Scioto Analysis
Economics | Public Policy

Ohio Human Development Report

December 2023

Contents

1 Executive Summary

Through the use of the HDI formula, this study aims to achieve three primary objectives. First, to develop a 30-year time-series report of HDI data for Ohio, alongside a national HDI map. Second, to calculate and map HDI values across the 88 counties in Ohio. Last, to correlate HDI indicators with demographic factors, analyzing racial differences within Ohio.

We conducted analyses and HDI calculations using data from the 5-year American Community Survey (ACS), the Bureau of Economic Analysis (BEA), and reports from the Ohio Department of Development. Additionally, a comparative study was made using Global Data Labs (GDL) Subnational HDI calculations and data, allowing for an in-depth contextualization of Ohio's well-being over a three-decade time frame as well as comparisons to the other 49 states over the same period.

After the completion of these objectives, it was evident that Ohio's HDI values have been steadily increasing over time. Similarly, demographic trends across the three components and county HDI levels have also been increasing, with the exception of life expectancy values in 2020, aligning from the COVID-19 pandemic. Clear differences among demographics were found for income levels, life expectancy, and mean years of schooling. Minorities in Ohio were found to have lower values among all three HDI components than white Ohioans, with the exception of Asian Ohioans who have both the highest average earnings and mean years of schooling values among Ohioans, and Hispanic Ohioans who were found to have the longest life expectancy.

2 Introduction

The Human Development Index (HDI) was developed by the United Nations in 1990 to measure national development in a more holistic sense than the economic indicators used previously.[1] While HDI is commonly used to compare development between nations, it has not been broadly used in a subnational context due to a focus on the use of GDP. In this report our research goal is to use the HDI formula to analyze and create human development comparisons between states and counties within Ohio while including critical quality of life indicators. We developed three

1. United Nations. "Human Development Index." Human Development Reports, July 17, 2023. https://hdr.undp.org/data-center/human-development-index/indices/HDI.

research objectives to complete this aim. First is to analyze HDI on a state level which we completed by developing a 30-year time series report for Ohio, alongside a national HDI map, by utilizing Global Data Labs (GDL) Subnational HDI calculations and data. Our second objective was to analyze HDI on a county level and geographically map HDI values for Ohio through data collection from the 5-year American Community Survey (ACS), the Bureau of Economic Analysis (BEA), and reports from the Ohio Department of Development. Our final objective was to correlate HDI indicators with demographic factors, using the same dataset described above.

This report is organized into four chapters. In the first chapter, we present HDI on a state level, our methods, HDI comparisons to other Midwestern regions, and our results for HDI values both in Ohio and at a national level. Chapter two looks at HDI on a county level, and provides our methods, data insights, and a HDI county map. In chapter three, we analyze racial demographic factors within Ohio by looking at each HDI. Chapter four presents the implications of our report.

HDI: A Capabilities Approach

Studies on well-being are performed with a variety of perspectives. Often, this drives the relevance and usefulness of the results. By taking a Capabilities Approach, both the freedom to achieve well-being and the ability to do so is of primary moral importance and well-being is understood in terms of people's capabilities and ability to function.[2]

A capabilities approach utilizes the Human Development Index to assess what people are able to achieve and how they function. Seeing as the HDI investigates health, education, and income, we are able to look at three ways that society is performing. We are then able to see the ways in which Ohio counties are not meeting their full potential in comparison to other counties and neighboring states. Our analysis using this measure highlights how Ohioans are faring and will help policymakers make thoughtful choices on ways to improve communities and assets.

The strengths of this approach outweigh the traditional use of GDP, which fails to consider multidimensional aspects of standards for living. For instance, GDP excludes major factors of well-being such as health and education. However, an HDI considers

2. Robeyns, Ingrid, and Morten Fibieger Byskov. "The Capability Approach." Stanford Encyclopedia of Philosophy, December 10, 2020. https://plato.stanford.edu/entries/capability-approach/.

how health and education in addition to economic factors are important to assessing the well-being of one's life. Considering these aspects provides an opportunity for analysts and policymakers to consider how each factor contributes to the overall well-being of different groups or society as a whole. Utilizing these elements, the tool serves as a useful guide for policymaking to improve social welfare planning, community development, economic growth, and additional quality of life improvements.

How is HDI Calculated

The Human Development Index utilizes income, education, and health variables. These variables are calculated in the formula: $HDI = (I_{Health} \cdot I_{Education} \cdot I_{Income})^{1/3}$

Comparison to Other Measures of Well-Being

Standard analysis of development is normally done through the narrow lens of economic development. In the context of the United States, Gross Domestic Product (GDP) is the way growth and development are typically measured. Alternative measures of economic health and well-being to GDP and HDI include the Better Life Index (BLI) and the Genuine Progress Indicator (GPI). The BLI focuses on social well-being, including material living conditions and quality of life, while the GPI identifies the cost and benefit trade-offs of economic growth among environmental, economic, and social categories.[3] While these indicators have value, they tell a different story than wellness as it relates to a capabilities approach. Due to HDI's focus on overall well-being and its use in a capabilities approach, this report utilizes HDI in comparison to GDP as a chosen measure of well-being.

GDP measures the total value of goods and services produced in a country in a given period of time.[4] GDP informs policymakers, businesses, and investors, both on a domestic and global scale. This measurement is useful when considering economic development, but there are many critiques when it relates to what GDP measures and

3. Grittayaphong, Praew. "Beyond GDP: Three Other Ways to Measure Economic Health." Saint Louis Fed Eagle, May 9, 2023. https://www.stlouisfed.org/open-vault/2023/apr/three-other-ways-to-measure-economic-health-beyond-gdp.
4. "GDP Is the Way We Measure the U.S. Economy and Its Growth ...," Bureau of Economic Analysis , accessed November 10, 2023, https://www.bea.gov/system/files/2020-04/GDP-Education-by-BEA.pdf.

does not measure. Some examples of goods GDP does not include are unpaid work, informal markets, and negative externalities. Additionally, GDP focuses on economic well-being and does not address health and education[5] of residents. Overall, GDP is incomplete when it comes to measures of welfare.

