all can participate, prosper, and reach their full potential.”² The main challenge in creating the CEI was to operationalize this definition into a metric. Like other opportunity and equity indexes, the CEI consists of a composite score for each census tract of five socio-economic indicators that primarily reflect people's status in society and inclusion in the economy. Section 3 includes a discussion of why these indicators were chosen and others were not.

The CEI and EFAs are part of a larger tradition of opportunity and equity indexing and mapping, but the CEI differs from traditional equity and opportunity indexes because instead of measuring how high or low the value of socio-economic indicator (or index of indicators) is in a neighborhood, it measures how far away that value is for the same indicator or index in the larger area—how close the neighborhood is to a socio-economic cross section of the county overall. This approach ensures that neighborhoods do not get “penalized” by way of a lower score for including people of lower socio-economic status. By more fully representing the county's diversity, the CEI ensures that this neighborhood is interpreted as contributing to greater equity.

The CEI takes the approach that “just and fair inclusion” means providing space in every neighborhood for the county's full range of diversity. Quantitatively, this means that the closer a tract's score is to the overall countywide score, the more just and inclusive it is. In contrast, inequitable tracts are where certain segments of the county's socio-economic cross-section are disproportionately concentrated, regardless of whether it is the “high” or “low” end of the cross-section.

Like any attempt to define or quantify equity, this approach is not perfect. The fact of living in proximity to wealth and privilege does not guarantee inclusion in economic, political, or social life. However, there is evidence that residential socio-economic diversity increases the economic mobility of disadvantaged people, and that geographically concentrated socio-economic disadvantage can have corrosive effects for disadvantaged groups, advantaged groups, and entire communities.³

The CEI is primarily a practical tool to help users determine the equity impact of potential plans and policies, as well as to determine what kinds of policies might be most impactful from an equity perspective. But it can also help establish a reflective, conceptually rigorous, and holistic countywide approach to equity.

² American Planning Association. (1990). *Planning for Equity Policy Guide*. https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Planning-for-Equity-Policy-Guide-rev.pdf

³ Chetty, R., Friedman, J. N., Hendren, N., Jones, M. R., & Porter, S. R. (2018). *The opportunity atlas: Mapping the childhood roots of social mobility* (No. w25147). National Bureau of Economic Research.; Galster, G. C. (2011). The mechanism (s) of neighbourhood effects: Theory, evidence, and policy implications. In *Neighbourhood effects research: New perspectives* (pp. 23-56). Dordrecht: Springer Netherlands.

2. LITERATURE REVIEW AND CRITIQUE OF EQUITY AND OPPORTUNITY MAPPING

Montgomery Planning staff conducted an extensive search for equity map examples before and during the process of developing the CEI. The purpose of this research was to understand how other communities approached using data in analyzing equity issues and to identify ideas that could inform the development of a tool for Montgomery County.

The CEI follows in the tradition of equity and opportunity mapping codified by the Kirwan Institute at Ohio State University in the early 2000s. These maps were initially used to help communities avoid concentrating public housing and voucher recipients in areas that already had high poverty rates. Eventually opportunity maps and equity atlases came to be used in more general regional planning efforts.⁴ A descriptive list of the indexes, dashboards, and tools we reviewed in creating the CEI is included in Appendix A.

Although some equity “atlases” (e.g. the [Portland](#), [Denver](#), and [Atlanta](#) Regional Equity Atlases) do not include indexes and map each indicator separately, the examples above generally follow the standard process of indexing and mapping in the Kirwan tradition:

“(1) Select variables that measure the presence or lack of opportunity, (2) Collect data and assign values to common geographic units, (3) Normalize the data and assign to subcategories, (4) Compute a composite opportunity index, (5) Create thematic maps, (6) Overlay with other variables of interest.”⁵

The CEI follows this workflow except for step four (see sections 3 and 4 for a description of the process and methodology).

Other indexes and tools, such as the [Dallas Equity Indicators](#) and the Urban Institute’s Spatial Equity Tool differ from the traditional Kirwin model because they examine geographical and racial and ethnic over- and under-representation. These methodologies are not replicable for neighborhood-level indexes, but their focus on disproportionality in representation informs the CEI.

Despite its popularity, opportunity and equity mapping has unresolved methodological questions.⁶ For one, the mathematical models that go into indexing have drawn little scrutiny. For example, it remains unclear how much to weigh one variable over another, or whether indicators have linear effects on opportunity.⁷ An example of a potential nonlinear variable is poverty, which appears to create negative neighborhood effects at certain tipping points.⁸ Reaching a certain poverty rate threshold in a neighborhood may greatly affect outcomes for residents, while changes in the rate below or above the threshold may have little effect.

⁴ Finio, N., Lung-Amam, W., Knaap, G. J., Dawkins, C., & Wong, B. (2020). Equity, opportunity, community engagement, and the regional planning process: Data and mapping in five US metropolitan areas. *Journal of Planning Education and Research*, 0739456X20945385.

⁵ Knaap, E. (2017). The cartography of opportunity: Spatial data science for equitable urban policy. *Housing Policy Debate*, 27(6), 913-940. p. 7.

⁶ Knaap, E. (2017).

⁷ Knaap, E. (2017).

⁸ Galster, G. C., Quercia, R. G., & Cortes, A. (2000). Identifying neighborhood thresholds: An empirical exploration. *Housing Policy Debate*, 11(3), 701-732.

Also, while scholars have a general idea about the mechanisms for neighborhood opportunity, their relative degrees of contribution and contextual effects are still not perfectly understood.⁹ The most recent and thorough scholarship on the topic, from the Opportunity Insights project¹⁰ headed by Raj Chetty of Harvard University suggests that traditional metrics like neighborhood incomes, poverty levels, shares of college graduates, and shares of two-parent households are correlated with economic mobility over a life course, but these correlations come with several significant caveats.¹¹ First, they only account for a portion of the statistical variability in economic mobility, leaving much of the problem unexplained. Second, mobility outcomes vary greatly for people of different races and ethnicities. Most notably and frustratingly, Black boys grow up to earn less than White boys who grew up in the same neighborhood in 99% of these neighborhoods.¹² There are essentially no neighborhoods that can help propel Black men to the same degree of economic mobility as their white peers. Some of this persistent gap can be explained by more recent findings that suggest that simply living in a “high opportunity” neighborhood may not be sufficient to increase economic mobility, and that actual social ties between people of different economic status within neighborhoods is a key mechanism.¹³

Knaap offers several additional critiques and suggests methodological improvements, one of which is a statistical process called confirmatory factor analysis for identifying dimensions of opportunity paired with unsupervised machine learning to determine how neighborhoods cluster along each dimension. These methods are promising but have high data and computational requirements. We failed to identify enough variables that could reliably be analyzed at the census tract level to perform a factor analysis in the first place. Further, with relatively high levels of correlation between variables, it is unclear whether adding more variables increases accuracy or simply injects more statistical noise.

Ultimately, there is no way to determine whether one opportunity or equity index is “right” or another is “wrong.” Because measuring equity and opportunity through available metrics and indicators is neither an exact nor settled process, people from different backgrounds, professions, and communities often disagree on what indicators belong in an index or atlas. While there is no right way to measure opportunity or equity, these disagreements can hamper efforts lead to “indicator fatigue” caused by drawn out debates about which indicators to use.¹⁴

Opportunity and equity mapping face conceptual challenges in addition to measurement and methodological ones. First, studies of opportunity and equity are rarely defined it in a rigorous way. Opportunity indexes especially have created the perception that opportunity is a phenomenon that people seize through their own agency even though research shows the process of how neighborhoods effect individuals is a passive one. University of Minnesota professor Ed Goetz summarizes this critique as follows:

“opportunity neighborhoods...are seen as actively translating opportunity into real benefits through their actions. But, of course, this is not what really happens. Instead, the households that occupy favored neighborhoods most often just passively benefit from advantage. They

⁹ Galster, G. C. (2011).

¹⁰ For a more thorough examination of Opportunity Insights data in Montgomery County, see the Third Place blogs [“The Opportunity Insights Project and Economic Mobility in Montgomery County,”](#) and [“The Opportunity Insights Project and Economic Mobility Part 2: A Closer Look at Neighborhoods.”](#)

¹¹ Chetty, R. *et al* (2018).

¹² 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.

¹³ Chetty, R., Jackson, M. O., Kuchler, T., Stroebel, J., Hendren, N., Fluegge, R. B., ... & Wernerfelt, N. (2022). Social capital I: measurement and associations with economic mobility. *Nature*, 608(7921), 108-121.

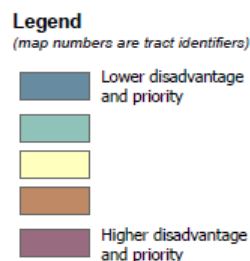
¹⁴ Finio, N. *et al* (2020).

benefit...simply by *existing* in those places. There are no special steps they take to benefit from the advantages of these neighborhoods. Households in favored neighborhoods...do nothing that residents of low opportunity neighborhoods do not also do.”¹⁵

Under Goetz’s framework, inequities result from people—through no agency of their own—being exposed to excesses or deficiencies of *advantage* that is accrued simply by being who we already are and living where we already live. The choice of most of the indexing efforts listed above not to include “opportunity” in their names may reflect this evolving outlook.

However, conceiving of equity as disproportionalities in passively accrued advantage or disadvantage also suggests that an equity index needs to account for both advantage and disadvantage. In practice, opportunity maps have tended to focus on one side or another. Opportunity mapping was initially developed to identify “high opportunity” neighborhoods as receiving areas for public housing and has evolved into an exercise often aimed at helping communities identify “low opportunity” neighborhoods so that more resources can be directed to these places. Some of the examples listed above employ this emphasis on disadvantage by including only the neighborhoods that score above or below a certain threshold as target or priority areas (e.g. Atlanta’s Equitable Target Areas index, the Bay Area’s Equity Priority Communities, and the DC region’s EEAs and EFAs). The scale for Seattle’s Racial and Social Equity Index also illustrates this approach. The most disadvantaged tracts are considered the highest priorities and the least disadvantaged tracts are the lowest priorities.

Figure 1: Seattle Racial and Social Equity Index’s Scale



This approach also follows a long-running trend in social science research to focus almost exclusively on disadvantaged neighborhoods. On one hand this focus is warranted because people in these neighborhoods deserve reparative and supplemental investments in their neighborhoods. On the other hand, this disproportionate focus on underserved and marginalized neighborhoods exoticizes them and ignores the fact that advantaged neighborhoods are part of the same urban ecosystem that produces such severe disadvantage.¹⁶ As scholar Junia Howell observes, “solely focusing on the problems of impoverished communities inadvertently gives the impression that these difficulties can be addressed without changing advantaged communities or the social structures that deem some neighborhoods advantaged and others disadvantaged.”¹⁷ Providing affordable options in advantaged neighborhoods to allow people from more disadvantaged neighborhoods to move would also help to increase equity but would be deprioritized in the traditional framework.

¹⁵ <https://shelterforce.org/2019/09/16/why-opportunity-neighborhoods-arent-really-for-everyone/>

¹⁶ Howell, J. (2019). The unstudied reference neighborhood: Towards a critical theory of empirical neighborhood studies. *Sociology Compass*, 13(1), e12649.

¹⁷ Howell, J. (2019).

In an equity or opportunity index, categorizing the most disadvantaged neighborhoods as the highest priorities leads to perverse outcomes because it penalizes advantaged neighborhoods by lowering their scores if they accept disadvantaged residents. This approach implies that policies to address disadvantage *in place* are the only options, and it simultaneously incentivizes advantaged neighborhoods to stay exactly as they are. Moving the benchmark to the middle—or most representative—set of neighborhoods as the CEI does, encourages a dual-pronged approach to increasing equity: ensuring that people have opportunities to improve their socio-economic status where they already live on the one hand, and that they have opportunities to move to places that might provide better access on the other.

