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MEASUREMENT OF INEQUALITY-ADJUSTED HUMAN DEVELOPMENT AT THE SUB-NATIONAL LEVEL FOR THE UNITED STATES IN 2015 AND 2020

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The search for an alternative indicator for the GDP led to the spread of composite indexes in recent decades. Among the indicators that demonstrated qualities for reliable measurement of the population's well-being is the Human Development Index (HDI) by the United Nations Development Program (UNDP) in 1990. One of the HDI's shortcomings was not considering inequality's differences in its three metrics (health, education, and income). The UNDP's inequality-adjusted HDI (IHDI) solved this problem, becoming an indicator of the actual status of the population's well-being. The program publishes the IHDI at the country level; however, there are no estimates at the sub-national level for the United States. This paper estimates the IHDI at the state and county levels for 2015 and 2020. The estimates contribute to the empirical evidence since no such calculations exist at this level of disaggregation. Our work confirms regional disparities when the HDI is adjusted for inequality.

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JEL Classification: O15, O51, C80, I15, I25, I31, J16

1. INTRODUCTION

In 2010, the United Nations Development Program (UNDP) introduced several indexes to adjust the Human Development Index (HDI). This was not the first attempt to correct the HDI, which has received criticism as an indicator of well-being since its inception in 1990 (Sagar and Adil Najam, 1998; Nathan et al., 2008; Klugman et al., 2011; Ravallion, 2011; Anand, 2018). Before 2010, there were attempts to adjust the HDI from different approaches incorporating inequality within and across countries (Hicks, 1997; Mazumdar, 2003; Stanton, 2006; Grimm et al., 2010). Since the HDI

measures national averages, it masks the distribution across the population for each dimension. Inequality causes the value of the index to adjust downward. Thus, the UNDP introduced the Inequality-adjusted Human Development Index (IHDI) in 2010 to correct this gap. Since then, the HDI has been regarded as an index of potential human development compared to the IHDI, which measures actual human development. The difference between the two indexes reflects the loss of human development potential due to the unequal distribution between and within each of the HDI's three dimensions.

Two organizations besides the UNDP calculate the HDI. The Global Data Lab from the Institute for Management Research at Radboud University estimates the HDI and sub-national indexes for 161 countries and 1625 regions from 1990-2019, following the UNDP methodology (Smits and Permanyer, 2019). The Measure of America (MOA) of the Social Science Research Council calculates the American Human Development Index (AHDI) since 2005 at the state and county level, following a similar methodology to that of the UNDP (Lewis and Gluskin, 2018). Although the ranking at the international level has opened a debate about what economic progress means, a measurement of the index at the domestic level is equally important since it reveals regional disparities that aggregate measures like GDP miss.

Estimates for HDI exist at the subnational level for the United States. Still, there are no measurements of the IHDI or the Gender Development Index (GDI) at the state and county levels. Moreover, the way inequality affects HDI in the U.S. is not homogenous. Inequality between and within the three dimensions varies significantly by region. These facts led us to measure the IHDI at the county levels for the United States for 2015 and 2020 to fill the gap in empirical evidence. This work contributes to estimating well-being indicators at a level of disaggregation that has not been calculated before. This statistical exercise provides additional information for decision-makers at the state and county levels that have mainly relied on the GDP per capita to assess the state of the well-being of their communities. Another benefit is to have indicators included in the Sustainable Development Goals that will help them align their efforts in achieving these goals by 2030.

Regarding the results for 2020, it is significant to add how COVID-19 disrupted the expected trends in each of the metrics. So, comparing 2015 and 2020, we will see some significant declines due to the pandemic, particularly in the health index. Our life expectancy estimations confirmed what the National Center for Health Statistics recently published about the decrease for most states (Arias, 2022).

The results show significant regional differences and confirm the need for policies to improve income conditions and health and education services. This empirical exercise allows us to identify the highest demands in different regions and recognize where economic growth has not translated into better well-being for the population within the United States. The following sections show that these differences become even more problematic when the Gender Development Index (GDI) is measured. The second considers the previous empirical literature on HDI and IHDI as the background for this work. The third section summarizes the methods according to the UNDP, with some necessary modifications, data, and sources. The fourth section shows the results at the

state and county level for the U.S., and we conclude with a section of final remarks, thoughts for further research, and policy recommendations.

2. EMPIRICAL LITERATURE

The need to adjust or replace GDP per capita as the primary indicator of population well-being has been extensively documented (Boarini et al., 2006; Brinkman and Brinkman, 2009; Stiglitz et al., 2009; Van den Bergh, 2009; Stanton, 2007; Nayak, 2013; Anand, 2018). The GDP has been questioned since it became the variable that defines a country's economic performance, beginning with Kuznets' seminal work on national income accounts (Kuznets, 1934).

Some aspects of the discussion about the GDP as the primary indicator of well-being are worth mentioning. First, GDP was conceived to quantify a country's economic performance by measuring the final value of the domestic production period. However, the GDP has been used to signify more than it should (Costanza et al., 2009; Shrotryia and Singh, 2020). Problems with the GDP include excluding activities that could influence economic performance but do not have a market value, such as environmental damage or household work. Moreover, there is an additional challenge for the GDP with the increase of the digital economy in recent years (Hulten and Nakamura, 2019; Moulton, 2019). In sum, adjustments or extensions of the GDP may resolve these gaps in the measurement (Hamilton, 2000; Jones and Klenow, 2016; Dynan and Sheinen, 2018; Lianos and Pseiridis, 2021).

Second, when the GDP is measured relative to the population, we have GDP per capita, which has been interpreted as an indicator of the population's well-being and has served to compare economic performance between countries. There has been a sustained call to replace the GDP per capita to measure the population's well-being (Brinkman and Brinkman, 2011). Third, the empirical literature review reveals that GDP per capita cannot function as a well-being indicator. Still, the consensus is to keep the GDP as a production variable that shows a country or region's economic performance since alternative indicators have shown a high correlation with GDP per capita, which leads to the conclusion that there was no need to replace the GDP (Cahill, 2005; Szigeti et al., 2014; Felice, 2016).

The global financial crisis of 2008 underscored the need for complementary indicators to GDP, which led to the HDI -and since 2010, the IHDI- becoming more instrumental in analyzing economic development. However, the HDI and IHDI were preceded and followed by another series of composite indices that sought to extend, complement, or replace GDP per capita. For instance, advocates for adjusting the GDP sought the inclusion of variables to account for environmental costs, such as the Index of Sustainable Economic Welfare (ISEW) (Daly and Cobb, 1989), later rebranded as the Genuine Progress Indicator (GPI) in 1995 (Cobb et al., 1995; Lawn, 2003). Other

indices in this category are the Adjusted Net Saving (World Bank, 1997), the Well-Being Index (HWI) in 2001 (Prescott-Allen, 2001), and the Index to Debt to the Future (D.F.) in 2021 (Lianos and Pseiridis, 2021). Multidimensional indices with a focus on relating income and social indicators that can be considered counterparts to the GDP include the Quality-of-Life Indicator (QLI) in 2015 (EUROSTAT, 2015), the Happy Planet Index (HPI) in 2006 (Marks et al., 2006), the OECD Better Life Index (BTI) in 2011 (Mizobuchi, 2014). Finally, the Human Life Indicator (HLI), created in 2019, seeks to replace the GDP to measure a population's well-being (Ghishlandi et al., 2019). The list of alternative indices is long, and the literature on alternative indicators has been well-examined (Parris and Kates, 2003; Boarini et al., 2006; Costanza et al., 2009; Fleurbaey, 2009; Fasolo et al., 2011; Bleys, 2012; Phelan et al., 2012). The search for a comprehensive and straightforward economic and social welfare measure continues, and the GDP remains the common yardstick for economic performance.

The HDI and IHDI belong to the group of alternative indicators to GDP that aims to quantify the well-being of a population. The HDI was conceived based on Amartya Sen's capabilities approach (Sen, 1980), while Ul Haq put the theory to practice in the UNDP report (Ul Haq, 2003). The framework of capabilities as a source of human development suggests that people deserve to live in a society where the conditions for a long healthy life exist, have access to knowledge through education, and have a decent living standard. Therefore, the creation of capabilities entails expanding people's rights to access the goods and services required to satisfy their needs and improve their well-being. The capabilities framework is translated into the HDI as an indicator of human development potential, reflecting the individual's freedom of choice. The capabilities framework is translated into the HDI as an indicator of human development potential, reflecting the individual's freedom of choice (UNDP, 1990; Ul Haq, 2003).

As previously mentioned, the HDI underwent several modifications to respond to criticisms (Sagar and Adil Najam, 1998; Ranis et al., 2006; Anand, 2018; Burchardt and Hick, 2018). The most significant changes occurred in 2010 with the UNDP report (UNDP, 2010) when the Inequality-adjusted HDI (IHDI) was added. That same report also added the Gender Development Index (GDI) and Gender Inequality Index (GII), as well as an indicator of poverty, the global Multidimensional Poverty Index (MPI). One of the continuing criticisms of HDI was its lack of attention to environmental variables. In 2020, the UNDP report with the experimental Planetary pressures-adjusted Human Development Index (PHDI) (UNDP, 2020a) filled this gap.

As with the GDP, there is extensive empirical evidence about improving the HDI (Rondón and Berrios, 2010; Nguefack et al., 2011; Bilbao-Ubillos, 2013; Salas-Bourgoin, 2014; Lind, 2019; Migala-Warchol, 2019; Resce, 2021). Much of this literature calls for weight changes, adding variables, modifying goalposts, or even replacing the HDI (Prakash, 2019). Other studies highlight the significance of adjusting human development for inequality even after the UNDP publication in 2010 (Castells-Quintana et al., 2019; Prakash and Garg, 2019; Parracho- Sant'Anna et al., 2018; Martínez, 2012). The last UNDP report of 2022 does not provide any more changes or additional indices

for human development; however, the report focuses on the uncertainties that COVID-19 brought in 2020 and the future of human development goals (UNDP, 2022).