Showing the Difference Between GDP v HDI in 2021

While there is some correlation between the different state's respective HDIs and GDPs, that is to be expected. One of the three components of HDI is GDP. However, the data in Figure 1 shows that the correlation is not perfect.

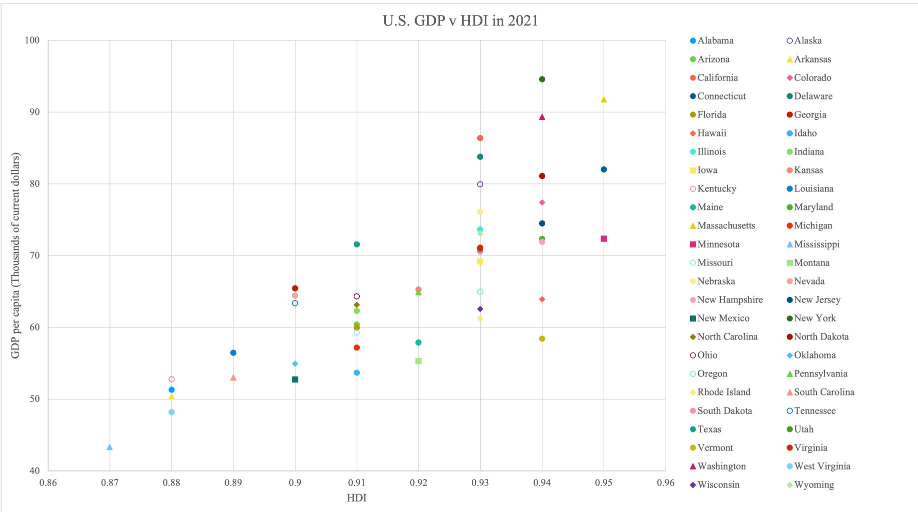

Figure 1: GDP Scatterplot Comparison to HDI for the United States in 2021

The data follows a heteroskedastic pattern, with a higher correlation between low HDI and low GDP which diminishes as GDP increases. In terms of human development, the marginal benefit of economic measures diminishes as they increase. This shows that there are some aspects of development not captured in GDP that can be found within HDI. The data shows that HDI has a unique ability when trying to identify wellness due to these different components. While GDP has its own uses, HDI's scope is larger and more varied.

5. "Gross Domestic Product: An Economy's All," IMF, June 15, 2019, https://www.imf.org/en/Publications/fandd/issues/Series/Back-to-Basics/gross-domestic-product-GDP.

3 HDI on a State Level

State HDI Time Series

Our primary objective is to create a time series of HDI values for the entire state of Ohio spanning from 1990-2021. A time series seeks to evaluate the growth or decline of Ohio HDI over time. To accomplish this objective, our first goal was to seek out a well-defined, well-used, and theoretically-sound methodology for calculating HDI. We follow the United Nations' methodology for calculating HDI as it is the most commonly-used and widely-accepted method of calculation of human development. In seeking out the best methods for accomplishing our objective, we utilized the work of the Global Data Lab (GDL), an independent research center of the Institute for Management Research at Radboud University in the Netherlands.[6]

GDL researchers used the United Nations' methods for calculating HDI to create a database of national and subnational HDI values. The subnational HDI dataset became the foundation for our Ohio HDI time series. Using subnational HDI values from other U.S. states, we compared Ohio to its neighboring Midwestern states and West Virginia.

Global Data Lab & UN Method

- HDI: GDL subnational calculation using the UN formula:
  - $HDI = (I_{Health} \cdot I_{Education} \cdot I_{Income})^{1/3}$

6. Global Data Lab "Mission: Turning Data into Knowledge." Global Data Lab, 2023. https://globaldatalab.org/about/mission/.

- Health: Life expectancy at birth
    - The equation $Health\ Index = \frac{Actual\ Value - Minimum\ Value}{Maximum\ Value - Minimum\ Value}$ was used to index life expectancy values. The maximum and minimum values of 85 and 20 were used, in accordance with the United Nations.
- Education: Mean years of schooling of adults aged 25+ and Expected years of schooling of children age six
    - The equation of $I = \frac{Actual\ Value - Minimum\ Value}{Maximum\ Value - Minimum\ Value}$ was used for the calculation of both the mean years of schooling index and the expected years of schooling index. Maximum and minimum values of 18 and 0 were used for expected years of schooling, and maximum and minimum values of 15 and 0 were used for mean years of schooling, the same values and equation used by the United Nations.
    - The equation $Education\ Index = (I_e + I_m)/2$, where I_e = the expected years of schooling index value and I_m = the mean years of schooling index value, was used in accordance with the United Nations calculations.
- Standard of living: Gross National Income per capita (PPP, 2011 US$)
    - GNI per capita was indexed by the formula:

$$I = \frac{\ln(x) - \ln(Minimum\ Value)}{\ln(Maximum\ Value) - \ln(Minimum\ Value)}$$

    where x = the gross national income per capita value of the respective area. The minimum value of 100 and maximum value of 75,000 were used in accordance with the United Nations calculations. The natural logarithm of each value is used in order to weigh increases in low incomes more highly than increases in already high incomes.
    - Income per capita values are adjusted for inflation, but are not adjusted for the cost of living.[7] To create the Subnational HDI, researchers calculated the subnational variation in the three indicators and applied it to the national-level data obtained from the United Nations Development Programme. The subnational values are determined using indicators from the Area Database for low-and middle-income countries (LMICs) and statistical offices for high-income countries (HICs). As GNI per capita and life expectancy data is not always available on a subnational level such as

7. Smits, J., and I. Permanyer. 2019. "Subnational Human Development Database." Nature Scientific Data 6 (190038). https://doi.org/10.1038/sdata.2019.38.

household surveys or census data sets, estimates are derived from under-five mortality and household wealth from the International Wealth Index.[8]

Comparing Ohio HDI to Midwest and West Virginia HDI Values

The Midwest region has some of the largest variance between HDI scores. Historically the region has been a mix of industrial and agricultural hubs. It is home to some of the nation's largest cities, such as Chicago, but still meets a considerable amount of the country's agricultural needs. This combination of rural and urban has given the region an interesting HDI composition. Over the course of two decades, Midwestern HDI has changed and shifted to develop trends unique to the region. These patterns of HDI can be seen in Figure 2.