Opportunity and equity indexes, and related planning activities, rarely focus on the “middle” of the scale even though places that fall in the middle can be thought of as the most equitable based on their distribution of socio-economic characteristics. As many indexes are constructed, these “middle-opportunity” neighborhoods are by definition median or near-median (often between the 40th and 60th percentile) neighborhoods of the larger reference area. Improving countywide equity would mean that more neighborhoods would look more like these median or near-median neighborhoods, with a representative cross-section of the county’s residents living in them rather than disproportionate concentrations of people with certain characteristics.

The CEI is constructed according to the idea that the most equitable neighborhoods have residents with a mix of socio-economic characteristics that is similar to the overall county. For this reason, the CEI uses an absolute rather than relative scoring system indicating how far a neighborhood deviates from the countywide score, making it possible to detect a countywide convergence toward or divergence from geographical equity (for a discussion about why relative scoring systems make change difficult to detect and interpret, see section 4). The CEI also does not measure “opportunity.” Rather, it measures how five indicators often associated with socio-economic advantage and disadvantage are distributed throughout the county.

3. INDICATOR SELECTION

CRITERIA FOR CEI INDICATORS

We consulted staff from various divisions at Montgomery Planning and Planning's Equity Peer Review group and external agencies, including the Montgomery County Office of Racial Equity and Social Justice, the Montgomery County Council Office of Legislative Oversight’s Racial Equity and Social Justice subject area staff, and the University of Maryland National Center for Smart Growth, to discuss CEI indicators and methodology. As noted in the previous section, not everyone agrees on what variables belong in an equity index, but based on our consultations and research we developed the following five criteria for indicators.

1. Indicators should measure important equity concepts

This criterion appears obvious, but there is not always agreement on how to quantify the concept of equity because inequities can play out along several separate and often intersecting dimensions. For example, is equity more about the prospects of economic mobility over a life course or someone’s current quality of life? Is racial and ethnic discrimination fundamental to the study of equity in the U.S., or should we focus more about measurable economic outcomes? Is equity influenced by physical access to certain locations, and if so, which locations? Are environmental conditions and health outcomes components of equity or are they downstream of more

fundamental racial and economic considerations. Finally, how does disability status, gender, or sexuality intersect with economic or racial equity? These topics all can and have been examined in the context of equity, but the topics that ultimately become part of the CEI are limited by the next four indicators.

2. Indicators should be easily understood by a general audience

The CEI is intended mainly to help professionals in Planning, County government, and community advocacy groups in policy and decision making. While these professionals often have subject matter expertise, most are not experts in data analysis and statistical methods. Indicators should be straightforward measures derived from recognizable data sources (e.g. the American Community Survey) and have undergone minimal manipulation or processing.

3. Indicators should be consistently available over time

A review of equity indexing initiatives observed that the group or agency doing the indexing commonly lacked the capacity to sustain the effort over time.¹⁸ Indicators may quickly become outdated, and data collected specifically for the indexing effort may not be collected again. If the capacity to track the index's change over time is important, then indicators should come from an easily available source that reliably produces consistent data over time. After considering many data sources, Montgomery Planning decided to use the U.S. Census Bureau's American Community Survey (ACS) data because of its consistency.

4. Indicators should be statistically reliable at the tract census level

The CEI uses census tracts as proxies for neighborhoods, so indicators must be statistically reliable at this relatively fine-grained geographic scale. Since many detailed ACS variables have high margins of error at the tract level, this criterion became the most limiting factor for CEI indicators. For example, variables that disaggregate important equity-related concepts by race and ethnicity are generally not valid at the tract level, nor are many transportation-related variables. Examples of these types of variables are tenure by race and ethnicity and car ownership of households. The reliability calculation methodology and reliabilities scores for each indicator in each tract and selected potential indicators that were not used is provided in Appendix B.

5. All CEI indicators should contribute new and independent information to the index

Each indicator should contribute novel information to an index because each indicator represents a different dimension along which an index measures equity. One way to gauge an indicator's contribution is to determine how correlated it is with other variables. If indicators are too highly correlated, they are likely contributing the same information and improperly weighting the index in one direction. We conducted a correlation analysis (see Appendix D) to ensure that no variables in the index are too highly correlated.

Also, if an indicator does not show enough variation, it may not provide enough information to meaningfully affect the index. Two ACS variables, access to health insurance and disability status, fall into this category because they are highly clustered around the average and have little variation around the county. For example, only 7 out of the 232 tracts in the county were more than 10 percentage points outside the countywide average percentage of residents with a disability. For the variables in the CEI, the smallest number of tracts more than 10 percentage points away from the countywide average was 64. Accordingly, the disability variable has a low standard

¹⁸ Finio *et al* (2020).

deviation—a measure of statistical variation—of 4.8 percentage points. The lowest standard deviation of the variables in the index is 9.4 percentage points.

6. Indicators should measure characteristics that can change over time

We selected only those that can change over a person’s life course to reinforce the approach that efforts to increase equity must include both those that allow people to increase their socio-economic status where they live *and* to move to places that give them access to better opportunities. If an indicator, such as race or ethnicity, is not changeable, then the only way a neighborhood can change its score in that indicator would be for new residents to move in or existing residents to move out. This outcome may be desirable in highly advantaged neighborhoods which also tend to be predominantly white neighborhoods in Montgomery County, but it could be undesirable in disadvantaged neighborhoods which tend to have more people of color and where increased diversity could simply reflect displacement of existing residents. Including only changeable indicators allows for the possibility that an increasing or more equitable score for a disadvantaged neighborhood was achieved by improving the lives of the people who live there.

CEI INDICATORS AND RATIONALE FOR INCLUDING

With these criteria in mind, we selected five variables for the CEI:

1. Percent of people living below 200% of the federal poverty level
2. Percent of people with less than a bachelor’s degree
3. Percent of people who speak English “less than very well”
4. Percent of people who rent housing
5. Per capita income

Table 1 shows the data source, equity topic measured, and justification for including each indicator.

Table 1: Sources, topics, and rationales for CEI indicators

Indicator	Source Table (from 2017-2021 5-year ACS)	Equity Topic	Rationale for Inclusion in CEI	Limitations
% of people below 200% of federal poverty level	Table C17002	Economic Insecurity	Poverty concentration is consistently found to be a main contributor to neighborhood effects.	200% of the federal poverty level is a low threshold for an expensive place like Montgomery County. Many families earning above this level likely still struggle to meet daily expenses but will not count in this indicator.
% of people with less than a bachelor's degree	Table B16010	Earnings potential	A college degree on average significantly increases people's earnings over their life course.	Some people with associate's degrees or technical certifications (e.g. tradespeople) can earn high wages.
% of rental housing units	Table B25003	Housing stability and wealth building	Renters face the possibility of eviction or displacement more than homeowners. Homeownership is a key way people build wealth and a contributor to the racial wealth gap. Median household income for renters is less than half of that for owners in Montgomery County. ¹⁹	Wealthy people can choose to rent their housing, and some high-earning people may prefer to rent for flexibility.
% of people who speak English "less than very well"	Table B06007	Barriers to inclusivity and resource access	People who have trouble speaking English are limited in the types of jobs available to them and may have difficulties accessing public and human services.	Immigration experiences, countries of origin, and cultural affinity groups may interact with language to impact economic outcomes. Also, language abilities are self-reported and may differ based on subjective assessments.
Per capita income	Table B19003	Income	Higher income means higher economic inclusion.	Some people who are disadvantaged in other ways may still have high incomes.

¹⁹ According to the 2017 to 2021 5-year American Community Survey, median household income for renters in was \$72,005 while for owners it was \$150,775.

These variables meet the five criteria listed above. All are straightforward concepts with simple metrics that internal and external partners agreed represented important concepts related to equity. All have been used in existing opportunity or equity indexes or maps.

All CEI indicators come from the 2017-2021 5-year ACS. The U.S. Census Bureau has reliably conducted the ACS with consistent variables since 2005 and will continue to do so for the foreseeable future. Updating the CEI and comparing it at different time periods can be accomplished by extracting the same ACS variables from different years. ACS variables can also be compared with decennial census variables as they are released every ten years.

Margins of error for these five indicators were generally acceptable at the census tract level, although the correlation coefficient between per capita income and percent without a bachelor's degree have a high negative correlation coefficient of -0.82 (values close to 1 and -1 indicate stronger correlations). Despite this relatively strong correlation, we still included both these variables because they measure distinct phenomena—income and educational attainment—and provide qualitatively different information to the index.

The indicators are also conceptually consistent, because they are all changeable over a person's life course or inter-generationally and can be affected by policy.

Many other potential indicators were considered but not included in the index. Despite not being included in the index, many of these indicators can still be analyzed from an equity perspective by applying the CEI to them to determine their distribution among neighborhoods in the county based on their CEI categorization.

INDICATORS NOT INCLUDED AND RATIONALE FOR NOT INCLUDING

RACE AND ETHNICITY

The omitted indicator that received the most consideration and discussion was race and ethnicity. All people and groups consulted agreed that race and ethnicity is a fundamental attribute on which community equity hinges. The legacies of anti-Black and anti-Latino/Hispanic racism and discrimination have created persistent structural disadvantages for these groups. Present day racism and discrimination further entrench these disadvantages. Black and Latino/Hispanic populations have scores that indicate disadvantage in all the CEI variables as compared to the general population and white-only population in both the U.S. and Montgomery County. This statistical disparity is an indication of the deep structural barriers to equity faced by people of color.

Despite the importance of race and ethnicity to the debate around equity, it was not included in the CEI for several reasons. The first is that it violates criterion number 6 above: a race/ethnicity indicator could only be changed through inter-neighborhood mobility and not by improving people's lives where they live.

Additionally, for indexing purposes, race and ethnicity cannot be disaggregated into its constituent categories, and thus cannot reflect the differences in experiences within and between racial and ethnic groups. Each indicator in the CEI except for per capita income is computed as a percentage of people who represent that characteristic out of the tract and county's total population. For example, the "percent of people without a bachelor's degree" indicator categorizes people as either having a bachelor's degree or not. This type of binary categorization is not suitable for assessing multiple race and ethnicities simultaneously because each group would be counted multiple times in the "not" category. For example, non-Hispanic Black people would be counted as "not Asian" and "not

Latino/Hispanic.” Depending on the composition of the tract, its CEI score could be improperly inflated or deflated from this double counting after all the scores are averaged together.

To fit into the scoring system for the index, all racial and ethnic categories would have to be collapsed into one “people of color” category. The problem with this approach is that the people of color category is too broad to capture the wide-ranging patterns of discrimination experienced by each racial and ethnic group. For example, while Asian Americans face numerous types of discrimination and racism, their median incomes and education levels are significantly closer to those of White people than to those of Black and Latino people in Montgomery County, and their residential patterns are more similar to those of white residents than to those of Black or Latino residents (see section 5).

Table 2: Median household income and Percent with at least bachelor’s degree for largest racial and ethnic groups in Montgomery County

<i>Race/Ethnicity</i>	Median Household Income	Percent with at least bachelor’s degree
<i>White</i>	\$141,003	75%
<i>Asian</i>	\$123,183	67%
<i>Hispanic or Latino</i>	\$86,302	27%
<i>Black or African American</i>	\$83,194	47%

Data: American Community Survey, 2021, 1-year estimates

For the purposes of the CEI, which is focused on socio-economic outcomes, it remains unclear how to characterize what can be seen as a cultural but not necessarily economic disadvantage.