The IHDI addresses much of this criticism and is worth discussing here. The IHDI adjusts the HDI for inequality in the distribution of each dimension. It is based on a distribution-sensitive class of composite indices and is equal to the geometric mean of the three inequality-adjusted indices from the HDI (UNDP, 2020b). Alkire and Foster (2010) explain the relationship between HDI and IHDI. They show that the HDI is an index of potential human development while the IHDI measures actual human development. Generally, we prefer the IHDI since it is a current assessment of human development instead of a measure of potential. The IHDI also allows a more disaggregated analysis by showing which dimensions of inequality are most harmful. Likewise, the IHDI is most useful when measured at subnational levels. At the international level, it enables comparison, but at the local or state levels, it allows the actual application of policy measures to reduce inequalities in one or more dimensions. Despite this, no organization publishes the IHDI at the state or county level for the United States. For the first time, this paper presents the IHDI for all states and counties in the United States. The results section highlights areas that need more attention, and our work confirms how inequality makes it even more difficult to achieve social and economic progress in traditionally underserved regions of the country (Suryanarayana et al., 2016; Permanyer and Smits; 2020).

We maintain that critical information is lost by relying on GDP per capita as a proxy for social welfare at the subnational level. In the case of the U.S., we argue that measuring well-being at the subnational level is critical because state and county leaders tend to have more influence over many facets of the immediate well-being of their residents than the federal government. As we mentioned, we follow the UNDP methodology; however, we made adjustments for a developed economy like the United States. The following section expands on the explanation.

3. METHOD AND DATA

We follow the UNDP's Technical notes to the 2020 Human Development Report (UNDP 2020b) precisely, except where noted, to compute the HDI, IHDI, GDI, and GII for states and counties in the United States in 2015 and 2020. We rely on the UNDP's Training Material for Producing National Human Development Reports (UNDP, 2015) to adjust some of the "aspirational goals" to make them more appropriate for subnational populations. Besides these few necessary adjustments, we make as few adjustments to our methodology as possible in the hopes that our estimates can be easily replicated and compared with the results published by the UNDP for countries. The choice to minimize changes in our methodology instead of creating potentially more precise measures of well-being is a conscious one.

Any difference between our methods and the recommended methodology stems

from a lack of available data. These differences are noted in detail below. For instance, for the measurement of the IHDI, the UNDP recommends using microdata to compute inequality measures. However, the smallest available public-use microdata area (PUMA) in the United States has a minimum of 100,000 residents, so county-level analysis with microdata is not possible. (U.S. Census microdata at levels smaller than a PUMA are kept private for 70 years after collection.) We suppress the results for counties with fewer than 2000 residents to limit spurious observations.

3.1. Education Indicator

We use the American Community Survey's five-year estimates for "Educational Attainment for the Population 25 Years and over" to estimate average years of schooling (AYS) and "School enrolment by type of school by age for the population 3 years and over" to estimate expected years of schooling (EYS). The use of five-year estimates will likely understate the impacts of the COVID-19 pandemic on educational outcomes in 2020. However, since the Census Bureau did not release standard ACS 1-year estimates for 2020 (U.S. Census Bureau, 2021), we consider this the best possible alternative. The education index is calculated as the geometric mean of the standardized indices created for EYS and AYS.

We follow the instructions in the UNDP's technical note but adjust the upper goalpost for each metric to reflect the more extensive range of educational outcomes observed in U.S. counties. The UNDP uses an upper goalpost of 15 years for AYS and 18 years for EYS. We extend the upper goalposts to 17 and 20 years for average and expected years of schooling, respectively. For the IHDI, the lack of microdata requires us to measure inequality between age groups instead of individuals. Having fewer groups to compare makes it harder to quantify inequality, but we consider this a suitable estimate in the absence of microdata.

3.2. Health Indicator (Life expectancy at birth)

We adopt the same goalposts used by the UNDP (the minimum is 20 years, and the maximum is 85 years). We derive life expectancy from crude death rates (the number of deaths occurring during the year per 1,000 population, estimated at midyear). This data is maintained and provided by the Centers for Disease Control and Prevention (CDC). We use Chiang's method (Chiang, 1968) to convert crude death rates into life expectancy at birth.

Estimates of the crude rates for some age groups were not always available for small populations. Thus, we pulled estimates for counties using five-year periods (for example, the life expectancy estimate we report for 2020 is obtained using all mortality data from 2016-2020) to ensure the best quality data possible. For states, we pulled data by individual years. This allowed us to see the full impact of the COVID-19 pandemic on health outcomes in 2020 at the state level. Consequently, it is central to note that the effects of the pandemic on counties in 2020 are likely understated because the mortality

data for 2020 includes data for each year from 2016 to 2020. The CDC's website also groups the mortality data into 5- or 10-year age increments. Even after combining the data, we could not obtain estimates for one or more age groups in several less populous counties.

Since we could not obtain an estimate for life expectancy at birth without complete mortality data for each county, we applied the following three-step imputation procedure to each age group in each county or state, for each period (five years for counties, one year for states), for males, females, and males and females:

First, we replaced extreme death rates in any age group with the median death rate for that age group. We define extreme values as a death rate of exactly zero or a death rate in the 99th percentile of all death rates for any county in that age group. We applied this imputation across all available years and all counties and states in the United States.

Second, if a given age group in a county or state had an estimate in one or more periods, we replaced the missing value with the mean of those estimates.

Third, if a given age group in a county or state still did not have an estimate, we replaced the missing value with the median for the three nearest counties (or states) with an estimate for that age group. We used Euclidean distances between each county's county seat and the geographic center of each state to determine geographic proximity between counties and states, respectively.

For the IHDI, the lack of microdata requires us to measure inequality between age groups instead of individuals. As with the inequality-adjusted education index, having fewer groups to compare makes it harder to quantify inequality, but we consider this a suitable alternative in the absence of microdata.

3.3. Income Indicator

The HDR uses GNI per capita. Since no such estimate exists at the sub-county level, we use median personal income. To estimate personal income, we use the American Community Survey's five-year estimates for "Inflation-Adjusted Dollars for the Population 16 Years and Over with Earnings in the Past 12 Months." Our use of five-year estimates is somewhat unfortunate since the five-year window likely obscures some of the impacts of the COVID-19 pandemic on personal income in 2020. However, since the Census Bureau chose not to release standard ACS 1-year estimates for 2020 (U.S. Census Bureau, 2021), we consider this the best possible alternative. We follow the methodology suggested by the U.S. Census Bureau to adjust for inflation on multi-year estimates (U.S. Census Bureau, 2018). We also use the recommended consumer price index (All Items CPI-U-RS Annual Averages). We adopt the HDR's lower goalpost of $100. Still, we adjust the upper goalpost from the recommended $75,000 to $100,000 to reflect the more extensive range of median income estimates observed in U.S. counties.

For the IHDI, the lack of microdata requires us to measure inequality between income brackets instead of individuals. Since we cannot compare inequality in personal income between individuals, we compare the inequality between income brackets

instead. As with the other two inequality-adjusted dimensions, having fewer groups to compare makes it harder to quantify inequality, but in the absence of microdata, we consider this a suitable estimate.

Income brackets group the data ranging from "$1 to $2,499 or less" to "$100,000 or more." We use the midpoint of each income bracket and multiply that by the number of persons counted in each bracket. For the top income bracket, we use a value of $125,000 (making the range of the top bracket the same size as the bracket immediately preceding it). This value likely underestimates the median income of the top bracket, but in the absence of a better estimate, we use it and accept that our estimate of inequality may understate the true value in some counties or states.

3.4. Gender Development Index (GDI)

After estimating HDI and IHDI, we can measure the GDI. The GDI is the ratio of the HDI for females over the HDI for males. It measures gender inequalities in achievement in the same three dimensions as the HDI: health, measured by female and male life expectancy at birth; education, measured by female and male expected years of schooling for children and female and male mean years of schooling for adults ages 25 years and older; and command over economic resources, measured by female and male estimated earned income (UNDP, 2020b). A value of one suggests perfect gender parity. Values below one indicate that women are disadvantaged, and values over one suggest that men are disadvantaged. After all the adjustments, we can measure GDI at the county level for 2015 and 2020.

3.5. Gender Inequality Index (GII)

The GII reflects gender-based disadvantages in reproductive health, empowerment, and the labor market. It shows the loss in potential human development due to inequality between the sexes. It ranges from zero, where women and men fare equally, to one, where one gender fares as poorly as possible in all measured dimensions (UNDP, 2020b). We followed the instructions in the technical note precisely to calculate this index for the 50 states in 2020 due to the lack of available data.

We use the American Community Survey's five-year estimates for 2020 for the education and labor force participation components. Data for the adolescent birth rate (ABR) comes from a 2020 report by the CDC (CDC, 2020). We use the CDC's Maternal mortality Rate (MMR) rates for 2018-2020 (CDC, 2022). Since some states had too little data to record the MMR accurately, we use the rate of the entire United States as reported by the CDC. For the share of parliamentary seats held by each sex, we use state legislatures, including both state Senates and state Houses or Assemblies in each state except Nebraska, which has a unicameral legislature (NCSL, 2020).

The different metrics are associated with the SDGs. The 2021/2022 UNDP report presents data accordingly (UNDP, 2022). Even though there are 17 SDGs, this work considers the following:

Health indicator (Life Expectancy at birth: Goal 3 – Good health and well-being.)

Education indicator (EYS: Goal 4 Quality of education, Target 4.3; AYS: Goal 4, Target 4.4.)

Income indicator (Personal Income: Goal 8 – Decent work and economic growth, Target 8.5.)

Gender inequality index (Maternal mortality ratio: Goal 3, Target 3.1; Adolescent birth rate: Goal 3, Target 3.7; Share of seats in the parliament: Goal 5, Target 5.5; Population with at least some secondary education: Goal 4, Target 4.4)

In sum, we followed the UNDP methodology closely, making all the needed adjustments to measure the different indicators for the U.S. The adjustments made our indicators more precise for a developed country at the subnational level of disaggregation. We cannot compare our results with previous empirical evidence because of these methodological considerations, at least at the state level. At the county level, there are no measurements for all U.S. counties for 2015 or 2020. The following sections present the HDI, the IHDI, the GDI, and the GII to give policymakers additional tools to evaluate well-being at the sub-national level using metrics not based solely on the production of goods and services.

4. RESULTS

4.1. State Level Results

This section provides the results for the HDI, IHDI, and GDI at the state and county levels for 2015 and 2020 and GII for 2020 at the state level. Although our primary contribution is publishing the first-ever database with inequality-adjusted measures for the HDI and its components for all U.S. counties, this section presents our more interesting findings. The complete data on each index and subindex for all counties and states are available upon request.