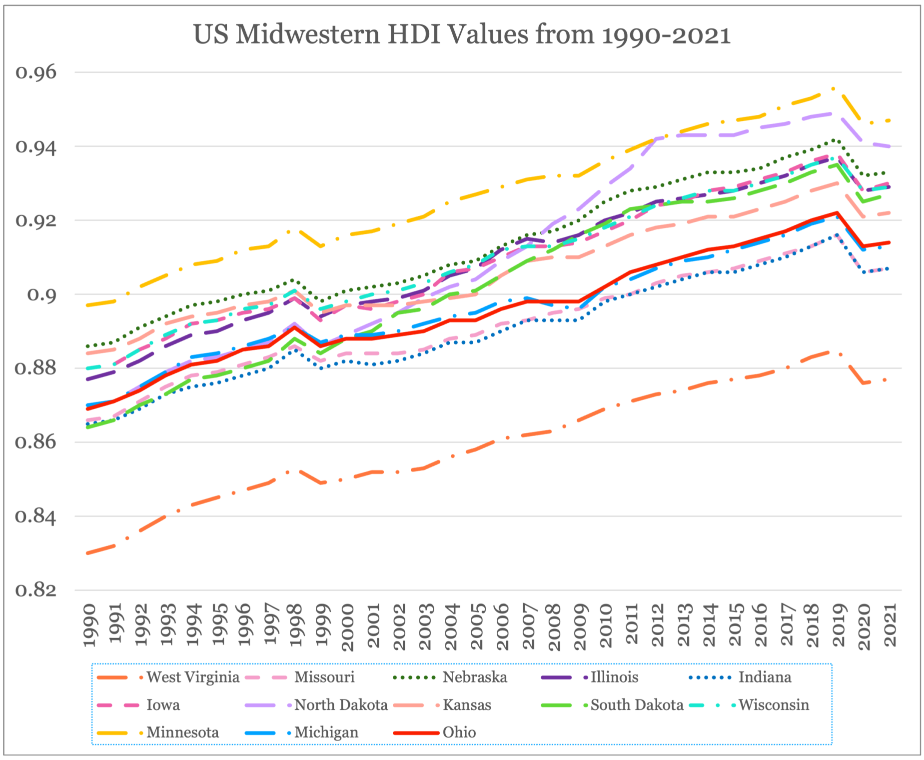

Figure 2: US Midwestern HDI Value From 1990-2021

8. Ibid.

Results: US Midwestern HDI Values From 1990-2021

Compared to other midwestern states, Ohio HDI ranks in the mid-low range, but vastly outpaces the neighboring state of West Virginia. Ohio HDI values mirror Michigan through the duration of the time series. Starting in the year 1999, Nebraska, Illinois, and Indiana began to outpace Ohio and other midwestern states. North Dakota has seen the greatest change in HDI over the time series, specifically growing exponentially between 1999 and 2012. However, South Dakota has also grown notably, moving from one of the lowest HDIs in the Midwest to the middle of the grouping. Minnesota trends upwards with the consistently highest HDI in the midwest, closely followed by Nebraska after 2012.

Comparing Ohio HDI and the Income, Education, and Health Index Values

In order to understand which of the three components drives HDI we illustrated the indexed value of each component (health, education, and income variables) and compared it to HDI as shown in Figure 3.

Compared to the other two HDI components, the income index values in Ohio are consistently higher than both the educational and health index values, showcasing how Ohio is lagging behind in non-economic areas of development. The above graph showcases several shifts in HDI component values over time. Notably, education index values saw a sharp decrease in 1999, then a slow return to 1998 levels by 2009. Health index values rose consistently until 2013, at which point the health index values stayed fairly stable until a sharp decrease in 2020, aligning with the COVID-19 pandemic.

State HDI Values

In addition to a focused look on Ohio's HDI and the broader Midwest, we visualized State HDI values across the United States to provide a nationwide comparison using GDL values. Figures 4 and 5 show mapped HDI values from the years 1990 and 2021, respectively. An interactive version of these maps are available in Appendix A including additional years of data.