Finally, during working sessions for the CEI with community partners, a reviewer expressed concern that the association of high concentrations of people of color with disadvantaged neighborhoods could be perceived as stigmatizing the residents of the neighborhood or even blaming them for the neighborhood’s conditions. This problem has been observed elsewhere in reviews of equity mapping and categorization.²⁰ In equity and opportunity mapping, values must be assigned to socio-economic characteristics such that some scores amount to low opportunity or, in the CEI’s case, disadvantage. Attaching a numerical value to a “people of color” indicator in an index introduces the logic that simply adding or removing people of color (or white people) can change a neighborhood’s score.

For all the reasons stated above, the concept of race and ethnicity is not directly included in the CEI. However, recognizing its central role in community equity, the online dashboard includes racial and ethnic diversity and segregation indices that can be explored alone or in tandem with the CEI to allow users to fully assess the role of race and ethnicity in Montgomery County.

HEALTH AND DISABILITY

Health data are not available from the census or locally at the tract level. The U.S. Centers for Disease Control and Prevention (CDC) produced a tract-level dataset of chronic disease called [PLACES](#), but its local disease outcome metrics are generated by models of the relationship between census and ACS socio-economic characteristics and

²⁰ Finio *et al* (2020) and <https://shelterforce.org/2021/01/04/opportunity-areas-shouldnt-just-be-places-with-a-lot-of-white-people/>

disease outcomes nationally. Incorporating these metrics into the index would be equivalent to adding extra ACS indicators or double-counting indicators already in the index. In short, the PLACES data already acts as a stand-alone health equity index.

The ACS includes a variable estimating people with disabilities that is reliable at the census tract level. However, the estimate of share of people with disabilities has a very low standard deviation across tracts (0.05), meaning that there is little variation across the county in disability rates. This means that the disability variable would add very little information to the index and violates criterion number 5 above.

Also, some health conditions and disabilities are permanent, meaning that this indicator, like the race and ethnicity indicator, would also violate criterion number 6 above since a changing score would only result from people moving.

ENVIRONMENT

Environmental information, including heat islands, tree cover, and other data that may become available will be analyzed using the CEI to determine how environmental harms and benefits are distributed throughout the county. Using environmental indicators in CEI analysis rather than in the index itself maintains conceptual consistency because environmental conditions—while important to people’s well-being—are not socio-economic characteristics.

TRANSPORTATION, MOBILITY, AND ACCESS

Some opportunity and equity indexes incorporate indicators that measure distance from or travel time to resources, amenities, and institutions. These points of interest include parks, grocery stores, medical clinics and hospitals, human services, and jobs. For any of these destinations, creating metrics that can be indexed requires intensive data collection and analysis as well as assumptions and methodological tradeoffs. For example, analysts must choose whether to use distance or time needed on the travel network as the key indicator of access. Distance is relatively easy to measure, but not necessarily reflective of access, because access depends upon the degree of transportation network connectivity. Determining network connectivity is a time- and data-intensive modeling task that increases the complexity and replicability of the index and reduces the likelihood that it will be revisited in the future. The access metric would have to be continuously updated as points of interest are added, removed, or moved, and as the road and transit network changes over time.

The ACS has several travel related variables such as commute mode and vehicles available, but each of these variables comes with one or several indexing disadvantages. First, the only commute mode variable that is statistically reliable at the census tract level is whether somebody drives alone to work. A “driving alone versus not driving alone” indicator yields contradictory information related to equity. Driving alone to work can be a sign of choice and privilege, but so can living near a metro station and commuting via metro—or even living close enough to a workplace to walk. Bus travel is generally thought of as the commute mode of last resort, but the “bus only” category is not reliable at the census tract level. Nor is, the “vehicles available” which would allow us to determine the rate of households that do not have access to personal vehicles (see Appendix B).

Many indexes include access to jobs as a variable, even though the number of accessible jobs—regardless of how “access” is defined—is minimally predictive of economic outcomes²¹. For this reason and the computational and data difficulties, access to jobs was not included in the index.

LIMITATIONS OF THE CEI AND INDIVIDUAL INDICATORS

As noted above, there is no universally accepted set of measures that represent equity, and many equity concepts that would ideally be included are not quantifiable or have other data limitations.

Indexing is a data-reduction technique, meaning that its purpose is to *reduce* information. Indexes are useful in assessing equity because it is such a complex, multi-dimensional concept that can be overwhelming if each dimension is considered simultaneously. The CEI reduces the idea of equity and the problem of inequity to a single indicator, which can serve as a touchstone for further investigation. It is not intended to perfectly capture all dimensions of equity across Montgomery County, let alone directly generate solutions.

Each indicator within the index is a generalization with plenty of exceptions. For example, there are wealthy people who lack a bachelor’s degree and highly advantaged people who live in census tracts the CEI classifies as disadvantaged. Many people who can afford to buy homes choose to rent. Further, census tracts are one of the best available proxies for neighborhoods but are still often too large to capture the differences between one side of a street and another.

The CEI is simply a starting point for officials, professional staff, and the public to start thinking about and discussing equity in the county. Accounting for spatial and socio-economic nuances within the CEI data requires further investigation.

²¹ Knaap, E. (2017); Chetty *et al* (2018).

4. METHODOLOGY

CEI SCORING BACKGROUND

The novel methodology of the CEI uses absolute rather than relative scores. Because individual index variables have different distributions, most opportunity and equity indexes use normalized versions of the variables.²² Normalization changes the distributions of the indicators so they match each other. There are several ways to normalize data, but common methods are to compute percentiles, z-scores, or to assign whole number scores based on the number of standard deviations away from the mean an observation is. The Equity Focus Areas take this latter approach.

This process is standard for indexing because it results in a standard set of values to combine into an index. However, it complicates the tracking of changes in equity over time because it allows for a situation in which the value of observation may change while its normalized score remains the same due to changes in the distribution (the reverse—an observation changing remaining the same but its normalized score changing—could also occur).

To illustrate this problem in the context of the CEI, imagine revisiting the CEI in ten years and finding that the percentage of people living below 200% of the poverty line decreased, and better yet, that most of this reduction came from the tracts that had the highest percentage of these people in the original calculation of the CEI ten years ago. This shift would be a sign that the county is becoming more equitable because the most disadvantaged tracts in terms of poverty concentration have been “catching up” to the tracts with very little poverty, meaning poverty rates are converging across neighborhoods. However, it is also possible that the tracts with the largest poverty reductions remain the *same distance*, in terms of rank, from the tracts with the least poverty and thus receive the same rank in the current distribution that they did ten years ago. The original bottom ten percent of tracts would still be the bottom ten percent of tracts even if their raw scores improved over time. In such a case, the equity situation in the county would be qualitatively different, but the equity index and maps would not change because the tract rankings would remain the same.

A related problem with a rank-based indexing approach is that ranking is zero-sum. If one tract improves its rank another tract must fall back. An equity map divided into quintiles—as they often are—will always have the same number of tracts in each quintile. Tracts may shift positions with each other over time, but rank-swapping does not provide information about whether the tract or county became more equitable or inclusive—only whether one tract outranked another.

A third problem with relative scoring is that all variables in an index contribute equally regardless of their distributions. Although this is the point of normalization it treats all variables as equally contributing to inequity when in reality they might not be. Variables can be manually weighted, but any weighting scheme would be subjective—there is not scientific way to determine the relative contribution of each indicator to the concept of equity.

²² Knaap, E. (2017).

The CEI accounts for these problems by using an absolute scale. Regardless of changes in the internal distribution of individual indicators or their composite score, they are measured against a static benchmark.

We selected the benchmark from the book *the Color of Law*²³ by Richard Rothstein. He suggests that communities can begin to address the legacy of residential segregation by aiming to house a “fair share” of low-income or Black residents relative to the larger area in which they are located. He offers “plus or minus 10 percent” as a reasonable metric to assess this fair share, such that each smaller community should be within plus or minus ten percent of the larger county’s or region’s African American population concentration to be considered racially integrated.

We apply Rothstein’s fair share concept and ten percent rule to the CEI’s socio-economic indicators to conceptualize and measure just and fair inclusion in the CEI. In theory, all tracts could be within ten percent of the county average, in which case they would all be in the same category and the county would be a very equitable and inclusive place. Likewise, the county could be severely divided along socio-economic lines, with no tract falling within the ten percent threshold. In reality, neither of these situations is the case. But unlike traditional rank-based scoring methods, a shift towards or away from equity or inclusion will be visible in the county and in individual tracts with an absolute scoring scale.

CEI SCORE COMPUTATION

This section provides a step-by-step overview of how we calculated the scores.

STEP 1: DETERMINE PERCENT DIVERGENCE FROM COUNTYWIDE AVERAGE FOR EACH INDICATOR.

For each of the five indicators, the value is obtained for each tract and for the county. Values are converted to percentages (i.e. concentrations or shares) by dividing them by the total population of the tract (and county). The percentage of each tract is subtracted from the percentage of the county and multiplied by ten to yield a number with a single-digit absolute value. The score for each tract is calculated by the following formula:

$$s_{t_i} = \left(\frac{v_{t_i}}{p_{t_i}} - \frac{v_{c_i}}{p_{c_i}} \right) * 10$$

Where

s_{t_i} = indicator score for tract

v_{t_i} = ACS estimated value for indicator in tract

p_{t_i} = ACS estimated value for total tract population (universe for ACS variable)

v_{c_i} = ACS estimated value for indicator in county

p_{c_i} = ACS estimated value for total county population (universe for ACS variable)

The Per Capita Income (pci) indicator score is computed differently because it is not derived from a percentage. Rather, it indicates how far a tract’s pci is above or below the countywide pci.

²³ Rothstein, R. (2017). *The color of law: A forgotten history of how our government segregated America*. Liveright Publishing.

$$s_{pci} = 100 - \left(\frac{pci_t}{pci_c} \right) * 10$$

Where

s_{pci} = per capita income indicator score

pci_t = tract per capita income

pci_c = county per capita income

STEP 2: AVERAGE THE FIVE INDICATOR SCORES FOR EACH TRACT.

For each tract, compute the average of the five indicator scores.

$$s_{t_{cei}} = \frac{s_{t_{i1}} + s_{t_{i2}} + s_{t_{i3}} + s_{t_{i4}} + s_{t_{i5}}}{5}$$

Where

$s_{t_{cei}}$ = tract CEI score

$s_{t_{i1,2,3..}}$ = individual indicator scores for tracts

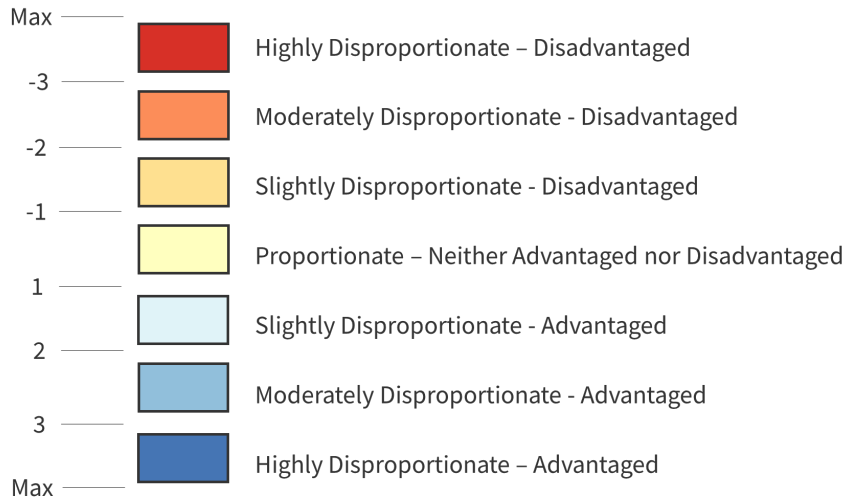
Table 3 CEI score computation example

INDICATOR	COUNTY VALUE	TRACT VALUE	DIFFERENCE	SCORE
PEOPLE WHO ARE UNDER 200% OF POVERTY	17.3%	22.7%	-5.4%	-0.54
PEOPLE WITHOUT BACHELOR'S DEGREE	40.2%	71.9%	-31.7%	-3.17
PEOPLE WHO RENT HOUSING	34.6%	10.7%	23.9%	2.39
PEOPLE WHO SPEAK ENGLISH LESS THAN VERY WELL	14.8%	34.4%	-19.6%	-1.96
PER CAPITA INCOME	\$59,384	\$32,228	-45.7%	-4.57
AVERAGE (CEI SCORE)				-1.57

CEI CATEGORIZATION AND INTERPRETATION

Following the ten percent rule, the CEI categories break at each incremental ten percent deviation from the county score, which is set to zero. Each increment of "1" in the scale represents ten percent. Scores from -1 to 1 are considered proportionate because they are within ten percent of the overall county CEI score in either direction. Each successive whole number increment represents an additional degree of disproportionality, as shown in the scale below. Although some tracts have magnitudes above four, the most disproportionately advantaged or disadvantaged category in the scale is "three and above."