Since it is helpful to have a national benchmark for our subnational findings, we summarize the results for the United States from the 2022 UNDP report (UNDP, 2022). The United States placed among the top twenty countries (0.18% annual growth between 1990-2021) since the first publication of the HDI in 1990 and until 2021. The COVID-19 pandemic has downshifted the trends expected for the following years. Even with significant support from government spending, the indices' dimensions have dropped compared to previous years.

In 2021, the United States ranked 21st for HDI and 8th for GDP per capita ($ PPP constant 2017) (World Bank, 2022). High-income countries like the United States do not necessarily rank as highly for health or educational outcomes as they do for income. For example, the United States has the lowest life expectancy (77.2 years) of the top 21 countries; its value is similar to Estonia (33rd) and Costa Rica (58th). The life expectancy was 78.9, previous to COVID-19 (2019), and still, it was the lowest among

the twenty top countries. The United States ranks higher on the education metric, with values comparable to developed countries such as Switzerland (1st) or Canada (15th). The income component is also the main driver of the United States' high HDI; the country's per capita income is the 6th highest among the 21 countries. Although the HDI for the United States is dragged down by its relatively low life expectancy, relatively high education and income components counter this effect. Estimations from the National Center for Health Statistics report a drop again for 2021, with COVID-19 as the main factor (Arias et al., 2022)

Compared to the 2021 HDI, the U.S. loses five positions when the index is adjusted for inequality. The overall loss is 11.1%, one of the highest among the top 21 countries in the HDI ranking (trailed only by Singapore (13%) and Hong Kong (13%)). The main reasons for the decrease came from the losses in life expectancy (5.9%), the highest among the 21 top countries, and in income (23.2%), the highest after Hong Kong (25.6%) and Singapore (25%). As we mentioned, the problems with income inequality in the U.S. have become pervasive for achieving the potential of human development. Hence, adjusting the metrics considering inequalities in each dimension and with enough disaggregation becomes urgent for identifying the areas that need more attention by the economic and social policies.

As a first approach to analyzing the IHDI, we start with the leading indicators for the HDI at the state level. Table 1 presents the HDI and its component indices for the 50 states in 2015 and 2020, classified by quintiles of human development (very high, high, medium, and low). Our estimates corroborate Measure of America reports with their latest data of 2016, where states such as Massachusetts are the first in the ranking of HDI (after the District of Columbia, which we do not include in our calculations). This state maintained the first position in 2015 and 2020 due to its performance in education and income indices. It is worth noting that most very high-development states are from northeastern states (except for Minnesota, Colorado, and Washington). In contrast, there is no geographical region concentration for the low human development classification, with West Virginia occupying the last position in the ranking.

The second column of Table 1 shows that the difference in HDI scores between the top (Massachusetts – 0.878) and bottom (West Virginia – 0.822) states is relatively small; the main differences are in the metrics where life expectancy and personal income show the disparities between states at the top and bottom of the ranking. Another fact is the change in the HDI in five years (last column). Over half of the states improved or kept their places in the ranking or remained in the same classification, and the rest decreased by no more than seven positions, which was the case of New York, among others.

The effects of COVID-19 on life expectancy deserve special mention. The pandemic interrupted the upward trend in life expectancy compared with previous years. All states in the very high human development classification saw a decline in life expectancy between 2015 and 2020 (Table 1). The most dramatic decrease occurred in New York (more than three years) and California (two years). In 2015, both states had the highest life expectancy in the country (California, 81.44, and New York, 81.03). The same

happened in the high and medium human development classification (except for Hawaii and Alaska). However, most of the states in the low human development classification saw slight increases in life expectancy, even West Virginia, which is at the bottom of the ranking. In 2015 it was clear the differences in life expectancy between very high and low human development; however, in 2020, that difference is reduced (Table 1).

As mentioned in the previous section, the inequality-adjusted HDI, or IHDI, measures the population's well-being, considering the inequality in each metric. Thus, we consider the IHDI the better indicator to measure the population's well-being. Hence, the HDI can be regarded as the aspirational level of well-being that could be achieved if no inequality existed. We calculate the IHDI in all states and counties, adjusting each of the HDI's three inputs (education, health, and income) for inequality. Table 2 presents the results for the 50 states in 2020 and ranking changes between 2015 and 2020; Figures 1-3 show these changes on a map.

The first two columns in Table 2 present the ranking and the IHDI in 2020. The third column shows the overall loss calculated according to the UNDP methodology. The table includes the loss for each dimension since this is critical to examine how inequality affects each metric. Figures 1 and 2 show the change between 2015 and 2020 and the three components of the IHDI for the 50 states. Table 3 shows the difference in the IHDI ranking between both periods, sorted by the changes in IHDI.

According to the methodology, we expect the value of IHDI to be lower than HDI in the presence of inequality. That is the case for the United States: significant changes occurred in the ranking of several states when comparing their indices with Table 1. Table 2 shows that Florida gained 23 positions after the adjustment, which put the state in the very high human development classification. In Figure 1, a shading change from black to white indicates an improvement in the ranking. The case of Florida is the combination of several factors: an improvement from 2015, the state gained 16 positions, and Florida's loss due to inequality is lower than that of other states (Table 3).

Adjusting the HDI for inequality is critical for some states. For example, in 2020, Massachusetts ranked 1st for HDI but fell to 9th after adjusting for inequality. For Massachusetts to improve the actual quality of life, it should address inequality instead of per capita GDP. Further analysis of the IHDI's components, as presented in Figure 2, shows that Massachusetts does relatively well in the education and health indices even after adjusting for inequality (ranking 1st and 9th, respectively) but falls from 3rd for the income index to 50th for the inequality-adjusted income index.

In the most extreme case, Table 2 shows that New Jersey loses 35 positions after adjusting for inequality, falling from a very high level of human development per the HDI to a low level of human development per the IHDI. States at the bottom had the most adverse changes with the correction. Also, with the adjustment, New Jersey, North Dakota, and Pennsylvania lost most positions, 15 and 17, respectively. West Virginia kept its bottom position after the adjustment for inequality. However, it lost only two places compared to the IHDI 2015 ranking. There were improvements in the ranking for income and health but a decrease in education (Table 3).

Table 1. HDI Components for 50 States: 2020 and 2015

States	2020						2015					Change in HDI Rank
	Rank HDI 2020	HDI	LE	EYS	AYS	PI (2019 dollars)	HDI	LE	EYS	AYS	PI (2019 dollars)	2015-2020
Very High Human Development												
Massachusetts	1	0.878	78.66	17.99	14.09	40,161	0.870	80.29	18.13	13.85	29,577	0
Connecticut	2	0.874	78.55	17.93	13.87	39,350	0.868	80.25	17.91	13.73	30,790	0
New Hampshire	3	0.871	79.28	17.32	13.96	37,487	0.859	79.52	17.49	13.82	29,213	3
Minnesota	4	0.868	79.11	17.16	13.89	37,786	0.857	79.83	17.27	13.72	28,740	3
New Jersey	5	0.868	77.40	17.84	13.79	40,311	0.868	80.59	17.87	13.55	30,750	-2
Maryland	6	0.865	77.25	17.25	13.96	42,034	0.864	79.46	17.32	13.80	33,204	-2
Colorado	7	0.865	78.66	16.89	14.04	37,395	0.857	79.84	17.10	13.85	28,498	1
Washington	8	0.864	79.59	16.49	13.83	38,126	0.852	80.18	16.62	13.63	28,271	4
Vermont	9	0.864	78.76	17.44	14.05	33,370	0.853	79.60	17.59	13.81	25,356	1
Virginia	10	0.861	77.98	17.07	13.89	37,356	0.855	79.42	17.22	13.66	28,960	-1
Rhode Island	11	0.861	78.38	17.69	13.55	34,221	0.851	79.46	17.71	13.31	26,246	2
New York	12	0.860	77.86	17.65	13.54	35,821	0.861	81.03	17.72	13.35	27,478	-7
High Human Development												
California	13	0.860	79.36	17.43	13.19	34,140	0.852	81.44	17.49	12.96	25,053	-2
Hawaii	14	0.858	79.44	16.19	13.68	37,276	0.844	78.75	16.53	13.50	28,775	7
Utah	15	0.857	78.89	16.93	13.85	32,253	0.844	79.71	16.89	13.65	24,137	5
Wisconsin	16	0.854	78.09	17.01	13.62	33,743	0.848	79.61	17.27	13.43	25,630	1
Oregon	17	0.853	78.85	16.65	13.74	32,471	0.840	79.48	16.81	13.52	23,582	7
Illinois	18	0.853	77.03	17.31	13.63	4,920	0.850	79.26	17.49	13.41	6,751	-4
Nebraska	19	0.853	77.88	17.06	13.60	33,541	0.846	79.23	17.31	13.43	25,460	0
Delaware	20	0.851	77.02	17.05	13.64	34,944	0.847	78.58	17.23	13.40	28,106	-2
Maine	21	0.849	78.04	16.86	13.72	31,235	0.836	78.46	17.04	13.49	23,431	8
Iowa	22	0.849	77.45	17.08	13.54	33,101	0.849	79.56	17.45	13.39	25,815	-7
North Dakota	23	0.849	77.14	16.46	13.70	36,769	0.849	79.59	16.75	13.51	28,192	-7
Florida	24	0.848	78.50	17.20	13.37	29,523	0.834	78.59	17.29	13.16	22,847	7

Table 1. HDI Components for 50 States: 2020 and 2015 (con't)