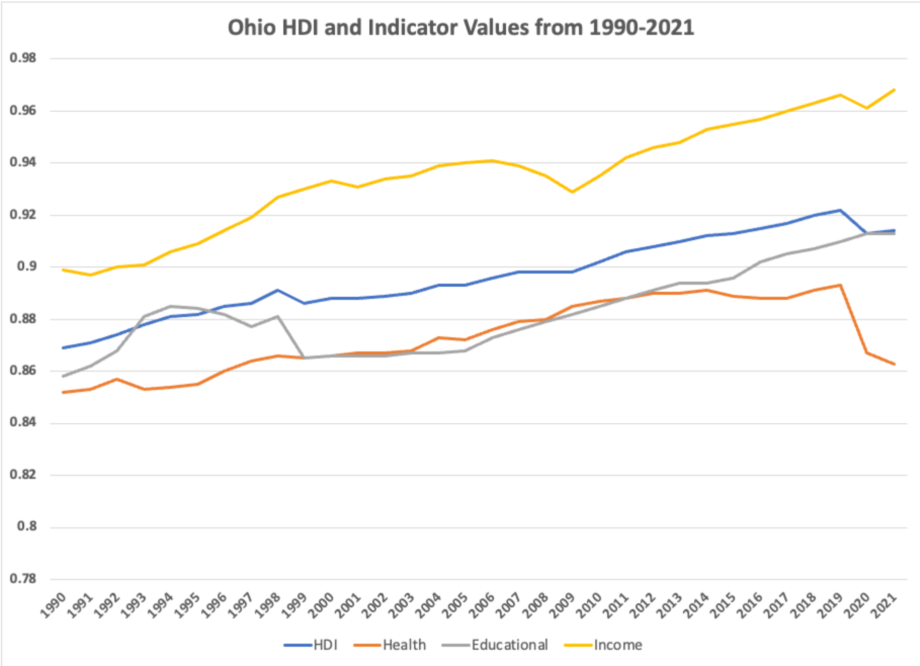

Figure 3: Comparing Ohio's HDI, Income, Education, and Health Index values from 1990-2021

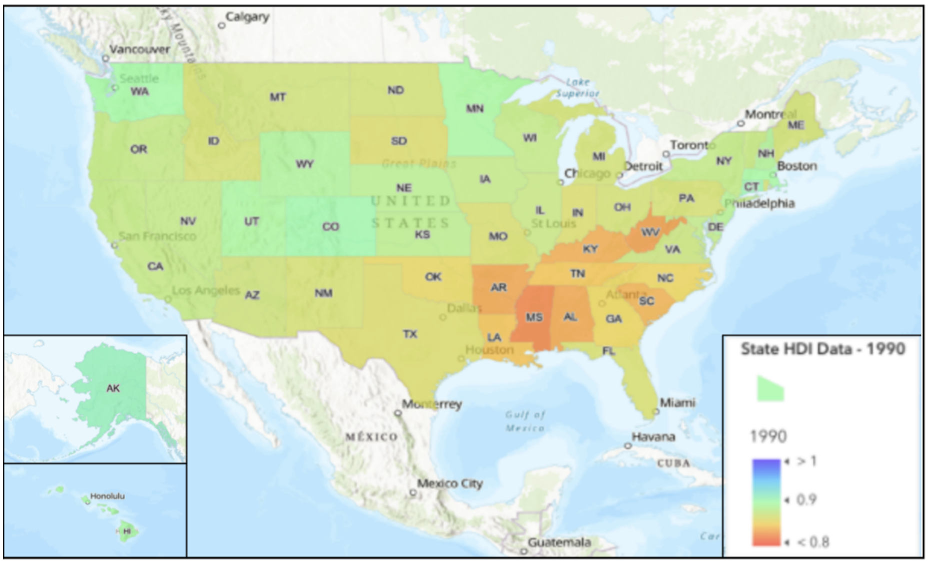

Figure 4: State HDI Values, 1990

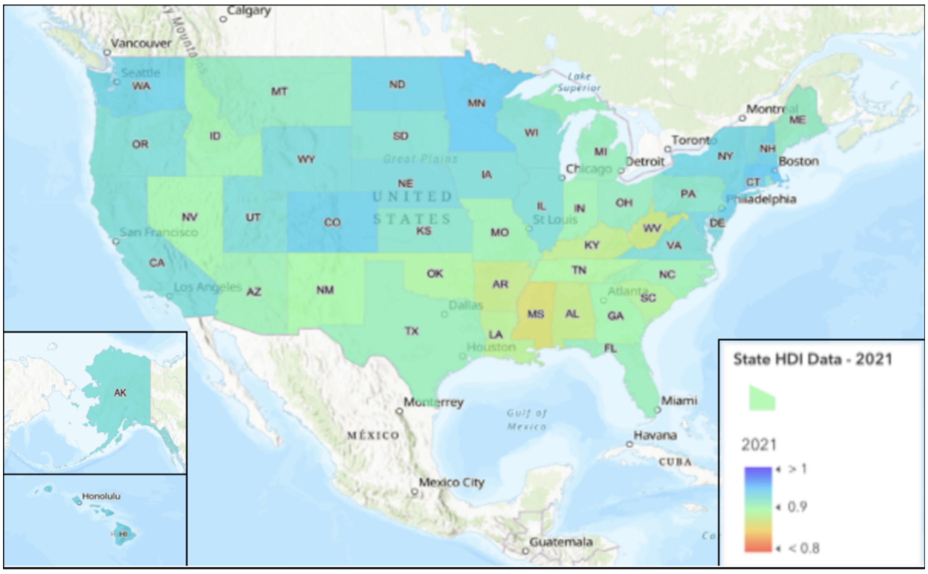

Figure 5: State HDI Values, 2021

Mapped HDI values show a general increase nationwide from 1990 to 2021. Over this period, Appalachian states have lower HDI values, while western and coastal states have higher HDI values. The upper midwest (Minnesota, Wisconsin, North Dakota, and South Dakota) are increasing in HDI more than some of the lower midwest (Kansas, Missouri, and Oklahoma) over the past few decades despite being similar in the 1990s. One should also note how the New England states (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont) along with Mid-Atlantic states (Delaware, New Jersey, New York, and Pennsylvania) and the National Capital Region (Maryland, Virginia, and the District of Columbia) are in a cluster of similarly improved HDI. The flow of heightening HDI goes into the Southeastern states (Florida, Georgia, North Carolina, and South Carolina) which are doing better than the southern states (West Virginia, Kentucky, Tennessee, Alabama, Mississippi, Louisiana, and Arkansas). The industrial Midwest (Illinois, Indiana, Ohio, and Michigan) is gradually growing in HDI between the high HDI Mid-Atlantic and Upper Midwest regions. Of the mountain states (Colorado, Idaho, Montana, Nevada, and Utah), Colorado and Utah HDI have improved the most from 1990-2021. Lastly, southern border states (Texas, New Mexico, and Arizona) have a lower HDI over the period in comparison to states on the Canada to United States Border.