Figure 2: CEI scoring scale



The CEI adopts the premise that tracts that most closely resemble the countywide socio-economic mix are the most equitable because they enable the most just and fair inclusion by allowing a full representation of the county’s diversity to live in the same or nearby neighborhoods. In this way, the countywide average is the target or benchmark against which all neighborhoods are gauged. Tracts that diverge too far from the countywide socio-economic mix—regardless of the direction of divergence—are places where inequity is present. A tract that is highly disadvantaged is just as disproportionate and inequitable as a tract that is highly advantaged. Both situations contribute to the overall spatial inequity in Montgomery County. This scoring system differs from traditional equity and opportunity maps in which the score starts at zero and increases in the positive direction, with lower scores indicating lower opportunity or equity and higher scores indicating higher opportunity or equity.

INDICATOR WEIGHTING IN THE CEI

The CEI method does not explicitly assign weights to variables as some indexes do, but since the indicators are not normalized, they end up assuming weights according to their distributions: indicators with larger standard deviations have larger impacts on the CEI score, and those with smaller standard deviations have smaller impacts. On one hand, this aspect of the CEI is a limitation because indicator distributions are not related to the indicators’ contributions to overall socio-economic well-being. On the other hand, weighting variables in opportunity and equity indexes has always been a subjective practice.²⁴ There is no consensus regarding the relative contribution of any indicator to any measure of equity or opportunity.

We show the effect of these various distributions by normalizing the individual indicators and regressing them on the non-normalized CEI score (note this is equivalent to computing the standard deviations of each of the indicator scores). The indicator with the lowest coefficient is set to “1” and the weights represent how many times larger each coefficient is than the lowest coefficient, shown in table 4.

²⁴ Knaap, E. (2017).

Table 4 Weights of CEI Indicators

Indicator	Coefficient	Weight
Per capita income	0.98	5.24
Renter occupied units	0.54	2.89
People without a bachelor's degree	0.40	2.12
People living below 200% of the poverty level	0.25	1.32
People who speak English less than very well	0.19	1.00

The per capita income indicator (PCI) contributes the most to the CEI score, and factors 5.24 times as strong in the CEI as the English-speaking indicator, which contributes the least. The Bachelor's degree indicator is in the middle, contributing 2.12 times more than the English-speaking variable.

Although these weights could be further adjusted by manually applying additional weights to any or all the indicators or adjusting the ten-percentage point threshold for each indicator based on its distribution, we did not change them. The project team agreed that per capita income has the most impact on a person's or family's material conditions and thus the most impact on their agency in improving their socio-economic conditions or deciding where to live. It is also the indicator with the highest degree of statistical reliability (see Appendix B). We further thought it is appropriate that indicators with smaller standard deviations have a small impact on the index for all but the most extreme values since it is these significant concentrations for concentrations of residents living below 200% of the poverty level and who have trouble speaking English that we want to capture. In short, we have no evidence-based rationale for changing the weights of the indicators from what their distributions dictate. However, we developed a method to correct for the possibility of improper weighting and to provide a way to compare indicators on a relative basis by computing drivers of inequity, described below.

DRIVERS OF INEQUITY

While the per capita income indicator most strongly influences CEI scores overall, it may not be the most impactful indicator for each individual tract. For planning and policy purposes, it may be important to know which indicator is contributing most to, or *driving*, inequity in relative terms in individual or groups of tracts. The CEI drivers provide this information.

The CEI remains categorized on an absolute scale, but we can use a relative, or normalized, scale to compare the influence of each indicator within the CEI. To compute the drivers, all indicators are normalized by determining their percentile, which can also be thought of as a rank, across tracts. Then, all indicators with scores in the opposite direction of the overall CEI score for each tract are removed, because these indicator scores are moderating the overall CEI score. The ranks of the remaining individual indicator scores are compared for each tract to assess the relative importance of each indicator.

The highest ranked remaining indicator for each tract is called the primary driver for that tract, because its rank is higher than those of all other remaining indicators. Even though it might not have the greatest absolute contribution to the overall magnitude of the CEI, the primary driver can be interpreted as the variable with the greatest relative contribution.

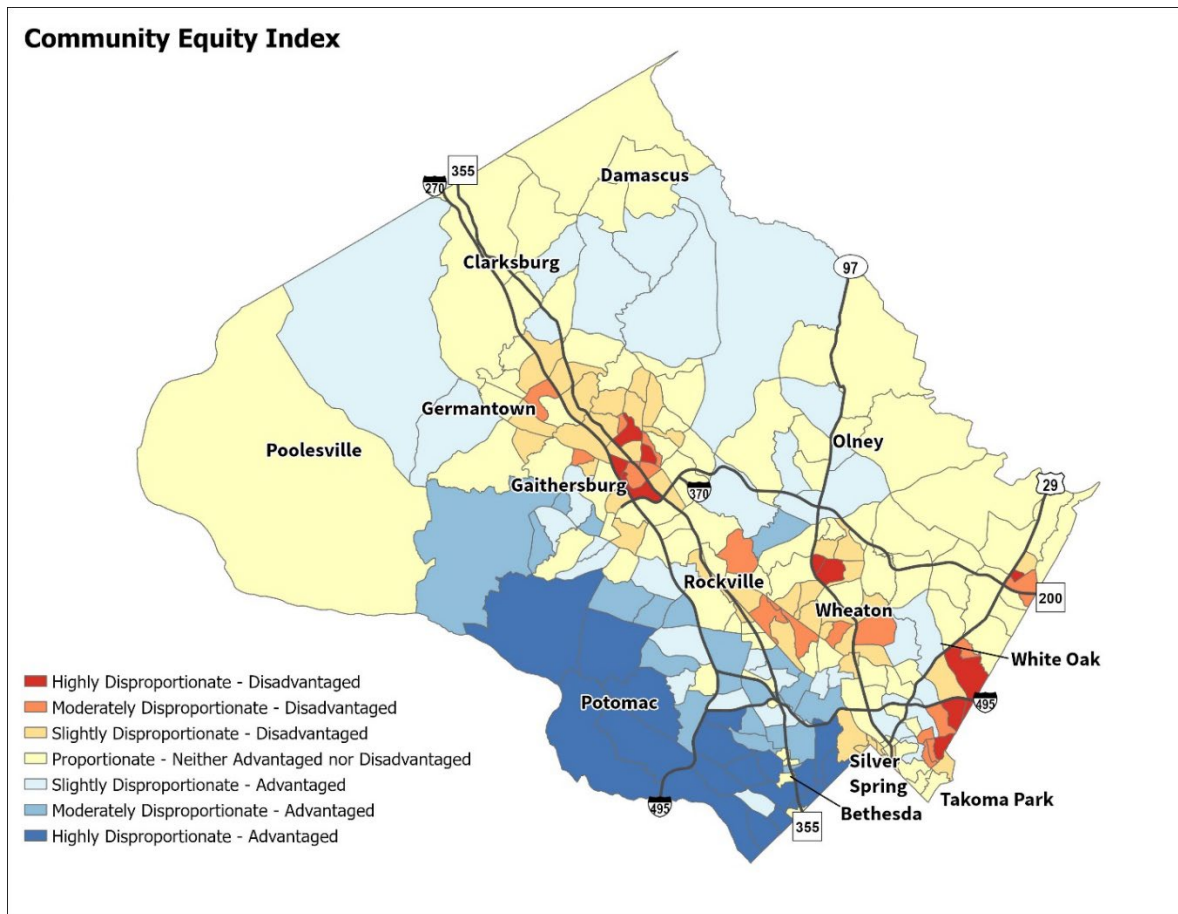
Drivers allow for targeted discussions about how best to approach inequity in certain tracts. For example, inequity in some disadvantaged tracts is driven by high rates of people living below 200% of poverty, while in others it is low levels of education (for more on how to interpret and use drivers, see Section 5).

5. CEI RESULTS AND ANALYSIS

The main product of the CEI is a map that can be used to gauge patterns of geographical advantage and disadvantage in Montgomery County. Planning and other public and nonprofit partners in the county can use the CEI data to guide efforts to make places more welcoming to all, improve conditions in disadvantaged places, and promote residential choice and mobility.

The variation in colors shows where advantage and disadvantage are proportionately and disproportionately clustered in the county. In the CEI, proportionate (yellow) tracts can be thought of as the goal or benchmark against which all other tracts are measured because they are representative of the county's socio-economic diversity. In this way, the CEI treats inequality between people and inequality between places as related but separate problems, and it focuses on the latter. That is, even when there is inequality between people, these inequalities should be distributed proportionately over space so that groups are not isolated from each other. Yellow, or proportionate, tracts come closest to achieving this distribution.

Figure 3: Community Equity Index for Montgomery County



This approach contrasts with that of traditional equity or opportunity mapping, where the high end of the index—usually a “high opportunity” tract—is thought of as the model to which other tracts should be compared. But in practice this traditional approach penalizes highly advantaged tracts for welcoming less advantaged neighbors and likewise implies that the only way for disadvantaged tracts to increase their ranking is to push out disadvantaged people in favor of advantaged ones. At the neighborhood level, one tract improves its position only by overtaking another, such that a hierarchy is always preserved.

In contrast, the CEI allows for a more flexible set of interpretations and shifts attention to the middle of the distribution where spatial equity is present. Most importantly, it leaves open the possibility that all tracts in the county could be yellow, which would indicate that people of various socio-economic characteristics are distributed relatively evenly across the county. Alternatively, the CEI could yield no yellow tracts, which would mean that the county is highly geographically inequitable. For any one county at any at one point in time, having more yellow tracts means a more equitable and normatively desirable situation. Conversely, more red and blue tracts signal more geographic inequity.

Over time, the county would ideally become more prosperous and would see this prosperity distributed more proportionately. Under this scenario, the countywide indicator scores would reflect increasing socio-economic advantage and the map would gain more yellow tracts. Alternatively, the countywide indicator scores could improve while the map loses yellow tracts, which would indicate that advantage is growing but becoming disproportionately concentrated in a few places; disadvantaged people would become more isolated and the socio-economic status of most people would not necessarily improve. Another undesirable scenario would be if the county becomes more equitable—the map becomes more yellow—but people within it become poorer. This trend could be a signal that the county is becoming a site of concentrated disadvantage within the larger metro region.