States	2020						2015					Change in HDI Rank
	Rank HDI 2020	HDI	LE	EYS	AYS	PI (2019 dollars)	HDI	LE	EYS	AYS	PI (2019 dollars)	2015-2020
Medium Human Development												
Wyoming	25	0.846	77.25	16.61	13.66	33,443	0.842	78.48	16.72	13.51	27,562	-3
Pennsylvania	26	0.845	76.84	17.00	13.56	32,557	0.839	78.43	17.20	13.33	24,968	0
Alaska	27	0.844	78.58	15.41	13.64	35,316	0.837	78.48	15.81	13.52	29,149	1
Kansas	28	0.843	76.55	16.88	13.68	32,328	0.842	78.43	17.22	13.51	25,313	-5
Michigan	29	0.842	76.47	17.09	13.57	31,107	0.836	78.08	17.36	13.37	3,453	1
Arizona	30	0.841	77.65	16.43	13.39	31,775	0.838	80.02	16.55	13.19	24,239	-3
Idaho	31	0.841	78.48	16.26	13.50	29,116	0.830	79.42	16.42	13.27	21,831	4
South Dakota	32	0.840	76.74	16.56	13.55	32,352	0.839	79.09	16.82	13.40	24,856	-7
Montana	33	0.839	77.04	16.33	13.82	30,189	0.829	78.22	16.42	13.61	22,697	3
North Carolina	34	0.837	76.60	16.70	13.51	0,482	0.829	77.99	16.87	13.22	23,186	3
Georgia	35	0.837	76.01	16.95	13.44	31,302	0.830	77.61	17.07	13.19	23,712	-1
Ohio	36	0.837	76.07	16.78	13.47	31,466	0.830	77.26	17.12	13.29	24,051	-3
Texas	37	0.837	76.89	16.70	13.08	31,855	0.832	78.90	16.83	12.83	24,442	-5
South Carolina	38	0.835	77.02	16.63	13.40	28,926	0.821	76.86	16.89	13.13	22,136	4
Low Human Development												
Missouri	39	0.834	75.76	16.70	13.52	31,045	0.829	77.37	16.94	13.31	23,534	-1
Mississippi	40	0.834	78.08	16.95	13.05	25,576	0.811	76.16	17.13	12.81	19,866	6
Indiana	41	0.833	75.88	16.69	13.31	31,288	0.827	77.19	16.94	13.13	23,940	-2
Oklahoma	42	0.832	76.73	16.58	13.24	29,305	0.815	75.77	16.67	13.09	23,059	1
Alabama	43	0.832	77.05	16.79	13.22	27,367	0.809	75.39	16.83	12.98	21,212	4
Tennessee	44	0.831	76.69	16.39	13.29	29,357	0.814	76.20	16.62	13.02	22,038	0
New Mexico	45	0.830	77.51	16.32	13.29	26,931	0.825	78.35	16.67	13.09	21,711	-4
Nevada	46	0.830	76.84	15.84	13.09	32,340	0.826	78.51	16.13	12.92	25,230	-6
Louisiana	47	0.829	76.58	16.83	13.05	27,478	0.814	76.05	16.87	12.83	22,254	-2
Kentucky	48	0.827	76.61	16.44	13.13	27,846	0.808	75.53	16.74	12.86	21,268	0
Arkansas	49	0.824	76.25	16.54	13.05	26,857	0.807	75.78	16.68	12.83	20,577	1
West Virginia	50	0.822	76.72	16.22	12.98	26,514	0.808	76.23	16.62	12.75	20,662	-1

Table 2. IHDI Components for 50 States: 2020

States	Rank 2020	Inequality-adjusted HDI			Coefficient of Human Inequality	Inequality-adjusted health index	Loss in Life Expectancy	Inequality-adjusted education index	Loss in Education	Inequality-adjusted income index	Loss in Income
		2020	Overall loss	Difference with HDI rank							
Very High Human Development											
Florida	1	0.739	0.128	23	0.126	0.725	0.194	0.722	0.123	0.773	0.062
Vermont	2	0.739	0.145	7	0.143	0.712	0.212	0.736	0.134	0.771	0.084
California	3	0.738	0.141	10	0.140	0.728	0.203	0.736	0.106	0.750	0.111
Wisconsin	4	0.738	0.136	12	0.134	0.704	0.212	0.743	0.100	0.768	0.089
New Hampshire	5	0.734	0.156	-2	0.155	0.714	0.217	0.747	0.115	0.743	0.134
Colorado	6	0.734	0.152	1	0.150	0.709	0.215	0.732	0.124	0.761	0.112
Maine	7	0.733	0.137	14	0.135	0.702	0.214	0.729	0.116	0.770	0.075
Connecticut	8	0.731	0.163	-6	0.162	0.704	0.218	0.752	0.122	0.738	0.146
Massachusetts	9	0.731	0.168	-8	0.167	0.703	0.221	0.764	0.115	0.726	0.164
Rhode Island	10	0.729	0.153	1	0.152	0.707	0.212	0.733	0.128	0.748	0.115
Hawaii	11	0.729	0.151	3	0.150	0.719	0.214	0.706	0.126	0.764	0.109
Virginia	12	0.728	0.154	-2	0.153	0.701	0.214	0.734	0.122	0.751	0.124
High Human Development											
Oregon	13	0.726	0.149	4	0.147	0.713	0.212	0.698	0.149	0.770	0.080
New York	14	0.726	0.156	-2	0.155	0.700	0.214	0.731	0.129	0.749	0.121
Minnesota	15	0.725	0.165	-11	0.164	0.712	0.218	0.705	0.158	0.759	0.116
Utah	16	0.725	0.154	-1	0.153	0.704	0.223	0.718	0.136	0.754	0.098
Michigan	17	0.725	0.139	12	0.137	0.684	0.213	0.724	0.124	0.768	0.075
North Carolina	18	0.724	0.136	16	0.134	0.685	0.214	0.718	0.119	0.771	0.068
Wyoming	19	0.723	0.145	6	0.143	0.694	0.212	0.717	0.122	0.760	0.096
Arizona	20	0.722	0.141	10	0.139	0.708	0.202	0.687	0.146	0.775	0.071
Maryland	21	0.722	0.165	-15	0.164	0.695	0.211	0.744	0.116	0.729	0.166
Texas	22	0.722	0.138	15	0.136	0.685	0.217	0.715	0.109	0.767	0.081
Idaho	23	0.721	0.142	8	0.139	0.699	0.223	0.704	0.124	0.763	0.071
Washington	24	0.721	0.166	-16	0.165	0.725	0.209	0.698	0.148	0.742	0.138

Table 2. IHDI Components for 50 States: 2020 (con't)

States	Rank 2020	Inequality-adjusted HDI			Coefficient of Human Inequality	Inequality-adjusted health index	Loss in Life Expectancy	Inequality adjusted education index	Loss in Education	Inequality-adjusted income index	Loss in Income
		2020	Overall loss	Difference with HDI rank							
Medium Human Development											
Nebraska	25	0.721	0.154	-6	0.152	0.693	0.221	0.702	0.150	0.770	0.085
Georgia	26	0.721	0.139	9	0.137	0.674	0.218	0.725	0.115	0.767	0.078
South Dakota	27	0.721	0.142	5	0.140	0.678	0.223	0.721	0.113	0.767	0.084
Kansas	28	0.720	0.146	0	0.144	0.677	0.222	0.718	0.128	0.769	0.081
Ohio	29	0.720	0.140	7	0.138	0.678	0.214	0.714	0.124	0.770	0.075
Montana	30	0.719	0.143	3	0.140	0.687	0.217	0.697	0.144	0.777	0.060
Illinois	31	0.719	0.157	-13	0.156	0.686	0.218	0.716	0.141	0.757	0.107
Delaware	32	0.719	0.155	-12	0.154	0.687	0.217	0.710	0.141	0.761	0.102
South Carolina	33	0.719	0.140	5	0.137	0.684	0.221	0.705	0.129	0.770	0.062
Iowa	34	0.718	0.154	-12	0.152	0.685	0.225	0.706	0.144	0.767	0.087
Indiana	35	0.718	0.138	6	0.136	0.675	0.215	0.719	0.111	0.763	0.082
Alaska	36	0.718	0.149	-9	0.149	0.724	0.197	0.684	0.130	0.749	0.119
Kentucky	37	0.718	0.132	11	0.129	0.674	0.227	0.717	0.101	0.766	0.060
Low Human Development											
North Dakota	38	0.717	0.155	-15	0.154	0.685	0.221	0.705	0.134	0.764	0.106
New Mexico	39	0.717	0.137	6	0.134	0.699	0.210	0.682	0.146	0.773	0.045
New Jersey	40	0.716	0.174	-35	0.174	0.687	0.222	0.735	0.137	0.728	0.162
Arkansas	41	0.715	0.132	8	0.129	0.673	0.222	0.712	0.106	0.762	0.058
Tennessee	42	0.714	0.141	2	0.138	0.674	0.227	0.704	0.121	0.767	0.067
Pennsylvania	43	0.714	0.155	-17	0.154	0.680	0.223	0.706	0.143	0.757	0.096
Alabama	44	0.712	0.144	-1	0.141	0.678	0.228	0.703	0.130	0.758	0.066
Missouri	45	0.712	0.147	-6	0.144	0.669	0.220	0.700	0.141	0.771	0.072
Mississippi	46	0.711	0.147	-6	0.144	0.703	0.213	0.675	0.165	0.759	0.055
Louisiana	47	0.710	0.143	0	0.141	0.673	0.227	0.704	0.124	0.755	0.071
Nevada	48	0.709	0.145	-2	0.144	0.689	0.212	0.672	0.139	0.770	0.080
Oklahoma	49	0.705	0.153	-7	0.151	0.678	0.224	0.674	0.162	0.766	0.068
West Virginia	50	0.704	0.143	0	0.141	0.677	0.225	0.680	0.137	0.758	0.061