4 HDI on a County Level

Ohio County HDI Calculations

Our second objective was to calculate the HDI values for each county in Ohio and create a map using those values to create a comparison of the counties. Since HDI is created for a much larger scale, we had to adjust some of the components in order to create a cohesive, coherent HDI measure. The components we chose were life expectancy, mean years of schooling, and income per capita in each county.

County HDI Calculation Methods

In order to calculate HDI on the county level, we utilized the same formula as both the United Nations and Global Data Labs, $HDI = (I_{Health} \cdot I_{Education} \cdot I_{Income})^{1/3}$. However, in the county analysis due to incomplete and missing data, we solely relied on mean years of schooling served as the Education component. We derived mean years of schooling data from the United States Census Bureau American Community Survey, specifically the 5-year estimates from the years 2019-2021. We then slightly adjusted the income component to income per capita in each county instead of GDP due to a higher exchange rate of goods and services on a county level, which tends to inflate metropolitan counties and discount rural ones. These data were obtained through the U.S. Department of Commerce's Bureau of Economic Analysis. Data for all three years was available excluding the fourth quarter of 2022, where the first three quarters were averaged across each other. The per capita incomes were then inflation adjusted to January 2022 USD. We found life expectancy data through the County Health Rankings and Roadmaps and the National Center for Health Statistics' Mortality Files. Each of these components was indexed and normalized using the UN's formulas. Education and Life Expectancy used the formula: $I = \frac{Actual\ Value - Minimum\ Value}{Maximum\ Value - Minimum\ Value}$ where the actual value was the county's measure and the maximum and minimum values were based on the UN's official recommendations for these calculations. Education's minimum value was 0 years of schooling and its maximum was 15 years. Life expectancy's minimum value was 20 years lived and its maximum was 85 years. Income is calculated and normalized logarithmically using the formula:

$I = \frac{\ln(Maximum\ Value) - \ln(Minimum\ Value)}{\ln(Maximum\ Value) - \ln(Minimum\ Value)}$.[9] Once the components were indexed, they were used in the final HDI calculation. After all the county HDIs were calculated, they were mapped using ArcGIS.

Results: Highlighting Ohio County HDI Values

To demonstrate HDI values within Ohio on a county level, we mapped these values from 2019-2021. Figure 6 demonstrates these HDI values on a three-year time series across the state.

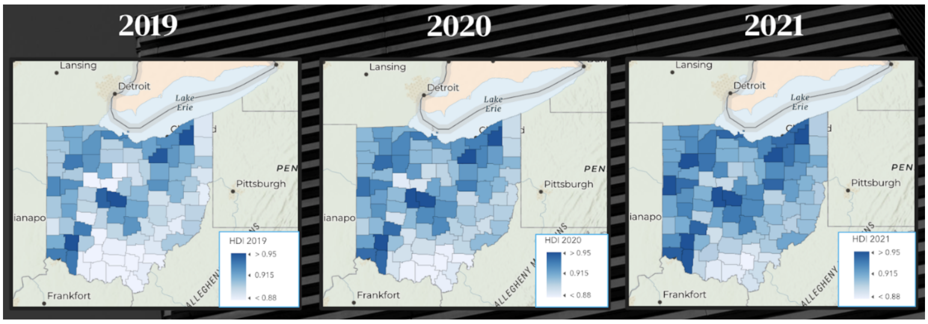

Figure 6: Ohio County HDI 2019-2021

HDI values across all Ohio counties increased slightly from 2019 to 2021. Appalachian counties demonstrate lower HDI values compared to other Ohio counties. Counties which contain suburbs of major cities have the highest HDI values and are followed by their respective urban counties.

From 2019 to 2021, Southern, Appalachian counties and Crawford, Wyandot, and Hardin counties in the Northeast have the lowest HDI values in Ohio. These are largely rural and farming-based communities. High-HDI counties include Delaware, Union, Summit, Geauga, Warren, Clermont, and Hamilton counties. These counties are largely major metropolitan and surrounding counties, often suburban.

A notable exception to this trend is in Holmes county, a rural farming-oriented community, which contains Ohio's largest Amish population.[10] Holmes county has one of the highest HDI values in the state in 2021 and an obvious increase from 2019.

9. "Technical Notes." Human Development Report, 2020. https://hdr.undp.org/system/files/documents//technical-n

10. The Young Center. "Twelve Largest Settlements, 2021." Amish Studies, 2021. https://groups.etown.edu/amishstudies/statistics/twelve-largest-settlements-2021/.

Select Ohio County HDI Values

In addition to mapping county HDI, we graphed HDI values of specific Ohio counties to further emphasize HDI disparities. Figure 7 shows counties with the highest HDI (Delaware), the lowest HDI (Jackson and Adams), and mid-level HDI (Franklin, Cuyahoga, and Hamilton).