INTERPRETING THE CEI MAPS

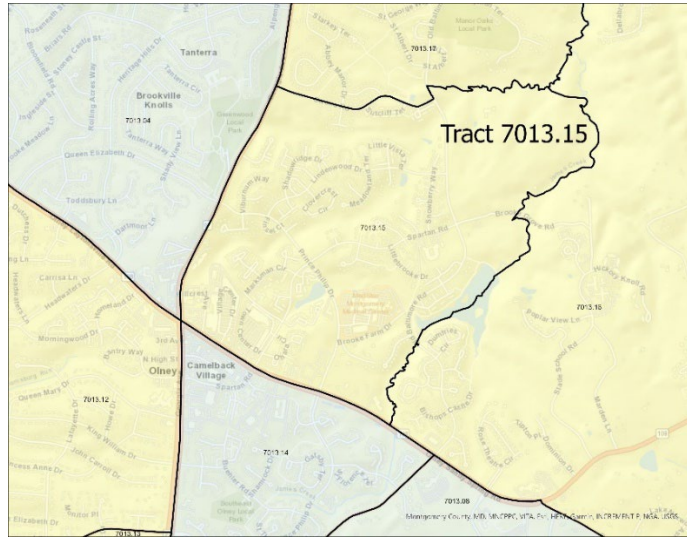
The CEI analysis produced two sets of maps. The first illustrates the results of the CEI scoring and the second illustrates the drivers behind the scores.

MAPS OF CEI SCORING

EQUITABLE TRACTS

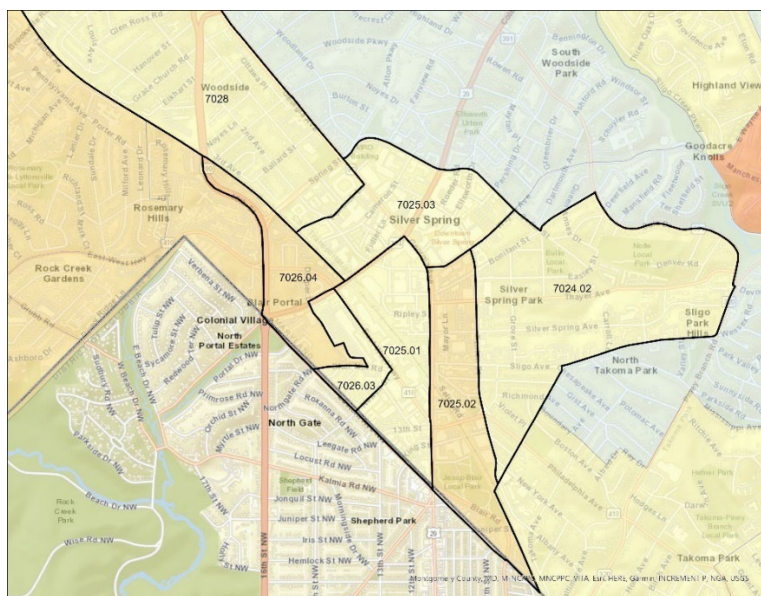
Yellow tracts are in the “Proportionate – Neither Advantaged nor Disadvantaged” category, with CEI scores within ten percentage points of the county (from -1 to 1). These tracts have, on average, similar concentrations of the indicators as the county overall, and as a result are socio-economically representative of the county. For example, tract 7013.15, bounded by Georgia Avenue to the west, Olney-Sandy Spring Road to the south, James Creek to the East, and Owens Road to the north, is within ten percentage points of the county average in all five indicators. This tract is truly representative of Montgomery County along all socio-economic dimensions in the index.

Figure 4: Tract that is representative of Montgomery County on all dimensions of CEI



However, the CEI is a composite score of five indicators, and most proportionate tracts do not line up so neatly. Many yellow tracts are advantaged in some indicators and disadvantaged in others, averaging out to Proportionate status. For example, five out of the seven tracts that include downtown Silver Spring are in the yellow category, and in absolute terms this is in a large part due to their high shares of rental housing units. Tracts 7025.03 and 7026.03 both have rates of renter-occupied units over 50 percentage points higher than the county (high rates of renter-occupied units by themselves are normal and not concerning for downtowns, but the disparity is due to other tracts that have almost no renter-occupied units). But these tracts also have concentrations of people with at least a bachelor’s degree that are all at between 11 and 26 percentage points higher than the county average, moderating their high scores on the rental housing indicator. Their scores vary above and below the county average to various degrees for the other indicators.

Figure 5: Downtown Silver Spring tracts



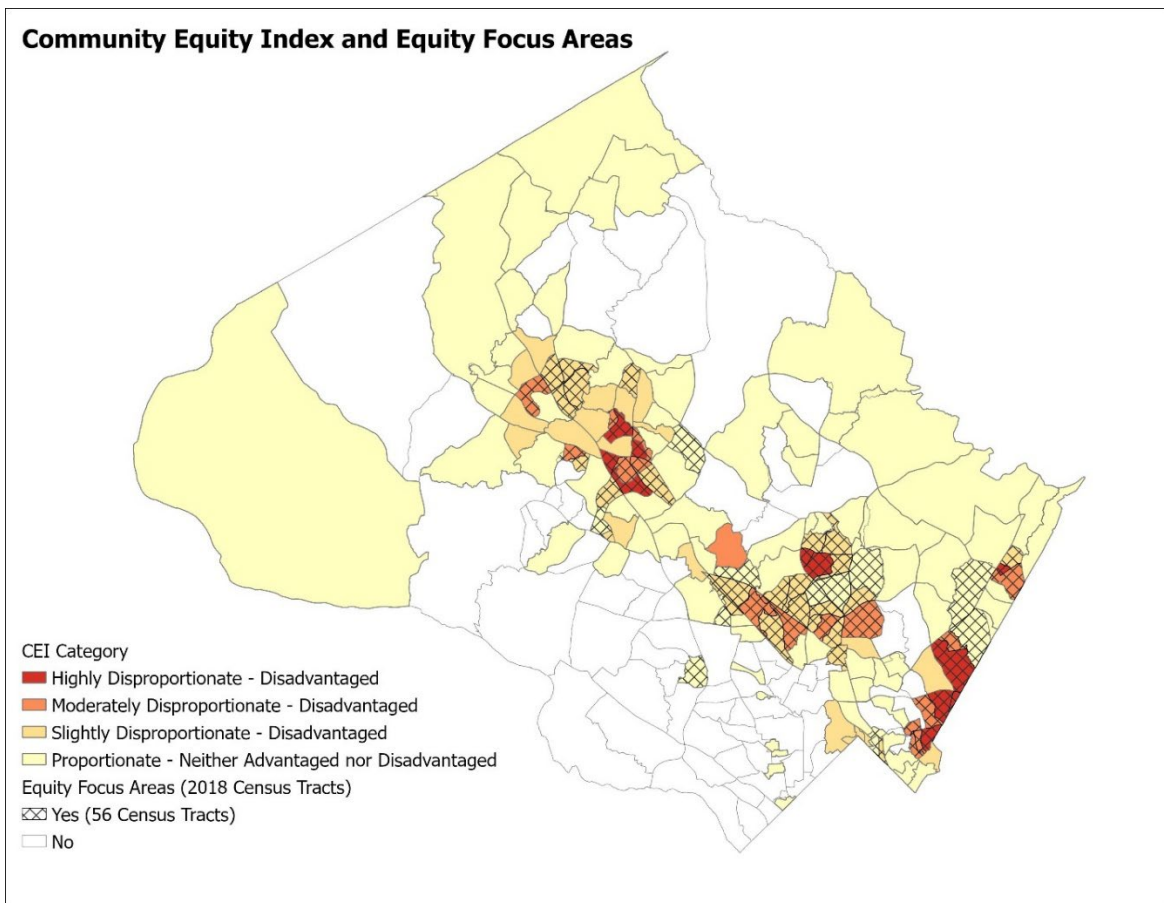
These examples illustrate one way to interpret the CEI. The five indicators are engaged in a push and pull with each other, where deviations from the norm of one variable in one direction can be canceled out by deviations from other variables in other directions. Equitable tracts are not all equitable in the same way, but the CEI provides a composite assessment of proportionality that can lead to further exploration.

DISADVANTAGED TRACTS

Tracts that are light orange to red in color are where disadvantage is disproportionately concentrated. These tracts are not representative of the county, and the residents here are not justly and fairly included.

While the Disproportionate – Disadvantaged tracts cannot be compared directly with Equity Focus Areas (EFAs) because the two analyses were done with different census geographies (EFAs on 2010 census tracts and CEI on 2020 census tracts), there is significant overlap. All red tracts (Highly Disproportionate – Disadvantaged) are contained within EFAs, and all but one of the dark orange tracts (Moderately Disproportionate – Disadvantaged) are also within EFAs. In this respect, the two most disadvantaged CEI categories can be used in a way similar to the EFAs. However, several yellow tracts (Proportionate – Neither Advantaged nor Disadvantaged) are coterminous with EFAs while several light orange tracts (Slightly Disproportionate – Disadvantaged) are not. Depending on the purpose of the analysis, a user can judge whether to include yellow or orange tracts as indicators of severe disadvantage.

Figure 6: Community Equity Index Overlayed with Equity Focus Areas



ADVANTAGED TRACTS

Light to dark blue tracts are also not representative of the county, but for the opposite reason. These tracts have disproportionate concentrations of people with advantage, indicated by high incomes, college degrees, home equity, and ease in communicating in English. These tracts have very low rates of poverty. In traditional opportunity and equity maps, these tracts might be labeled as “high-opportunity.”

MAPS OF DRIVERS

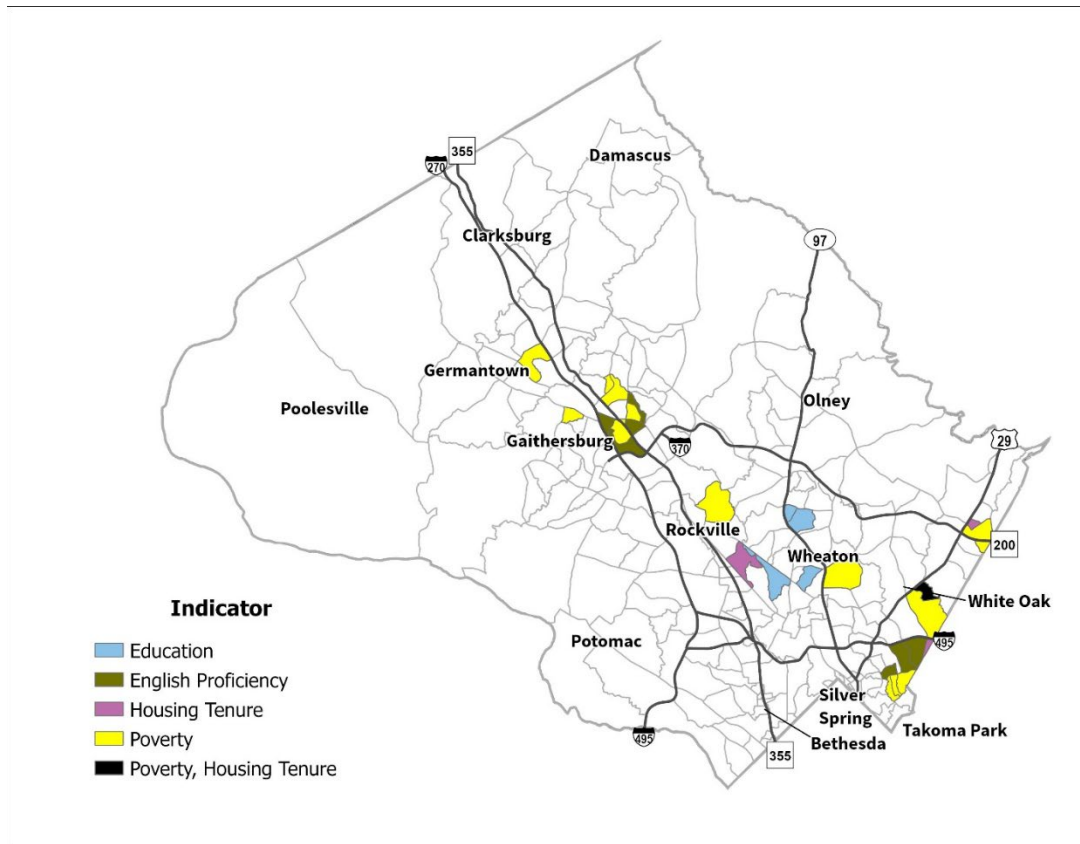
As noted above, each indicator has a different distribution throughout the county, so it contributes differently to the CEI score. The per capita income indicator has the widest range and largest standard deviation, exerting the most influence on the index in general, but other variables exert outsized *relative* influence on tracts in certain CEI categories.