Table 3. IHDI Rank Changes from 2015 to 2020: States

State	2020 IHDI Ranking	Change from 2015 Inequality-adjusted Ranking*				
		IHDI	Education	Health	Income	Human Capital
Connecticut	8	+23	+41	-8	-11	+21
Maine	7	+22	+2	+19	+14	+16
Florida	1	+16	-5	+29	+10	+13
Idaho	23	+16	+2	+5	+22	+11
North Carolina	18	+12	+1	+2	+12	+9
Hawaii	11	+10	-7	+25	-23	+14
Montana	30	+10	+3	+4	+36	-1
South Carolina	33	+10	+13	+6	+21	+4
Kentucky	37	+8	+18	+2	+18	+10
Nebraska	25	+7	-7	+3	+15	+1
Wyoming	19	+7	-2	0	+8	+2
Ohio	29	+6	-1	+2	+13	+3
Oregon	13	+6	-20	+13	+4	+3
Rhode Island	10	+6	+8	+11	-32	+8
South Dakota	27	+6	+20	-26	+23	0
Vermont	2	+5	-3	+14	+13	+4
Tennessee	42	+4	+12	-1	+14	+5
Alabama	44	+3	+2	+10	+8	+6
Arkansas	41	+3	+15	-3	+18	+5
Indiana	35	+3	+8	-3	+8	+5
Michigan	17	+3	-7	0	+13	-5
Mississippi	46	+3	-4	+30	+17	+1
Texas	22	+3	+9	-6	-11	+4
Georgia	26	+2	+3	-8	-4	+4
Utah	16	+2	-14	+5	+8	-6
Virginia	12	+2	+7	-5	-22	+3
New Hampshire	5	+1	-1	+9	-22	+1
Oklahoma	49	+1	0	+5	+16	0
Wisconsin	4	+1	-2	+6	-7	-2
Alaska	36	0	+2	+12	-12	+13
Kansas	28	-1	0	-8	+5	-6
California	3	-2	+7	0	-25	0
Colorado	6	-2	-5	-1	-26	0
Minnesota	15	-2	-5	+1	-28	-3
West Virginia	50	-2	-12	+5	+13	-5
Louisiana	47	-5	-12	-6	+7	-5
Massachusetts	9	-7	0	-8	-7	0
Nevada	48	-7	0	+1	-5	-5
Missouri	45	-8	-9	-11	+16	-8
Arizona	20	-9	-11	-8	+5	-20
Pennsylvania	43	-9	+9	-4	-11	-3
Washington	24	-9	-11	+4	-35	+3
Iowa	34	-11	-1	-15	+9	-11
New York	14	-11	0	-18	-33	-9
Maryland	21	-12	+1	-12	-17	-3
North Dakota	38	-14	+2	-27	+11	-14
New Mexico	39	-17	-19	-10	+23	-23
Illinois	31	-19	-10	-12	-31	-13
Delaware	32	-24	-18	+2	-29	-16
New Jersey	40	-30	+1	-25	-9	-11

Notes: Technically, a positive change in rank means a region's overall standing is worse off. Because this makes for confusing tables, we use a plus sign to represent an improvement and a minus sign to mean a deterioration in a region's overall standing.

Figure 1 helps to visualize the changes between 2015 and 2020; these changes were not significant except for the states we had mentioned for the states in the high and medium human development classification. This change is also noticeable in Figure 1, where the shade goes from almost white in 2015 to dark gray in 2020. New Jersey also lost positions in the IHDI ranking from 2015 (the highest loss of all states) and had the highest overall loss for 2020 (17.4%).

The inequality coefficient is another indicator to show the loss after the adjustment; it is similar in value to the overall loss; however, the inequality coefficient is the unweighting arithmetic mean of the three dimensions' inequality. If the disparity in each dimension is the same, then the overall loss is the same as the inequality coefficient. In Table 2, that is not the case; as we can see, each coefficient for health, education, and income is different. The gap between the top and bottom states is more evident in the income index than in health or education. Table 3 helps to see changes in the rankings for IHDI between 2015 and 2020. For instance, Connecticut is at the top of the list. It gained 23 positions in the ranking, thanks to improvements in the ranking for education. Maine's increase in the ranking is due to the 19 positions gotten in the health dimension. It is also noticeable that changes in the ranking are not homogeneous, and policymakers should consider which dimensions of IHDI require more attention.

The three maps in Figure 2 show the components of the IHDI for the fifty states in 2020. Since IHDI is the composite index of the three metrics, it is helpful to see which states fare better in each metric. Only a few states have similar shades in all three indexes. For instance, the shading on Maine is light in all three indices, revealing a relatively high position in the ranking in each of the three components. Florida, the state with the top overall ranking, shows different shades for each component, with near-white shades in the health and income indices and a gray shade in the education index. We can also geographical regions across the three maps in Figure 2. The first map is the adjusted education index; dark-shades seem to be spread evenly across the country, although the northeast region seems to be the area where states fare best in the adjusted education index. The second map is the adjusted health index. There are regions with high rankings in the West and the Rocky Mountains, except for Nevada. Moreover, it is evident that states in the Midwest or the South with the exception of Florida are lower in the ranking for the adjusted education index. In the third map we see that states in the Midwest performed better for the adjusted income index, an effect that seems to counterbalance the low ranking in the adjusted health index.

Figure 3 isolates the adjusted income index to compare it with an inequality-adjusted measure for Human Capital (defined as the non-income IHDI). Separating the income measure from the other two (education and health) shows that states like Montana or Nevada are highly ranked for inequality-adjusted per capita personal income. Still, poor educational and health outcomes drag their Human Capital rankings below the median state's.

In sum, an accurate picture of the population's well-being requires the adjustment of the HDI considering the disparities in the three dimensions due to inequality. The UNDP

put the U.S. in a very high development category, according to HDI and IHDI. However, at the subnational level, the scores are much lower. It shows the heterogeneity in the three dimensions and regions, making a more disaggregated examination at the county level even more significant.

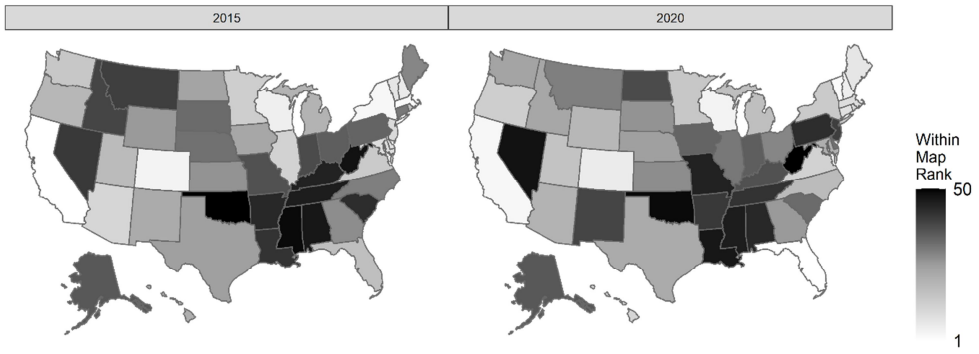

Figure 1. IHDI by State: 2015 and 2020

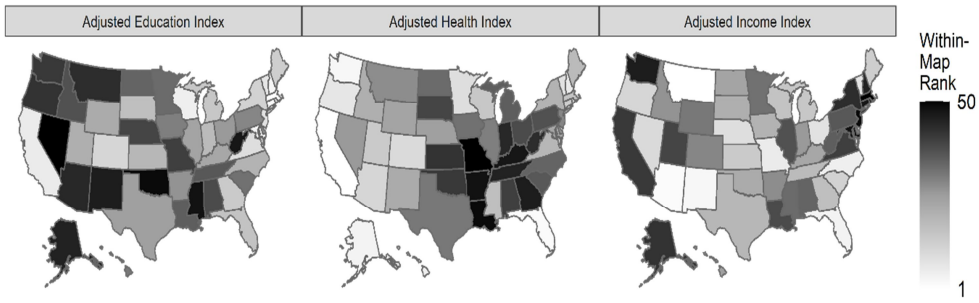

Figure 2. Components of the IHDI by State: 2020

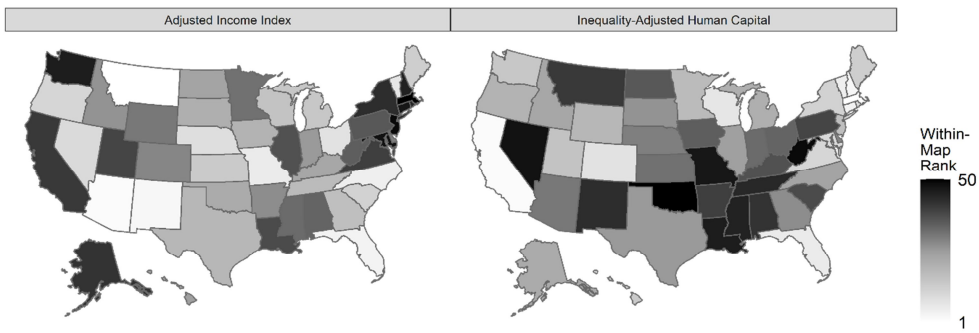

Figure 3. Adjusted Income Index and Adjusted Human Capital: 2020

The data for the HDI and IHDI can be disaggregated by gender to assess their significant gaps. Table 4 and Figures 4 and 5 present the data disaggregated by gender at the state and county level in 2020. Table 4 shows the totals for the HDI and IHDI in 2020 and the loss due to inequality by gender sorted by quintiles of gender development. The third column shows the values of the GII for 2020. All states show a GDI of less than one, indicating that the HDI is lower for women than men. In 2020, the GDI had values very close to one, even for states at the bottom of the ranking. There is only a difference of 0.05 between Florida at the top and Utah at the bottom, so the GDI ranking is helpful to show in which states there are more significant differences. Figure 4 also shows the changes between 2015 and 2020. It seems the improvements in the ranking are not evident in the five years. However, big states like California and Texas gained some positions in the ranking.

Another characteristic of the GDI ranking in Table 4 is that, compared with previous tables, the states with high rankings in HDI or IHDI are not necessarily classified as very high gender development. For instance, Alaska is third for GDI but in the medium human development classification for HDI and IHDI. Oklahoma is 11th in the GDI ranking but is in the low human development classification for HDI and IHDI. At the bottom of the GDI ranking is Utah, which is in the group of high development classification for HDI or IHDI. In sum, there is a need to disaggregate the indexes by gender to show these gaps. Women continue to be disadvantaged even in states with very high human development.

The fifth and eighth columns in Table 4 show whether the loss due to inequality has been more significant for women or men in 2020. Even though the HDI for women is lower than for men, the loss due to inequality has been higher for men, with three points of difference for women. This loss occurs to a greater extent in the health and education metrics, where women have performed better. However, women's losses are higher when the income metric is considered.

The second column of Table 4 is the GII. The GII differs from the GDI since it considers other metrics for estimating the composite index. GII values range from zero to one. A value of zero indicates no inequality, while a value of one indicates extreme inequality. The GII ranking provides a different picture of gender disparities. For instance, Washington state ranks 46th in the GDI but reaches 8th in the GII. Significant differences between the GII and GDI occur in several other states (e.g., Utah and Massachusetts). Still, the indices also concur in other states, such as Maine, Ohio, Alabama, and Wyoming, achieving similar rankings for the GDI and GII. Furthermore, states such as New York or Vermont do not have these inconsistencies between indexes; both states ranked high or very high for all indexes studied here.