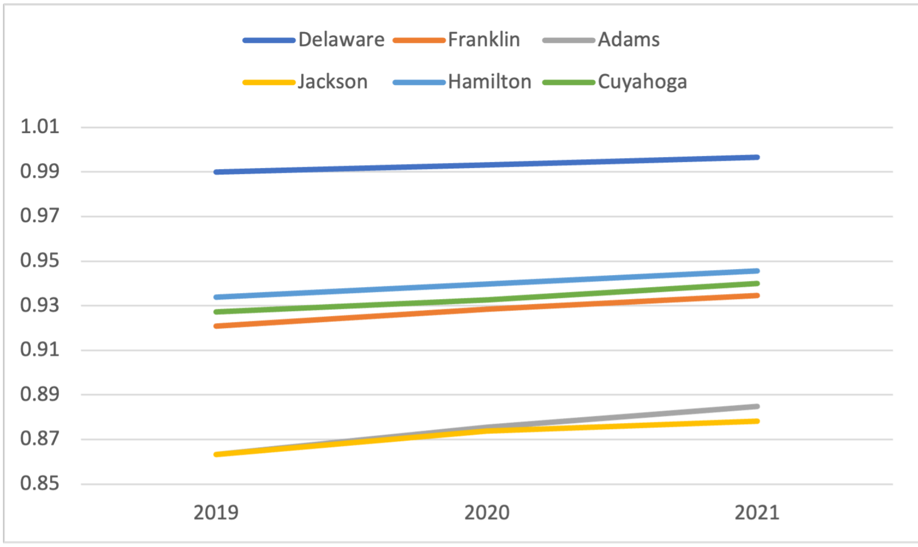

Figure 7: Select Ohio County HDI Values 2019-2021

While Delaware has the highest HDI, its growth over three-years is more stagnant compared to Jackson and Adams. Hamilton, Franklin, and Cuyahoga, which are home to Ohio's metropolitan centers of Cincinnati, Columbus, and Cleveland, respectively, have nearly equal HDI which shows that well-being amongst cities does not vary greatly in Ohio.

It is evident that when considering measuring and improving well-being on a county-level, policy-makers should consider how targeting programs to specific geographic regions can reduce inequities in well-being across the state. Mapping HDI by county demonstrates a clear need for support in rural Ohio counties, particularly those in Southern Ohio.

5 Ohio HDI Indicator Demographics

HDI Indicator Demographic Analysis

Within the state of Ohio, we disaggregated the data by race and ethnicity in order to observe trends in human development between different racial and ethnic groups in the state. We completed this analysis with the hopes of showcasing which Ohioans are being left behind throughout the state's continued development. The following methods were used in our racial/ethnic breakdown of Ohio HDI components:

Methods

We conducted our demographic analysis using HDI indicators on data from the United States Census Bureau, Ohio Department of Health (ODH),[11] and American Community Survey 5-year estimates. For the life expectancy breakdown, it is important to recognize that life expectancy is only sometimes calculated and is difficult to obtain. Due to this, the ODH's data regarding life expectancy at age 65 was the most comprehensive and diverse set that we could find. This data set allowed us to see certain health trends over the course of 10 years, however only data for those identifying as white, Hispanic, and African-American was available in the dataset.

We derived demographic income data from the Census Bureau's LED Extraction Tool,[12] where monthly earnings at the beginning of the quarter were averaged across all reporting Ohioians and separated by those identifying as the race "White Alone," "Black or African American Alone," "American Indian or Alaska Native Alone," "Asian Alone," "Native Hawaiian or Other Pacific Islander Alone," and "Two or More Race Groups." We also separated average monthly earnings at the beginning of the quarter by those identified by the ethnicities "Not Hispanic or Latino," and "Hispanic or Latino." The data was available from the years 2000 to 2022, excluding the last quarter of 2022 and the first quarter of 2000. We then multiplied the data by 12 in order to be framed in a yearly context and adjusted for inflation to January 2023 USD.

11. "Ohio State Health Assessment." Online State Health Assessment, October 5, 2022. https://odh.ohio.gov/explore-data-and-stats/interactive-applications/2019-online-state-health-assessment.
12. "LED Census Extraction Tool." United States Census Bureau, 2023. ledextract.ces.census.gov

We obtained demographic education data through the 5-year American Community Survey (ACS) for Ohio for years 2015 through 2021. These specific years were the only ones that had educational attainment data in relation to demographics. From each consecutive data set, we extrapolated the following variables; the estimated total educational attainment for "White Alone, not Hispanic or Latino," "Black or African American Alone," "American Indian or Alaska Native Alone," "Asian Alone," "Native Hawaiian or Other Pacific Islander Alone," and "Hispanic or Latino." Then we collected the estimated total of each previously mentioned race receiving a "Bachelor's Degree or higher." We then divided the estimated total receiving a bachelor's degree or higher by the estimated total educational attainment for each race. We completed this for each year to get a percentage of each demographic population receiving a bachelor's degree.

Results

Average Yearly Income Earnings

As shown by Figure 8, average earnings rose slightly among each demographic from 2000 to 2022, however some demographics did see more of an increase, with Hispanic/Latino and Hawaiian/Pacific Islander seeing the largest increases. Earnings varied greatly by demographic as well, with Asian Ohioans earning $15,590 more on average in 2022 than the next highest earning demographic, White Ohioans. Black Ohioans earned the least on average of every demographic, followed by those of 2 or More Races earning the second least, Native/Alaskan Native Ohioans earning the third least, and Hispanic/Latino Ohioans earning the fourth least, demonstrating the income inequalities found throughout Ohio.