For example, an especially high concentration of people living below 200% of the poverty level is the main driver of the Highly and Moderately Disproportionate – Disadvantaged categorization. Of the 28 tracts in these categories, 14 have the poverty indicator as the primary (or tied for primary) driver. In other words, what really sets these tracts apart from the rest of the county is their concentrated poverty. In these tracts, which comprise half of the most severely disadvantaged tracts in the county, improving the basic material conditions of the residents could make the most strides towards just and fair inclusion. Also, since living around concentrated poverty is one of the most consequential factors in determining life satisfaction and outcomes,²⁵ programs that help residents relocate to more advantaged areas as well as redevelopment initiatives with careful attention to preventing displacement could benefit these tracts.

Similarly, targeted Spanish language outreach and English training could be especially impactful in the seven tracts around Gaithersburg and Long Branch that have especially high concentrations of people who have difficulties speaking English. Most of the residents who fall into this category in these areas are immigrants from Latin America.

²⁵ Galster, G. C. (2011).

Figure 7: Primary Drivers for Highly and Moderately Disproportionate – Disadvantaged tracts



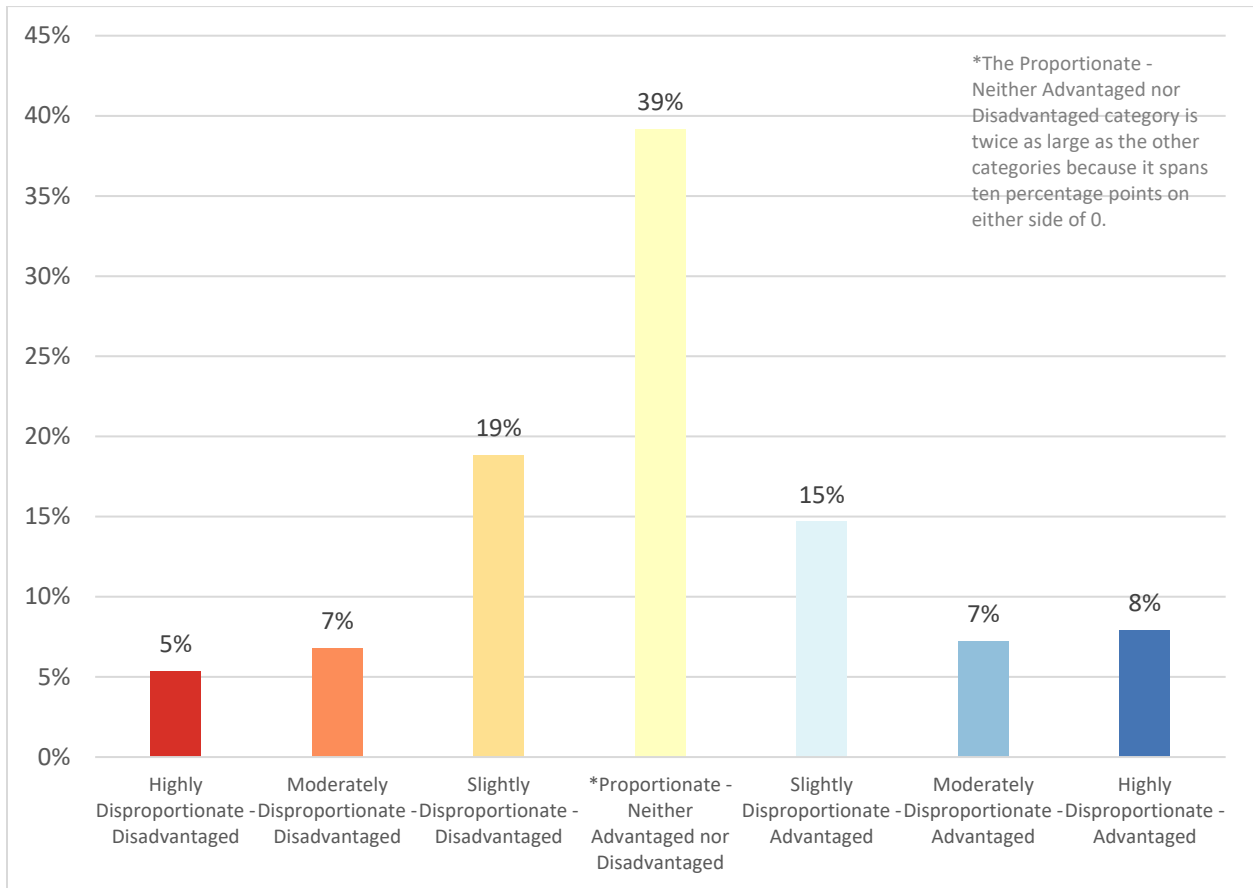
On the other end of the scale, the classification of Highly and Moderately Disproportionate – Advantaged tracts is almost completely driven by their high per capita incomes. Thirty out of 38 tracts in these two categories have per capita income as their primary driver. Even though these tracts have low rates of poverty and high levels of homeownership, English proficiency, and college educated residents, their high level of per capita income is the main contributor to their advantage.

THE CEI AND OTHER EQUITY-RELATED VARIABLES

The CEI can also be used to explore the distribution of other variables related to equity across the county. Population can be used as a basic example. There are clearly tracts with high levels of advantage and disadvantage, but what are the relative sizes of these tracts? Do more people live in one or the other, or perhaps somewhere in the middle?

As it turns out, Montgomery County’s population is spread fairly evenly among CEI categories.

Figure 8: Percent of county population in each CEI category



A plurality of people in the county (39%) live in Proportionate tracts (note that the Proportionate category range of scores is twice as large as the other categories because it spans ten percentage points on either side of 0). Some of the most populous tracts in the county, including several in downtown Silver Spring and downtown Bethesda, are in this category. The category also has more tracts than any other, with 86 out of the county’s 232 total tracts.

The fact that almost 40% of the county’s residents live in yellow tracts and another 34% live in “slightly” disproportionate (light orange or light blue) tracts is a good thing! There are plenty of inclusive (at least statistically) places in the county. But there is still progress to be made. Over a quarter of the county’s population (27%) resides in highly or moderately advantaged or disadvantaged tracts.

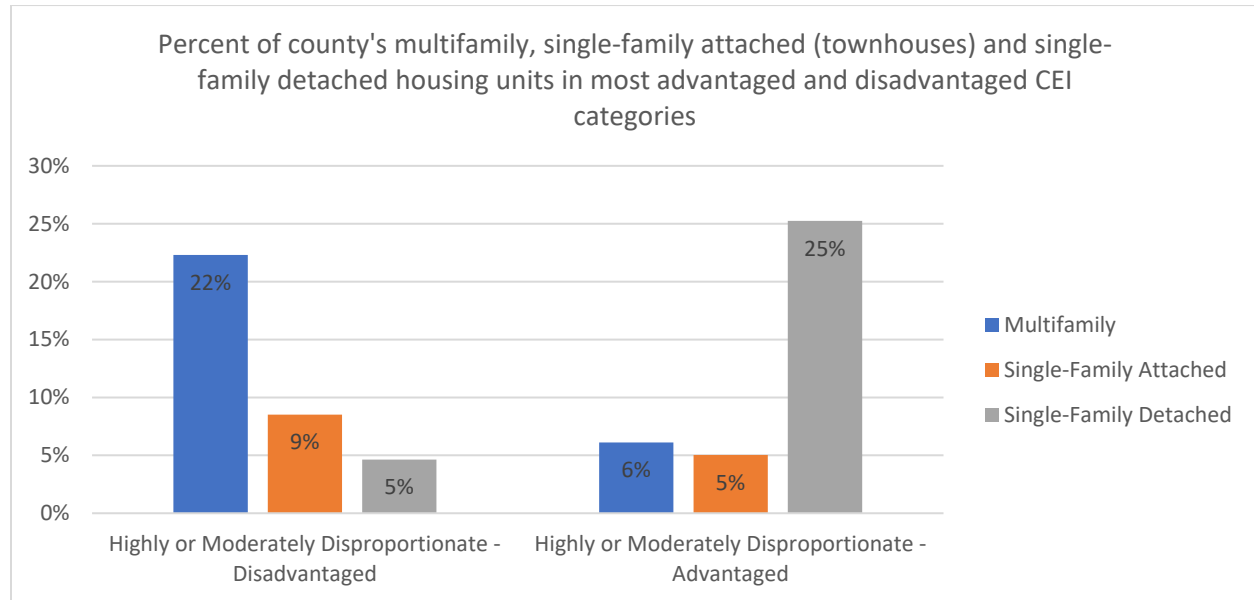
Keeping these proportions in mind—12% of the county’s population in Highly and Moderately Disproportionate – Disadvantaged tracts and 15% of the county’s population in Highly and Moderately Disproportionate – Advantaged tracts—we can assess how other equity-related factors are distributed in the most severely disproportionate tracts.

HOUSING

Housing is unequally distributed across highly advantaged and disadvantaged tracts. The tracts with the two most disadvantaged categorizations (orange and red tracts) contain 22% of the county’s multifamily housing and only 5% of the county’s single family detached housing. In contrast, tracts with the most advantageous categorizations

(the two darkest blue shaded tracts) contain 25% of the county’s single family detached housing and only 6% of the county’s multifamily housing.

Figure 9: Housing type distribution in Highly and Moderately Disproportionate – Advantaged and Disadvantaged tracts



Because most of the county’s multifamily housing is rental housing, and rental occupancy is one of the CEI indicators, it may be over-represented in disadvantaged areas in the first place.

Still, the disparity in housing types based on advantage and disadvantage suggests that adding multifamily housing to advantaged areas may create more spatial equity and inclusion in the county by encouraging spatial mobility of disadvantaged residents throughout the county. More residential options could also help deconcentrate poverty and allow disadvantaged residents to access benefits available in highly advantaged communities, such as high performing schools.