The GDI is based on the HDI and shows the gender disparity when the index is below one. GII is a better estimate of gender inequality since it is built based on variables that show the position of women in the labor market, a different indicator for health and empowerment. Although, data availability has been the major constraint to working more with the GII indicator at the county level.

Table 4. GDI and HDI, IHDI, and Loss Due to Inequality by Gender, 2020 States

State	Both		Female			Male		
	GDI	GII	HDI	IHDI	Loss Due to Inequality	HDI	IHDI	Loss Due to Inequality
Very High Gender Development								
Florida	0.995	0.134	0.845	0.743	0.120	0.848	0.727	0.143
Maine	0.994	0.077	0.846	0.738	0.128	0.851	0.725	0.149
North Carolina	0.994	0.153	0.834	0.729	0.126	0.839	0.716	0.147
Alaska	0.993	0.128	0.842	0.735	0.127	0.848	0.705	0.169
New York	0.993	0.083	0.857	0.739	0.138	0.863	0.712	0.175
Nevada	0.992	0.105	0.827	0.715	0.135	0.833	0.704	0.155
Maryland	0.992	0.089	0.863	0.737	0.146	0.870	0.707	0.188
Mississippi	0.991	0.254	0.827	0.705	0.148	0.834	0.701	0.160
Delaware	0.991	0.136	0.848	0.726	0.144	0.855	0.712	0.167
Vermont	0.991	0.037	0.861	0.742	0.139	0.869	0.735	0.154
Oklahoma	0.991	0.212	0.827	0.709	0.143	0.835	0.697	0.165
Georgia	0.990	0.175	0.833	0.730	0.123	0.841	0.709	0.157
High Gender Development								
Hawaii	0.990	0.109	0.852	0.739	0.133	0.861	0.715	0.170
Arkansas	0.989	0.260	0.819	0.717	0.124	0.828	0.712	0.140
California	0.989	0.034	0.854	0.749	0.123	0.864	0.726	0.160
Arizona	0.989	0.154	0.836	0.728	0.129	0.845	0.716	0.153
New Mexico	0.989	0.150	0.826	0.718	0.131	0.835	0.716	0.143
North Dakota	0.988	0.139	0.844	0.727	0.138	0.854	0.707	0.172
Connecticut	0.987	0.056	0.868	0.743	0.143	0.879	0.717	0.184
Illinois	0.987	0.064	0.847	0.730	0.138	0.858	0.706	0.177
Wisconsin	0.986	0.105	0.847	0.748	0.117	0.859	0.721	0.160
Ohio	0.986	0.151	0.830	0.727	0.124	0.842	0.706	0.161
Montana	0.986	0.114	0.833	0.722	0.133	0.845	0.715	0.153
Tennessee	0.986	0.256	0.825	0.718	0.130	0.837	0.708	0.154
Texas	0.986	0.193	0.830	0.729	0.122	0.842	0.713	0.154

Table 4. GDI and HDI, IHDI, and Loss Due to Inequality by Gender, 2020 States (con't)

State	Both		Female			Male		
	GDI	GII	HDI	IHDI	Loss Due to Inequality	HDI	IHDI	Loss Due to Inequality
Medium Gender Development								
New Jersey	0.986	0.097	0.861	0.733	0.149	0.874	0.699	0.200
Louisiana	0.986	0.248	0.825	0.717	0.130	0.837	0.704	0.158
Kentucky	0.985	0.247	0.821	0.721	0.122	0.833	0.712	0.145
Missouri	0.985	0.178	0.829	0.718	0.133	0.841	0.705	0.162
New Hampshire	0.985	0.042	0.864	0.749	0.133	0.877	0.718	0.181
South Dakota	0.985	0.159	0.836	0.728	0.129	0.848	0.721	0.150
Colorado	0.985	0.054	0.858	0.747	0.130	0.871	0.719	0.175
Rhode Island	0.985	0.068	0.854	0.734	0.140	0.867	0.718	0.172
Massachusetts	0.985	0.014	0.871	0.745	0.145	0.885	0.715	0.192
Virginia	0.984	0.124	0.854	0.740	0.133	0.868	0.715	0.176
Indiana	0.984	0.191	0.826	0.724	0.124	0.839	0.705	0.160
Pennsylvania	0.984	0.087	0.839	0.721	0.140	0.852	0.705	0.172
Kansas	0.984	0.154	0.837	0.727	0.131	0.851	0.713	0.162
Low Gender Development								
Nebraska	0.984	0.158	0.846	0.727	0.141	0.860	0.715	0.168
West Virginia	0.983	0.213	0.815	0.707	0.133	0.829	0.701	0.154
Iowa	0.983	0.116	0.842	0.726	0.138	0.857	0.710	0.171
Oregon	0.983	0.074	0.847	0.736	0.131	0.861	0.716	0.169
Minnesota	0.983	0.074	0.860	0.736	0.144	0.876	0.712	0.187
Michigan	0.982	0.102	0.833	0.723	0.131	0.847	0.714	0.158
South Carolina	0.978	0.222	0.826	0.716	0.133	0.845	0.718	0.150
Washington	0.978	0.084	0.855	0.737	0.138	0.874	0.704	0.194
Wyoming	0.977	0.186	0.837	0.732	0.125	0.856	0.717	0.163
Alabama	0.975	0.267	0.820	0.713	0.131	0.841	0.708	0.158
Idaho	0.971	0.126	0.827	0.717	0.133	0.852	0.723	0.151
Utah	0.961	0.115	0.840	0.729	0.132	0.874	0.726	0.169

Table 5. HDI, IHDI and Components for Top and Bottom 20 Counties: 2020

	HDI				IHDI			
County	**Index**	**Education**	**Health**	**Income**	**Index**	**Education**	**Health**	**Income**
Falls Church City, VA	0.928	0.928	0.892	0.964	0.622	0.792	0.687	0.442
Middlesex, MA	0.912	0.895	0.946	0.896	0.740	0.795	0.749	0.680
Los Alamos, NM	0.909	0.899	0.885	0.942	0.667	0.781	0.699	0.543
Norfolk, MA	0.908	0.886	0.939	0.898	0.730	0.776	0.744	0.675
Boulder, CO	0.905	0.929	0.922	0.865	0.757	0.805	0.735	0.733
New York, NY	0.904	0.885	0.919	0.908	0.706	0.771	0.720	0.633
Somerset, NJ	0.904	0.883	0.926	0.903	0.714	0.751	0.737	0.657
Washtenaw, MI	0.904	0.926	0.935	0.852	0.767	0.824	0.740	0.740
Morris, NJ	0.904	0.890	0.914	0.907	0.710	0.748	0.726	0.658
Loudoun, VA	0.903	0.881	0.897	0.933	0.681	0.720	0.717	0.613
King, WA	0.903	0.860	0.957	0.895	0.731	0.747	0.766	0.682
Arlington, VA	0.903	0.878	0.880	0.953	0.675	0.768	0.690	0.580
Howard, MD	0.903	0.894	0.891	0.923	0.706	0.782	0.708	0.636
Marin, CA	0.901	0.888	0.899	0.917	0.726	0.793	0.727	0.665
Tolland, CT	0.900	0.899	0.942	0.862	0.744	0.781	0.750	0.703
Nassau, NY	0.900	0.869	0.940	0.893	0.730	0.753	0.750	0.687
Alameda, CA	0.900	0.869	0.942	0.889	0.733	0.762	0.755	0.684
Chester, PA	0.899	0.871	0.942	0.885	0.729	0.760	0.741	0.687
San Francisco, CA	0.899	0.877	0.905	0.914	0.696	0.759	0.707	0.628
Johnson, IA	0.898	0.912	0.957	0.831	0.774	0.780	0.773	0.768
…	…	…	…	…	…	…	…	…

Table 5. HDI, IHDI and Components for Top and Bottom 20 Counties: 2020 (con't)

	HDI				IHDI			
County	**Index**	**Education**	**Health**	**Income**	**Index**	**Education**	**Health**	**Income**
Culberson, TX	0.731	0.596	0.853	0.768	0.477	0.509	0.669	0.319
East Carroll Parish, LA	0.748	0.670	0.840	0.744	0.569	0.579	0.649	0.489
Presidio, TX	0.754	0.652	0.894	0.735	0.554	0.574	0.704	0.422
La Salle, TX	0.754	0.664	0.864	0.747	0.550	0.582	0.690	0.413
Wolfe, KY	0.756	0.711	0.861	0.706	0.537	0.604	0.677	0.378
Hudspeth, TX	0.756	0.670	0.904	0.714	0.509	0.581	0.708	0.321
Luna, NM	0.758	0.690	0.840	0.752	0.628	0.588	0.663	0.635
Mississippi, MO	0.761	0.714	0.842	0.732	0.618	0.620	0.653	0.583
Lee, KY	0.761	0.699	0.868	0.726	0.603	0.603	0.683	0.532
Jenkins, GA	0.762	0.746	0.817	0.726	0.519	0.589	0.643	0.368
Zavala, TX	0.762	0.716	0.834	0.742	0.588	0.625	0.652	0.499
Holmes, OH	0.762	0.598	0.908	0.816	0.641	0.522	0.710	0.712
Jackson, KY	0.763	0.726	0.814	0.751	0.588	0.620	0.636	0.517
Emporia City, VA	0.763	0.678	0.841	0.780	0.575	0.595	0.663	0.481
Morgan, MO	0.763	0.676	0.839	0.784	0.633	0.588	0.658	0.656
Newton, TX	0.764	0.695	0.832	0.771	0.620	0.592	0.658	0.611
Pickett, TN	0.764	0.664	0.850	0.790	0.538	0.578	0.675	0.399
Covington, MS	0.764	0.707	0.834	0.758	0.610	0.619	0.659	0.557
Johnson, GA	0.765	0.687	0.837	0.780	0.610	0.603	0.679	0.555
Magoffin, KY	0.765	0.723	0.836	0.741	0.612	0.627	0.653	0.559