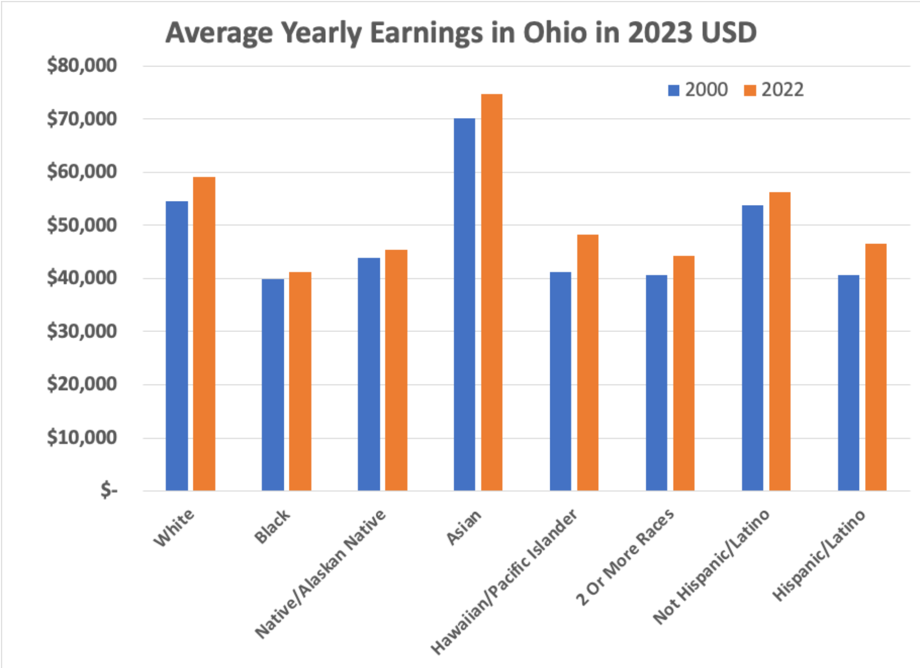

Figure 8: 2000 and 2022 Average Yearly Earnings per Employee in Ohio By Race in 2023 USD

Life Expectancy for Different Races in Ohio

Based on the data available, figure 9 depicts the trends in life expectancy for three different ethnic communities: White, Hispanic, and African-American. Consistent with historical trends, the Hispanic community in Ohio tends to live longer lives while African Americans have the shortest life expectancy. White Ohioans had the most consistency in their life expectancy over the years compared to their counterparts. In 2020, there was a significant dip in life expectancy for all three groups due to the pandemic. However, it can be seen in the figure below, that the decrease in both Hispanic and African Americans was steeper than for White Ohioans.

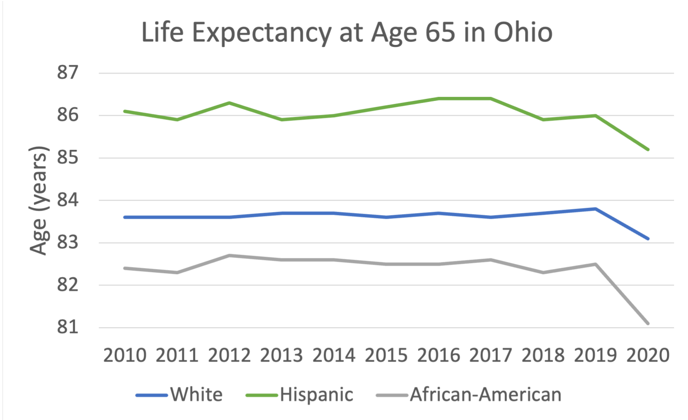

Figure 9: Life Expectancy for Different Races in Ohio Over 10 Years

Demographic Changes in Bachelor's Degree or Higher Recipients

There are clear trends in the percentage change in demographics from 2015-2022 as shown in Figure 10. First, the Asian demographic consistently has the highest percentage of their population receiving a bachelor's degree or higher. However, it peaked with its highest percentage in 2015 at 0.63. It dropped in 2016 at 0.61 and is now steadily increasing, but has not reached its 2015 percentage. The American Indian or Alaska Native population steadily increases to 0.19, but then sharply drops after 2020 to 0.15 in 2021. Besides this group, all of the other demographic groups' percentages steadily increased even during the COVID-19 pandemic.

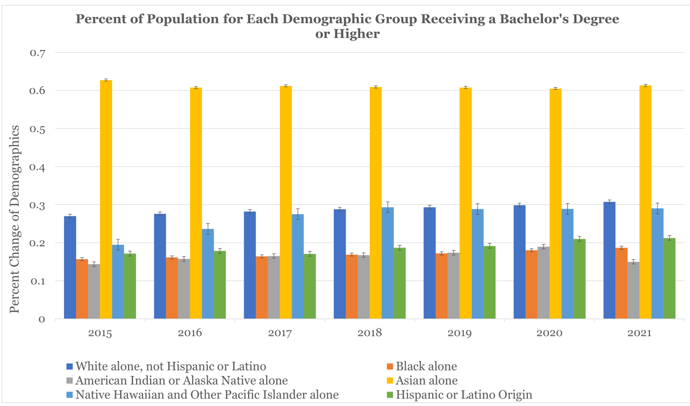

Figure 10: Demographic from 2015-2022 Based on Receiving a Bachelor's Degree or Higher

6 Future Implications

Implications

The Human Development Index offers valuable data points for trend analysis by demographics such as race, location, gender, and other components that help to reveal influences on quality of life. Due to the innate ability of HDI to display relationships between variables, such as mean years of schooling and life expectancy, our findings could be insightful in the use of evidence-based policymaking by showcasing where improvements should be made to increase the overall development of Ohio. Further, by simultaneously implementing a capabilities approach in our analysis, we were able to determine how both geographic factors and racial inequalities can limit access to the societal development experienced by Ohioans. Through our assessment of geographic and racial differences in HDI and its three components, policymakers will now have the ability to better see which areas of development are lagging behind and should be targeted to better benefit the state of Ohio. For instance, Appalachian counties demonstrate lower HDI values compared to other Ohio counties (which are largely rural and farming-based communities) could be supported through adaptations made to policy concerning support for farmers. Other data trends will likely also spur demand for strategic policy change that better addresses both the racial and geographic inequalities identified in this report, as well as the lower health and education levels throughout the state of Ohio (Figure 11). The evidence of reports such as the one presented here will help to inform governments and leaders on options to best accomplish their objectives.

Figure 11: Outline of Key Policy Making Process From The Green Book (HM Treasury, 2020, Box 2 page 6), amended to add well-being considerations and background research stage

A Map Data

Interactive results of our State and County HDI maps can be found on the following sites:

(a) State HDI Map

(b) Ohio County HDI 2019-2021

(a) State HDI Time Series (All Years)

(b) Interactive HDI Maps

B Additional Methods

Mean Years of Schooling Methods

Using Census Bureau data our team calculated the Mean Years of Schooling by county in Ohio. We only utilized survey data material including specified years of schooling attainment. By doing so, we found the total portion of the survey respondents and discerned five different attainment levels; “Estimate Population 18 to 24 years High School graduate”, “Estimate Population 25 years and over less than 9th grade”, “Estimate 25 years and over High School Graduate, “Estimate Population 25 years and over Associate Degrees”, and “Estimate 25 years and over Bachelor’s degree”. Next, we found how many people were sampled in each county by adding the number of participants of each district together.