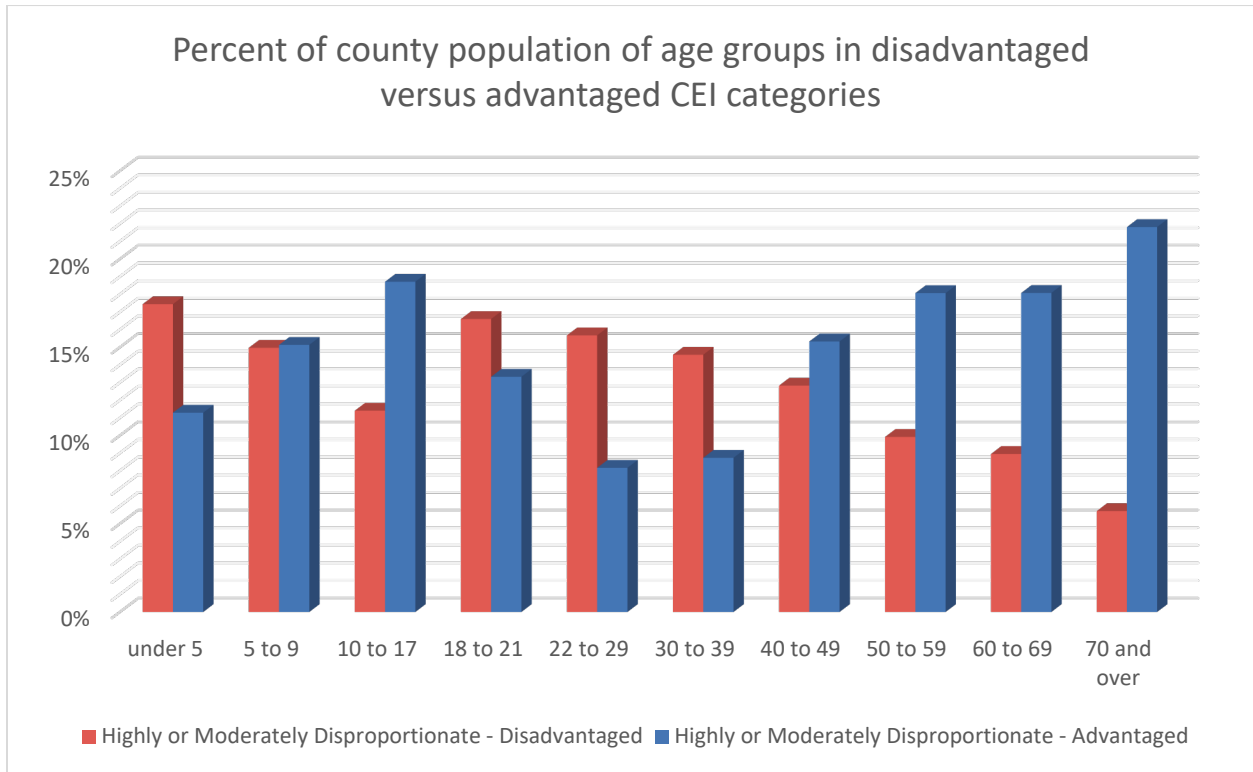
AGE

People of different age groups are also distributed disproportionately in highly advantaged or disadvantaged tracts. In particular, red and orange tracts have many more very young children (under 5) than their overall population would suggest, as well as many more young working-age adults from 22 to 39. In contrast blue tracts have a highly disproportionate share of older adults, with 19% of the county’s 50-plus population compared to only 8% of the county’s 50-plus population in the red and orange tracts. Older age groups are increasingly over-represented in blue tracts and under-represented in red and orange tracts, with the age-70 and over group showing a 22% to 6% disparity.

The causes of and implications for these age-related disparities across the county need more study, but housing likely plays a role in this phenomenon also. The very expensive, predominately single-family housing in the highly and moderately disproportionate – disadvantaged areas is inaccessible to early-career and low-wage workers, and long-time homeowners in highly and moderately disproportionate - advantaged areas may have purchased their

homes several decades ago when homeownership was more attainable. Adding more diverse and affordable housing options in these areas would help reduce this age disparity.

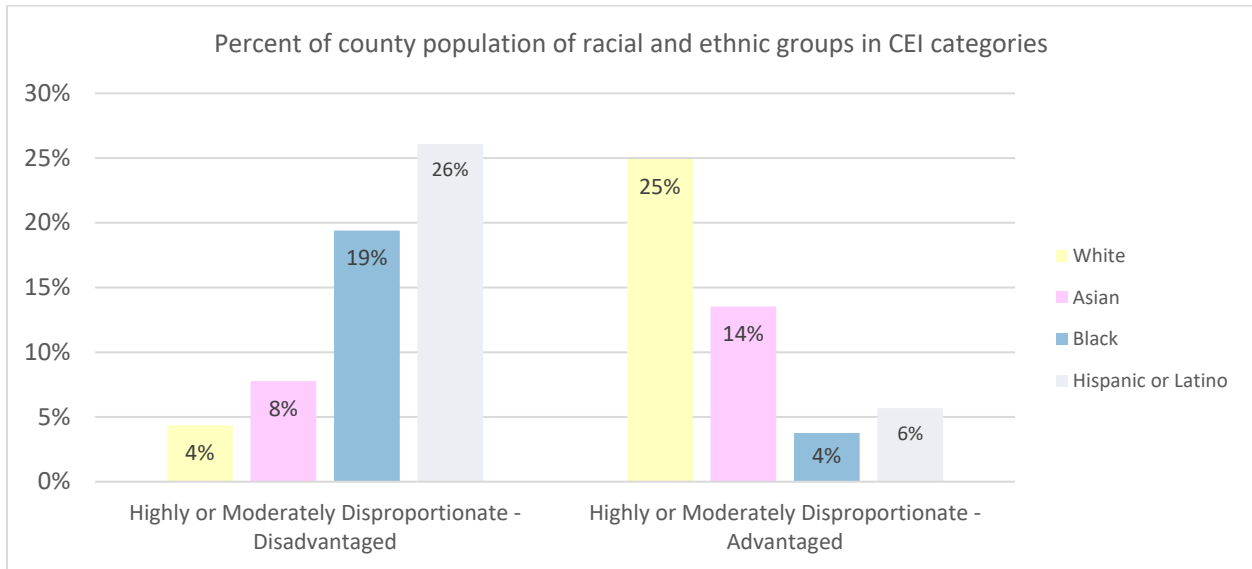
Figure 10: Distribution of age groups Highly and Moderately Disproportionate – Advantaged and Disadvantaged tracts



RACE AND ETHNICITY

One of the most important aspects of equity is race and ethnicity. As explained in section 3, race and ethnicity is not included in the CEI to preserve variable consistency, and Montgomery Planning has separate measures for racial and ethnic predominance that can be overlaid with the CEI. But the CEI can still be used to examine racial and ethnic disparities by determining which types of tracts have higher or lower concentrations of racial and ethnic groups than would be expected based on their populations.

Figure 11: Distribution of racial and ethnic groups in Highly and Moderately Disproportionate – Advantaged and Disadvantaged tracts



Like age groups and housing types, racial and ethnic groups are disparately distributed in advantaged and disadvantaged areas. Hispanic and Latino residents are the most overrepresented group in orange and red tracts. Twenty-six percent of the Hispanic and Latino population lives in these tracts that contain only 12% of the county population. At the other end of the CEI, 25% of the county’s white population lives in the blue and dark blue tracts, where 15% of the total population lives. Black residents are not quite as over-represented in red and orange tracts as are Hispanic or Latino residents, with 19% of their population living there, but they are more under-represented in the most advantaged tracts with only 4% of the county’s Black population in these highly advantaged tracts.

Asian residents are more evenly distributed than people in the other four major racial and ethnic groups, but they remain under-represented in red and orange tracts.

While race and ethnicity are not included in the CEI, this analysis shows that advantage and disadvantage is still strongly related to race and ethnicity, and that residential segregation remains one of the prime contributors to these disparities.

6. CONCLUSION

The Community Equity Index assesses how the county’s socio-economic diversity is distributed—which neighborhoods have concentrated advantage or disadvantage, and which neighborhoods are representative of the county’s diversity. This tool will allow Montgomery Planning, our partner agencies, and the public to understand socio-economic characteristics across the county more fully and work towards solutions to promote just and fair inclusion. These solutions could include providing greater residential mobility and housing options for disadvantaged people, and also resources and services that allow them to increase their socio-economic status where they currently live. While the CEI offers a novel approach to analyzing equity in the county, it is only a starting point. Equity is a complex topic that cannot be reduced to a single index. This tool must be used holistically with other tools, such as community outreach, land use analysis, and research into local history to fully assess context and develop recommendations to advance equity in neighborhoods across the county.

APPENDIXES

APPENDIX A – DESCRIPTIVE LIST OF OTHER EQUITY AND OPPORTUNITY INDEXES, TOOLS, AND DASHBOARDS CONSULTED

Equity Index, Dashboard, or Tool	Description – Purpose, Variables, Geographies	Links
<p>Protected Classes Model</p> <p>(Atlanta Regional Commission)</p>	<p>Supports equitable treatment of the populations identified by Title VI of the Civil Rights Act and the Executive Order on Environmental Justice from 1994. The populations are Older Adults, Youth, Women, Racial Minorities, Ethnic Minorities, Foreign born, those with Limited English Proficiency, people with Disabilities, and people with Low-Incomes. Data are for census Tracts.</p>	<p>Website and Methodology</p>
<p>Environmental Justice Model</p> <p>(Atlanta Regional Commission)</p>	<p>Guides investment to improve highly disproportionate human health and environmental outcomes.</p> <p>Focus is on the concentration of Racial Minorities, Ethnic Minorities, and Low-Income populations because they are the strongest indicators of inequality. Data are at the census tract level.</p>	<p>Website and Methodology</p>
<p>Equity Priority Communities</p> <p>(Bay Area Metropolitan Transportation Commission)</p>	<p>Informs investment decisions, engagement with the community, and planning to reduce disparities in transportation, housing, and other community services.</p> <p>This model is based on concentrations of people with the characteristics: People of Color, Low-Income (<200% of Federal Poverty Line), Limited English Proficiency, Zero-Vehicle Households, Seniors 75 years and older, People with Disabilities, Single Parent Families, and Rent-Burdened. A tract is an Equity Priority Community if it exceeds threshold values for Low-income and People of Color or exceeds the threshold for Low-income and two other variables, not including People of Color. Measures census tracts.</p>	<p>Website</p>
<p>Indicators of Potential Disadvantage</p> <p>(The Delaware Valley Regional Planning Commission)</p>	<p>To comply with regulation for Metropolitan Planning Organizations that must consider equity in transportation decisions.</p> <p>Concentrations of Older Adults, Youth, Women, Racial Minorities, Ethnic Minorities, Foreign born, those with Limited English Proficiency, people with Disabilities, and people with Low-Incomes are mapped. census tracts are scored for how many standard deviations outside of the regional average they are for each indicator. These are combined for a composite score.</p>	<p>Website</p>

Equity Index, Dashboard, or Tool	Description – Purpose, Variables, Geographies	Links
<p>Equity Matrix</p> <p>(Portland Bureau of Transportation)</p>	<p>To change systems that impact marginalized groups by making them more equitable.</p> <p>Concentration of racial or ethnic groups and those at various income levels are the two factors ranked from 1-5, added together, and then compared across census tracts. The population of people with limited English proficiency is measured and mapped but not incorporated into the composite score due to unreliable data.</p>	<p>Website</p>
<p>Racial and Social Equity Composite Index</p> <p>(City of Seattle)</p>	<p>Helping priority populations by mapping where they are.</p> <p>Factors (census tracts are assigned a score based on their rank):</p> <ul style="list-style-type: none"> • Race, English language learners, and Origins: people of color, those with limited English, and foreign born • Socio-economic: Income below 200% of the poverty level, and Education that is less than a Bachelor’s degree • Health: those who have no Leisure-time Physical Activity, Diagnosed Diabetes, Obesity, Poor Mental health, Asthma, Low Life Expectancy at birth, or a Disability. <p>Prevalence of people of color, those with limited English, and foreign born were weighted variables. The others are equally weighted within their category.</p>	<p>Website</p>
<p>Puget Sound Regional Council Opportunity Map</p>	<p>Combines measures of five key elements of neighborhood opportunity and positive life outcomes: education, economic health, housing and neighborhood quality, mobility and transportation, and health and environment. The level of opportunity score (very low, low, moderate, high, very high) is determined by sorting all census tracts into quintiles based on their index scores. Areas of opportunity that experience greater proportions of growth may experience an increased risk of displacement.</p>	<p>Website</p>