Table 6. IHDI Rank Changes from 2015 to 2020: Top and Bottom 20 Counties

County	2020 IHDI Ranking	Change from 2015 Inequality-adjusted Ranking				
		IHDI	Education	Health	Income	Human Capital
Jefferson, TX	1311	+1458	-238	-394	+2520	-382
McIntosh, GA	1419	+1331	+960	-676	+915	+379
Nodaway, MO	536	+1331	+64	+500	+652	+162
Greeley, NE	1035	+1254	+848	-416	+681	+243
Idaho, ID	1139	+1205	+624	+421	+729	+719
Clay, SD	1136	+1173	+9	-316	+393	-45
Athens, OH	1253	+1167	+12	+452	+377	+115
Cook, MN	235	+1164	+1663	+769	+356	+1727
Gregory, SD	854	+1139	+1324	-120	+1223	+774
Crook, OR	912	+1100	+746	+292	+1134	+725
Alleghany, NC	1299	+1084	+1755	+20	+505	+1245
Floyd, VA	997	+1076	+1284	+392	+603	+1292
Madison, ID	1914	+1073	-17	+1113	+209	+167
Harrisonburg city, VA	636	+1041	+35	-523	+400	+19
Boundary, ID	1414	+1039	+583	+740	+453	+1074
Koochiching, MN	547	+1038	+932	+314	+918	+698
Drew, AK	1370	+1022	+367	-382	+1038	+172
Republic, KS	1329	+1017	+591	+561	+341	+747
Allen, KS	1445	+1010	+715	+1246	+667	+1140
Cherry, NE	471	+984	+718	-458	+1023	+80
…	…	…	…	…	…	…
Pocahontas, IA	2460	-1233	-87	-1120	-1364	-686
Fairfax City, VA	1274	-1250	-4	-1949	-1502	-206
Middlesex, VA	2291	-1260	-504	404	-1704	-83
Nantucket, MA	1551	-1268	154	-572	-1626	-24
Carson, TX	2727	-1296	-655	212	-1077	-358
San Francisco, CA	1401	-1298	-42	-877	-1342	-189
Beaver, UT	2903	-1301	-802	255	-632	-438
Arlington, VA	2110	-1312	54	-1365	-442	-173
Hartley, TX	2723	-1334	-418	15	-1265	-214
Petersburg Borough, AK	2186	-1402	-1599	37	-1164	-850
Clear Creek, CO	1554	-1415	-162	-575	-2067	-260
Crawford, GA	2644	-1448	-723	-1505	-745	-1371
Ness, KS	2721	-1518	-729	-944	-656	-913
King and Queen, VA	2929	-1553	1108	-1253	-1104	113
Falls Church City, VA	2912	-1668	-20	-280	-217	-134
Gilpin, CO	1918	-1685	-40	14	-1641	-11
Hanson, SD	2547	-1695	-2250	-290	-973	-1694
Decatur, KS	2882	-1733	-1819	-1144	-874	-1748
Jim Hogg, TX	3019	-1781	-1070	943	-2483	-515
Camden, NC	2626	-1813	-2102	-81	-939	-1427

Notes: Technically, a positive change in rank means a region's overall standing is worse off. Because this makes for confusing tables, we use a plus sign to represent an improvement and a minus sign to represent a deterioration in a region's overall standing.

Table 7. GDI, HDI, IHDI, and Loss Due to Inequality by Gender, 2020 Top and Bottom 20 Counties

County	Female			Male			Both
	HDI	IHDI	Loss Due to Inequality	HDI	IHDI	Loss Due to Inequality	GDI
Stewart, GA	0.823	0.672	0.183	0.730	0.582	0.203	1.126
Mora, NM	0.799	0.533	0.333	0.727	0.474	0.347	1.099
Reeves, TX	0.825	0.663	0.196	0.772	0.629	0.186	1.069
Hyde, NC	0.819	0.514	0.373	0.768	0.560	0.271	1.065
Echols, GA	0.815	0.615	0.245	0.766	0.580	0.243	1.064
Pawnee, KS	0.835	0.701	0.161	0.786	0.644	0.180	1.063
Greensville, VA	0.812	0.682	0.160	0.765	0.624	0.185	1.061
Concho, TX	0.811	0.584	0.280	0.764	0.607	0.206	1.060
Presidio, TX	0.765	0.560	0.269	0.725	0.541	0.254	1.056
Granite, MT	0.862	0.689	0.201	0.818	0.648	0.208	1.053
La Salle, TX	0.774	0.523	0.324	0.735	0.587	0.202	1.052
Owsley, KY	0.788	0.641	0.187	0.751	0.604	0.196	1.049
Noxubee, MS	0.807	0.643	0.204	0.770	0.626	0.188	1.048
Glascock, GA	0.826	0.675	0.183	0.789	0.622	0.212	1.048
Pickett, TN	0.775	0.535	0.310	0.741	0.535	0.278	1.046
Bent, CO	0.817	0.660	0.192	0.781	0.607	0.223	1.046
Towner, ND	0.810	0.614	0.242	0.774	0.597	0.229	1.045
Ozark, MO	0.795	0.622	0.218	0.761	0.647	0.150	1.045
Bristol City, VA	0.800	0.663	0.171	0.766	0.642	0.163	1.044
Sussex, VA	0.809	0.693	0.143	0.775	0.656	0.154	1.044
…	…	…	…	…	…	…	…
Lincoln, WY	0.814	0.682	0.162	0.869	0.703	0.191	0.937
Utah, UT	0.836	0.710	0.151	0.893	0.753	0.157	0.936
Marshall, SD	0.825	0.675	0.182	0.882	0.654	0.258	0.936
Dickens, TX	0.766	0.615	0.197	0.819	0.657	0.198	0.935
Yoakum, TX	0.768	0.574	0.252	0.821	0.592	0.279	0.935
Cimarron, OK	0.786	0.611	0.223	0.842	0.592	0.298	0.932
Baylor, TX	0.761	0.619	0.187	0.817	0.595	0.271	0.932
Wirt, WV	0.772	0.642	0.169	0.829	0.665	0.198	0.932
Eureka, NV	0.751	0.532	0.292	0.806	0.437	0.457	0.932
Hutchinson, TX	0.780	0.658	0.156	0.838	0.698	0.167	0.931
Mason, TX	0.810	0.621	0.233	0.870	0.601	0.309	0.931
Uintah, UT	0.783	0.643	0.178	0.841	0.694	0.175	0.931
Valley, NE	0.812	0.675	0.168	0.873	0.720	0.175	0.930
Adams, ND	0.825	0.660	0.200	0.888	0.702	0.209	0.929
Franklin, ID	0.801	0.643	0.198	0.862	0.700	0.188	0.929
Greenlee, AZ	0.789	0.627	0.205	0.851	0.642	0.246	0.927
Madison, ID	0.802	0.620	0.227	0.865	0.733	0.153	0.926
Haines Borough, AK	0.806	0.586	0.272	0.873	0.667	0.236	0.923
Niobrara, WY	0.775	0.614	0.207	0.840	0.649	0.227	0.923
Morgan, UT	0.835	0.713	0.146	0.911	0.687	0.246	0.917

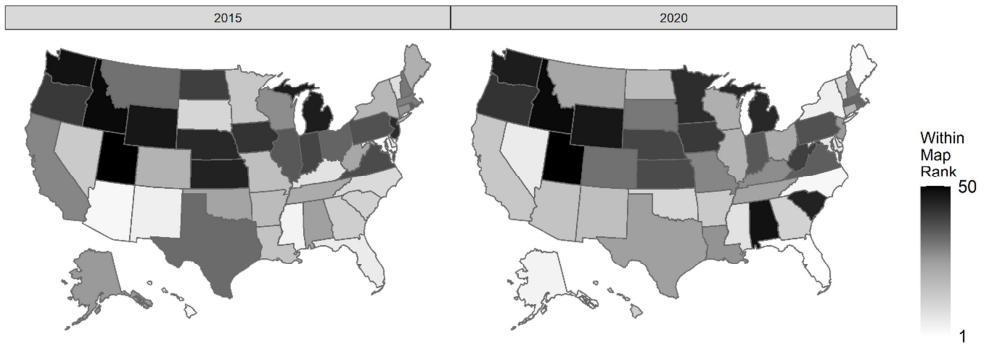

Figure 4. GDI by State in 2015 and 2020

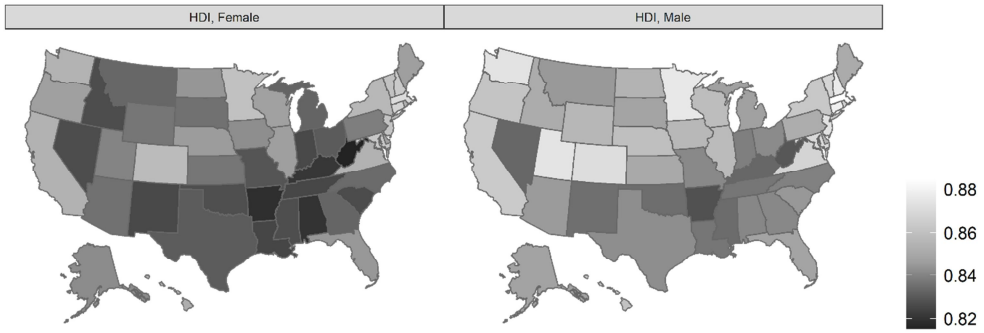

Figure 5. Male and Female HDI by State in 2020

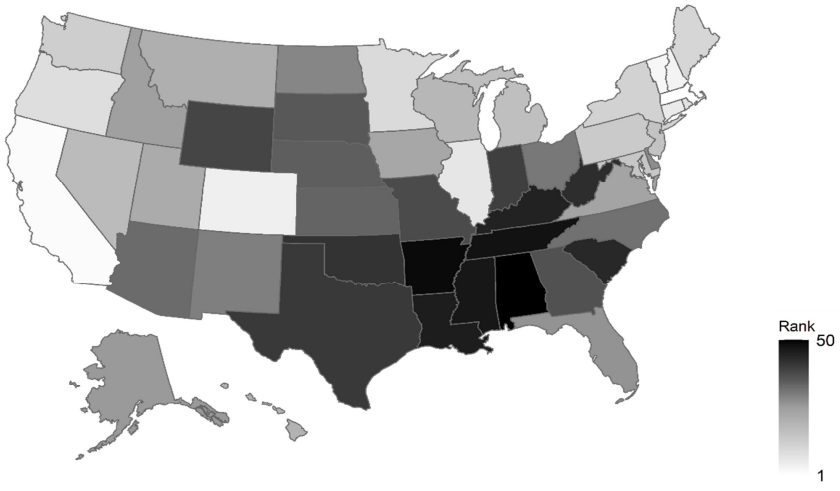

Figure 6. Gender Inequality Index (GII) by State in 2020

Unlike the state results, some counties have a GDI greater than 1 (Table 7). In these counties, the HDI for women is more significant than for men. Comparing the third and sixth columns in Table 7 indicates whether the loss due to inequality impacted women or men more significantly in 2020.