We took note of the number of years involved for each attainment level; for example, someone who answered as “25 years and over less than 9th grade” was noted as completing 10 years to indicate K-9th grade. The same process was repeated for the other response options. These steps set the foundation for our future calculations that would reveal the Mean Years of Schooling by County.

The next process involved finding the sum product of the number of years completed by the number of people in the county who completed the survey in order to find the total number of school years completed by that county.

Example: “Years of Schooling High school 18-24” = 13 years of schooling,

Adams County Population who selected “Years of Schooling High School 18-24” = 1,099 people 13 years x 1,099 people = 14,287 years of schooling completed in total by that population.

Once this was completed for each variable the product was divided by the total number of survey respondents per county to find the average years of schooling per-person in that county.

Example: 14,287 / Sum of total respondents (“Estimate Population 18 to 24 years High School graduate” + “Estimate Population 25 years and over less than 9th grade” + “Estimate 25 years and over High School Graduate” + “Estimate Population 25 years and over Associate Degrees” + “Estimate 25 years and over Bachelor’s degree”) = Average Years of Schooling Per-person in Adams County.

This calculation was repeated for each variable using the respective years of schooling; the sums were added together to get the total Mean Years of Schooling across all categories for each county.

Map Methods

To construct a visual time series, we imported the data from the GDL as a CSV file, cleaned it to retain only US state HDI values, and constructed a web layer in ArcGIS online to display our results. From the web layer, we generated an interactive map. The map displays HDI values for 50 states and the District of Columbia from 1990-2021.

C Data Index

Dataset #1: EducationData(2015)_xlsx

Source: 5-Year American Community Survey: https://www.census.gov/data/developers/data-sets

Description: This data includes the following information on mean years of schooling by county in Ohio: estimate total population per years of schooling variable, survey response quantity, calculated mean years of schooling, and demographic education data. This data was used to produce Figure 10 in the report.

Dataset #2: EducationData(2016)_xlsx

Source: 5-Year American Community Survey: https://www.census.gov/data/developers/data-sets

Description: This data includes the following information on mean years of schooling by county in Ohio: estimate total population per years of schooling variable, survey response quantity, calculated mean years of schooling, demographic education data. This data was used to produce Figure 10 in the report.

Dataset #3: EducationData(2017)_xlsx

Source: 5-Year American Community Survey: https://www.census.gov/data/developers/data-sets

Description: This data includes the following information on mean years of schooling by county in Ohio: estimate total population per years of schooling variable, survey response quantity, calculated mean years of schooling, demographic education data. This data was used to produce Figure 10 in the report.

Dataset #4: EducationData(2018)_xlsx

Source: 5-Year American Community Survey: https://www.census.gov/data/developers/data-sets

Description: This data includes the following information on mean years of schooling by county in Ohio: estimate total population per years of schooling variable, survey response quantity, calculated mean years of schooling, demographic education data. This data was used to produce Figure 10 in the report.

Dataset #5: EducationData(2019)_xlsx

Source: 5-Year American Community Survey: https://www.census.gov/data/developers/data-sets

Description: This data includes the following information on mean years of schooling by county in Ohio: estimate total population per years of schooling variable, survey response quantity, calculated mean years of schooling, demographic education data. This data was used to produce Figure 6, Figure 7, and Figure 10 in the report.

Dataset #6: EducationData(2020)_xlsx

Source: 5-Year American Community Survey: https://www.census.gov/data/developers/data-sets

Description: This data includes the following information on mea years of schooling by county in Ohio for the year 2020: estimate total population per years of schooling variable, survey response quantity, calculated mean years of schooling, demographic education data. This data was used to produce Figure 6, Figure 7, and Figure 10 in the report.

Dataset #7: EducationData(2021)_slsx

Source: 5-Year American Community Survey: https://www.census.gov/data/developers/data-sets

Description: This data includes the following information on mea years of schooling by county in Ohio for the year 2021: estimate total population per years of schooling variable, survey response quantity, calculated mean years of schooling, demographic education data. This data was used to produce Figure 6, Figure 7, and Figure 10 in the report.

Dataset #8: percapitaincomebycountyinohio_xlsx

Source: Bureau of Economic Analysis: https://www.bea.gov/data/income-saving/personal-income

Description: This data includes the following information on per capita income by county in Ohio: personal income. This data was used to produce Figures 6, 7, and 8 in the report.

Dataset #9: BeginngQuarterMonthlyEarnings.xlsx

Source: US Census Bureau LED Extraction Tool

https://ledextract.ces.census.gov/

Description: This dataset was used to determine mean income per capita by race/ethnicity in our demographics section. Used to produce figure 8.

Dataset #10: StateHDI.xlsx

Source: https://globaldatalab.org/shdi/table/

Description: This dataset shows subnational HDI globally. It was cleaned to show State HDI values within the United States and produced the interactive map time series and figures 4 and 5.

Dataset #11 Ohio 2019-2021 Summary Report

Source: County Health Rankings and Roadmaps

https://www.countyhealthrankings.org/explore-health-rankings/ohio/data-and-resources

Description: This dataset contains the life expectancy data used in the county-level HDI calculations, taken from the mortality files.

Dataset #12 County HDI Calculations

Source: https://buckeyemailosu-my.sharepoint.com/:x:/g/personal/williams_7496_buckeyemail_

Description: This dataset is the Excel file with our completed HDI calculations done on the county level.

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