Equity Index, Dashboard, or Tool	Description – Purpose, Variables, Geographies	Links
<p>Equity Dashboard</p> <p>(TransitCenter Foundation)</p>	<p>Tracks how public transit systems serve riders and how that changes over time.</p> <p>TransitCenter Equity combines travel times (fare-constrained transit, unconstrained transit, and car) and the location of these destinations to estimate how many destinations can be reached in a certain amount of time, e.g. jobs reachable within 30 minutes. It also estimates travel time to reach a certain number of opportunities, e.g. travel time in minutes to one hospital or to three hospitals, better understanding people’s need for options, where the closest hospital may not match someone’s need financially or type of care provided. These types of measures are used for healthcare facilities, grocery stores and supermarkets, and higher education. Data are measured for census block groups.</p>	<p>Website</p>
<p>Equity Indicators Project</p> <p>(City of St. Louis)</p>	<p>Sheds light on inequitable areas. The tool uses 72 indicators in the categories: Child Well-being, Educational Attainment, Education Quality, Financial Empowerment, Neighborhoods, Health and Safety, Policing, Court Reform, and Civic Engagement. The indicators are reported only for the City of St. Louis as a whole.</p>	<p>Website</p>
<p>A Great Divide: L.A. Equity Index</p> <p>(City of Los Angeles)</p>	<p>Informs efforts to bridge the gap between advantaged and disadvantaged neighborhoods.</p> <p>Indicators are scored and added together for a composite score between 1-10. The indicators are: Rent-burdened population, Air Quality, those with High School and College degrees, Early Education Achievement, and Access to Food Resources. Data measured for census tracts.</p>	<p>Website</p>

Equity Index, Dashboard, or Tool	Description – Purpose, Variables, Geographies	Links
<p>California School Dashboard</p> <p>(State of California)</p>	<p>Shows how schools and local educational agencies are performing to improve learning, testing, and equity.</p> <p>Several indicators are compared with other schools or education centers in the state, where the data are available. These are: academic achievement in English Language Arts, Mathematics, English Learner Progress, progress towards College/Career, Chronic Absenteeism, Graduation rate, and Suspensions.</p> <p>Local indicators are self-reported by the education center and are judged against standards set by the State Board of Education. Listed below these indicators are <i>Standard Met, Not Met, or Not Met for Two Years</i>. These are (in order of importance): Basic Conditions of Learning, Implementation of State Academic Standards, Parent and Family Engagement, School Climate, Access to a Broad Course of Study, Outcomes in a Broad Course of Study, Coordination of Services for Expelled Youth, and Coordination of Services for Foster Youth.</p>	<p>Website</p>
<p>Dallas Equity Indicators</p> <p>(City of Dallas)</p>	<p>The purpose of this tool is to focus public policy efforts on improving the lives of disadvantaged residents and how their outcomes change over time.</p> <p>The 60 indicators are in the categories of Business Development, Income, Employment, Poverty, Early Education., Elementary and Middle School Edu., High School Edu., Edu. in General Population, Access to Housing, Housing Affordability and Service, Neighborhoods, Transportation, Civic Life, Incarceration, Law Enforcement, Victimization, Access to Healthcare, Population Health, Maternal and Child Health, and Health Risk Factors. These are measured mostly for the city overall and sometimes at the neighborhood level.</p>	<p>Website</p>

Equity Index, Dashboard, or Tool	Description – Purpose, Variables, Geographies	Links
<p>Oakland Equity Indicators</p> <p>(City of Oakland)</p>	<p>The City created a baseline measurement of 72 equity indicators in the following categories, so it can compare outcomes of groups and areas over time.</p> <ul style="list-style-type: none"> ● Economy: Business Development, Employment, Financial Health, Job Quality ● Education: Enrollment, Achievement, Program Access, Teachers ● Public Health: Access to Preventive Care, Child Health, Mortality, Physical and Mental Health ● Housing: Affordability, Displacement, Essential Services, Housing Quality ● Public Safety: Incarceration, Law Enforcement, Staffing, Community Stressors ● Neighborhood and Civic Life: Built Environment, Civic Engagement, Environment Health, Transportation and Infrastructure <p>Nearly all indicators were measured citywide, but one was by Police Area, and two were by City Council District.</p>	<p>Website</p>
<p>Spatial Equity Data Tool</p> <p>(Urban Institute)</p>	<p>Allows users (often in governments) to contextualize their own datasets with mapped Census data, which provides information for equity considerations in a broader geographic area. This way, a dataset, like internet access, can be layered with race, income, and other information for various geographies. This also prevents those who complain more to local governments from directing resources to their communities first and exclusive of others.</p> <p>The variables for comparison are any in the American Community Survey. Offers geographic disparity score for every state, county, and tract.</p>	<p>Website</p>

Equity Index, Dashboard, or Tool	Description – Purpose, Variables, Geographies	Links
<p>Health Opportunity Index</p> <p>(Virginia Department of Health)</p>	<p>Helps communities understand and improve disparities in the Social Determinants of Health.</p> <p>Thirty variables are organized into the following broad categories (Profiles) and Indices:</p> <ul style="list-style-type: none"> • Community Environmental Profile – Workability Index: Density, Diversity (Land Use), Design (Connectivity), Distance to Transit; similarly for Population Churning Index, and Population-Weighted Density • Consumer Opportunity Profile – Affordability Index, Education Index, Food Accessibility Index, and Material Deprivation Index • Economic Opportunity Profile – Employment Access Index, Income Inequality Index, and Job Participation Index • Wellness Disparity Profile – Access to Care Index and Segregation Index <p>These variables are scored and combined for Counties, Legislative Districts, and the Virginia Health Districts for comparison.</p>	<p>Website</p>
<p>Equity Maps</p> <p>(City of San Antonio)</p>	<p>Created so that any government stakeholder can make data-informed decisions and judgements.</p> <p>A score (1-5) was assigned for concentration of the following populations: People of Color, Income, those with Less than a High School Education, and those who Speak English less than “Very Well.”</p> <p>Data are organized by census tract.</p>	<p>Website</p>

Equity Index, Dashboard, or Tool	Description – Purpose, Variables, Geographies	Links
<p>Index of Relative Socio-economic Advantage and Disadvantage</p> <p>(Australian Bureau of Statistics)</p>	<p>Inform data-driven decisions for funding and improved services, new businesses, and research of the connection between health and education outcomes due to the socio-economic conditions of an area.</p> <p>Variables are: Percent people with stated annual household income between \$1 and \$25,999, Percent Families with children under 15 years of age who live with jobless parents, Percent Occupied private dwellings with no internet connection, Percent People aged 15 years and over whose highest level of education is Year 11 or lower, Percent People (in the labor force) unemployed, Percent Employed people classified as 'laborers', Percent Occupied private dwellings paying rent less than \$215 per week, Percent One parent families with dependent offspring only, Percent People aged under 70 who have a long-term health condition or disability and need assistance with core activities, Percent People aged 15 and over who are separated or divorced, Percent Employed people classified as Machinery Operators and Drivers, Percent Employed people classified as Low Skill Community and Personal Service Workers, Percent Occupied private dwellings with no cars, Percent Occupied private dwellings requiring one or more extra bedrooms (based on Canadian National Occupancy Standard), Percent People aged 15 years and over who have no educational attainment, Percent People who do not speak English well</p> <p>The geography is a “Local Government Area,” a Bureau of Statistics designation.</p>	<p>Website</p>

Equity Index, Dashboard, or Tool	Description – Purpose, Variables, Geographies	Links
<p>Data Dashboard</p> <p>(ImpactTulsa)</p>	<p>Key indicators measure and assess the events that impact children’s likelihood to thrive.</p> <ul style="list-style-type: none"> • Student Level Domain – Gender, Race/Ethnicity, English language learners, Student Mobility, Attended Pre-K, Economic Disadvantage, Homeless, Special Alert (Medical), EBL, Suspensions • Neighborhood Health – Built Environment Score, Life Expectancy, Mental Health/Substance Abuse Visits, Emergency Room visits, Infant Mortality rate, Teen Pregnancy, Low Birth Weight • Neighborhood Socio-economic Status – Percent of Population with Less than a High School Education, Percent below 100% of Federal Poverty Line (FPL), Percent below 200% FPL, Unemployment rate, Receipt of SNAP, Housing Cost Burden, Housing Quality and Condition • Neighborhood Safety – Violent Crime (aggravated assault, rape, robbery), Narcotics crime, Gun-related mortality, Arrests • Neighborhood Custodianship – Nuisance/311 complaints, Negative Land Use, Built Environment Nuisance • Neighborhood Access – Walkscore, Transit, Grocery Stores, Vehicle Access, Industrial/Oil Land Site, Highway, Parks, Trails, and Schools <p>These variables are combined into a composite score and reported at census tract level.</p>	<p>Website</p>
<p>Equity Dashboard</p> <p>(Portland, OR regional government, called Metro)</p>	<p>Make tracking efforts towards racial equity in government employees more transparent.</p> <p>The factors below each have a breakdown of Race, Gender, and sometimes Age. The report covers the population overall and individually for departments:</p> <ul style="list-style-type: none"> • Metro workforce, Age, Manager and non-manager, Regular and Temporary Status Employees; Full-time and Part-time, based on Payscale, New hires, Years at Metro, Promotions and job reclassifications <p>The populations in these data are government employees and not organized by geographic area.</p>	<p>Website</p>

Equity Index, Dashboard, or Tool	Description – Purpose, Variables, Geographies	Links
<p>National Equity Atlas</p> <p>(PolicyLink and USC Equity Research Institute)</p>	<p>This dashboard displays data for a wide variety of indicators and throughout the country. The main categories are Demographics, Economic Vitality, Readiness, Connectedness, and Economic Benefits.</p> <p>The information is displayed for the nation, states, regions, cities, and counties.</p>	<p>Website</p>
<p>Economic Equity Dashboard</p> <p>(City of Detroit)</p>	<p>Displays a variety of indicators and allows comparisons with the Detroit metro area, Michigan, and the US; how the indicator has changed over time; and where possible, Detroit is compared to top 100 US cities for labor force participation or Unemployment. Other comparisons are made as relevant to the topic.</p> <p>The categories of indicators are:</p> <ul style="list-style-type: none"> • In Context: Regional Economy, Income and Wealth Building, Access to Quality Employment, Business and Entrepreneurship, Education, Health, and Neighborhoods and Housing <p>These indicators are listed for Detroit, Metro Detroit, Michigan, and the US.</p>	<p>Website</p>

APPENDIX B – RELIABILITY OF INDICATORS AND OTHER POTENTIAL INDICATORS

Statistical reliability of indicators is indicated by the coefficient of variation, which is calculated according to the formula

$$CV = \left(\frac{MOE}{1.645}\right)/EST$$

Where

CV = Coefficient of Variation

MOE = Margin of Error of Estimate

EST = Estimate

See ACS General Handbook Section 7, Understanding Error and Determining Statistical Significance

Thresholds for classifying reliability as high, medium, and low are from ESRI: <https://doc.arcgis.com/en/esri-demographics/latest/regional-data/acs.htm>

RELIABILITY OF CEI INDICATORS

	RELIABILITY	COUNT
Per capita income	high	204
	medium	28
	low	0
People living at or above 200% of the federal poverty level	high	184
	medium	48
	low	0
People with bachelor's degree or higher	high	155
	medium	77
	low	0
People who speak English less than very well	high	1
	medium	206
	low	25
Renter occupied units	high	54
	medium	152
	low	26

RELIABILITY OF SELECT INDICATORS DISAGGREGATED BY RACE AND ETHNICITY

	RELIABILITY	COUNT
Housing tenure (rent vs. own) for Black or African American	high	2
	medium	200
	low	262
Median household income - Black or African American	high	24
	medium	105
	low	28
	insufficient population	75

RELIABILITY OF SELECT TRANSPORTATION-RELATED INDICATORS

	RELIABILITY	COUNT
Bus ridership	high	1
	medium	41
	low	190
No vehicles available	high	0
	medium	32
	low	200

APPENDIX C – INDICATOR STANDARD DEVIATIONS

INDICATOR	CEI Score Standard Deviation	Indicator Value Standard Deviation
Per capita income	4.92	\$29,200
Renter occupied units	2.71	27.1%
People with bachelor's degree or higher	1.99	19.9%
People living at or above 200% of the federal poverty level	1.23	12.3%
People who speak English less than very well	0.94	9.4%

APPENDIX D – CORRELATION MATRIX FOR POTENTIAL CEI INDICATORS