Figure 6 presents the Gender Inequality Index (GII) in map format, with the corresponding index values shown in the final column of Table 4, another indicator that measures gender-based disadvantages to women in reproductive health, empowerment, and the labor market. Like the IHDI, it shows the loss in potential human development due to inequality between genders (UNDP, 2020a). We do not calculate the GII at the county level since one of its inputs is the share of female legislators, which is less relevant at sub-state levels in the United States.

4.2. County Level Results

Table 5 shows the HDI, IHDI, and their corresponding components at the county level, limiting results to the 20 counties with the highest and lowest HDI values. The complete data for all counties (with a 2015 population of at least 2000) is available upon request. The top two counties in the table, Falls Church City, Virginia, and Middlesex, Massachusetts, have high HDI values for very different reasons: Falls Church City has a relatively low index value for health (0.892) but high values for education (0.928) and income (0.964). At the same time, the inverse is true of Middlesex, which has a high index value for health (0.946) but relatively low values for education (0.895) and income (0.896). Similar to what we saw in the HDI, analysis of the parts of the IHDI show considerable variability in which index determines whether a county has a high or low IHDI value. Consider, for example, Washtenaw County, Michigan (home to the University of Michigan as well as several other institutions of higher education) in row 8 in Table 5, which has average values for its inequality-adjusted health (0.740) and income (also 0.740) indexes, but a very high value for education (0.824). This sort of component analysis can benefit local policymakers needing to choose whether to spend limited resources improving health, educational, or financial outcomes for county residents.

Figure 7 presents the IHDI for 2015 and 2020 at the county level. The differing sizes of counties make visual analysis of specific counties difficult. Still, the map does show regional shifts over time in a way that is obscured at the state level. For instance, in 2020, the IHDI of counties in the south had risen relatively faster than in other parts of the country since 2015 (Figure 7). Figure 8 shows the loss due to inequality in all counties in 2020. Orange County is Florida's most equal county, which decreases from an HDI of 0.858 to an IHDI of 0.771 for a 10.2% loss in human development due to inequality. The worst is Crockett County, Texas, falling from an HDI of 0.803 to an IHDI of 0.446, a 44.4% loss due to inequality. The median loss due to inequality across counties in 2020 is 14.7%. Interestingly, the shading patterns in Figure 8 mirror the patterns in both panels of Figure 7, suggesting that the loss of human development due to inequality may be a significant determinant of how a county ranks on an inequality-adjusted well-being index such as the IHDI.

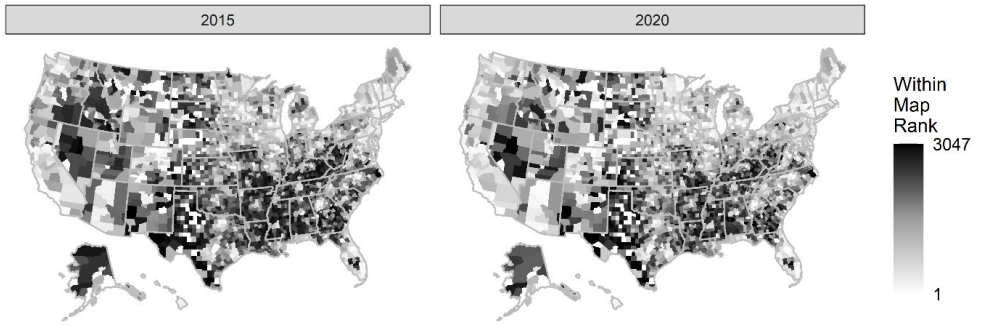

Figure 7. IHDI by County: 2015 and 2020

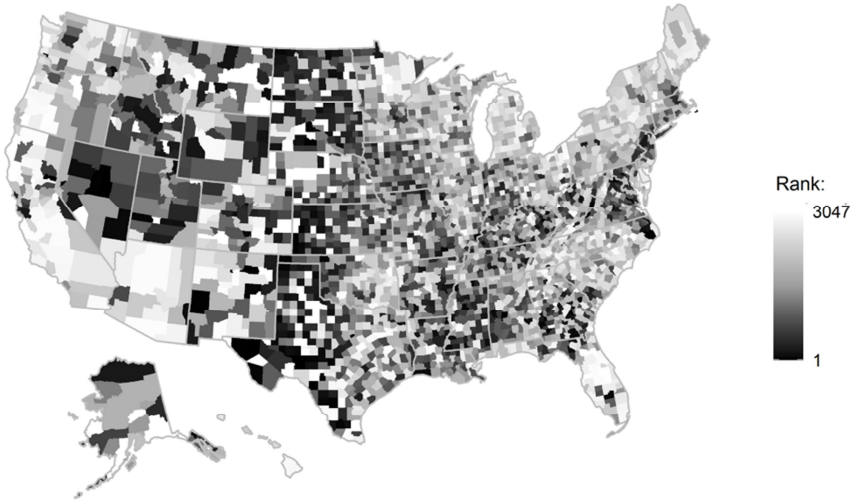

Figure 8. Loss of Human Development Due to Inequality by County: 2020

Table 6 shows similar patterns at the county level to what we observed at the state level in Table 1. For example, Camden County, North Carolina, ranked 813 out of 3047 counties for its 2015 IHDI, but in 2020 it had fallen to 2626 positions. This slide resulted from relative losses in all three dimensions of human development, but the loss of 2102 ranking positions in the education dimension is clearly the biggest reason for the steep slide. On the other hand, Jefferson County, Texas, had a very low IHDI ranking in 2015 (2769). Still, a moderate improvement in its ranking for the inequality-adjusted income dimension helped it climb far enough up the rankings to become an above-average county for IHDI (ranked 1311) in 2020.

Table 7 shows the GDI, HDI, IHDI, and loss due to inequality by gender in 2020 for the counties with the highest and lowest GDI (the ratio of female HDI to male HDI) values. This level of disaggregation complements the analysis presented at the state level

in Table 4. Unlike the states in Table 4, the top 20 counties in terms of GDI all have values over 1, indicating that women have higher levels of human development in at least the top 20 counties. Although the gender gap still favors men in most counties, policymakers can study these counties to see which actions might help narrow the male-to-female gender gap in other regions. The state of Utah, which ranked 50th for the GDI in 2015 and 2020, has three counties in the bottom 20 of Table 7. This level of disaggregation can be helpful at the county and state levels. For instance, policymakers at the state level hoping to narrow the human development gender gap statewide may choose to allocate state funds to address the disparity in Utah County (Utah's second-most populous county, ranked 19th from the bottom of Table 7) to help the state as a whole.

5. CONCLUSION

The GDP's inadequacy as a signal of a population's well-being is well-established. The previous empirical literature has provided alternative indicators that replace, supplement, and complement the GDP that quantifies well-being without depending exclusively on a region's measurable economic output. This work includes information at the county level for the United States that has not been measured before. Our contribution at this level of disaggregation aims to provide more evidence about the problems that exist due to inequality and how it affects the well-being of the U.S. population. Our findings stand as beneficial supplements to the GDP, and the results section shows how they provide a complete image of each state and county's economic and societal well-being.

Among the many alternative indicators of the GDP, the HDI's easy interpretability, the relative availability of its inputs, universality, and derivatives have made it one of the most well-known and accepted ways to compare nations. We build on previous work showing that the HDI and its derivatives are applicable at the subnational level. We highlight the lack of subnational alternatives to GDP and emphasize the need for additional metrics.

Data availability at the county level made it possible to estimate the IHDI, GDI, and GII following the UNDP methodology. Furthermore, the results complement existing HDI information by highlighting how inequality in the three dimensions of the HDI limits the United States from achieving its potential in terms of human development. This loss in potential human development is heterogeneous at the state and county levels and by region. The maps confirm that the country's southern region lags behind the rest regarding income, while other areas are more affected in health and education. The difference between the non-income metrics is evident when the Human Capital index is measured at the state level. Inequality also disproportionately affects women with lower HDI values than men, even before adjusting for inequality. The disaggregation at the county level makes it possible to highlight where specific policies are necessary for

gender equity.

We limit the scope of our database to the most common indices at the most common geopolitical levels (state and county in the United States). We do this in the hope that policymakers will use the HDI, IHDI, and GDI to compare the progress of counties and states in the same way nations are now compared. Despite this, an important criticism of the presented work is that our focus on assigning a metric to counties and states often draws arbitrary lines through communities. Our work provides a tool to policymakers at the state and county levels in the United States. Still, additional work should consider these same indicators and others using less arbitrary geographical boundaries (e.g., cities, metropolitan statistical areas, census tracts, and communities or neighborhoods). Additional indicators of well-being should also be calculated at the local level in countries outside the United States. One expected result in 2020 was a decrease in life expectancy due to COVID-19. The upward trend from the previous decades was disrupted and the years gained improving the health conditions were lost for most states.

COVID-19 was also a wake-up call for data collection, in which government offices suffer the problem of slow data release. The surge for alternative sources of data information about people's economic, social, health, and education conditions during the pandemic brought innovative ways to get the information in a much shorter time (i.e., Economic Tracker by Opportunity Insight, Weekly Economic Index by the New York Federal Bank, Household Pulse Survey Data by the U.S Census Bureau). Moreover, as data collection and aggregation worldwide continue to improve, we see no reason for large aggregators like the UNDP and the World Bank not to publish subnational indices for every country worldwide. As subnational-level policy tools, better economic performance indicators are needed to coordinate sustainable and equitable economic growth efforts. Our work makes it possible for researchers, policymakers, and political leaders who may have used GDP per capita in the past to compare the well-being of residents in states or counties in the United States now to use inequality-adjusted metrics of human development. Furthermore, the data estimated at the county level would help follow the achievement of some critical SDGs: SDG 3 Ensure healthy lives and promote well-being for all at all ages (life expectancy); SDG 4 Quality of education (expected years of schooling and average years of schooling); SDG 5 Gender equality (Gender Development Index) and SDG 8 Decent work and economic growth (Personal income). Communities interested in assessing how they are doing in terms of the SDGs will have in this database a first approach to the areas that need more attention in achieving these goals by 2030.

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