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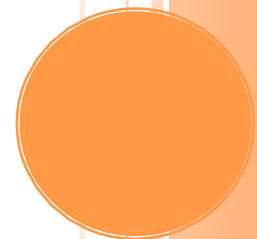
# OHIO'S ECONOMY: 2009-2016

*Assessing Ohio's Recovery from the Great Recession*

Using a comprehensive measure of economic progress, we determine that Ohio's economy has rebounded well from the Great Recession. At the same time, rising inequality has dampened Ohio's recovery, limiting per-capita economic progress over the time period. Policymakers must balance goals of increasing personal consumption with strategies to reduce inequality in order to create sustained economic growth in the future.

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# OHIO'S ECONOMY: 2009-2016

## *Assessing Ohio's Recovery from the Great Recession*

### OVERVIEW: OHIO'S ECONOMIC PERFORMANCE

The statistic most associated with economic performance is gross domestic product (GDP), which is the sum of the value of all goods and services exchanged in the economy. While gross domestic product has done a good job of giving us an overall view of the economy, the measure leaves out some important components of economic performance. For instance, gross domestic product does not capture the value of housework, so if someone decides to hire a housekeeper and stop cleaning her own house, gross domestic product rises while services in the economy do not increase. Similarly, gross domestic product counts purchases that would be better off avoided in the first place such as car maintenance and cleaning up of environmental damage.

In order to deal with these problems, a growing group of economists are using an alternative indicator known as the “genuine progress indicator,” or GPI. The genuine progress indicator starts with personal consumption much like GDP does, but then adds in corrections for inequality, environmental damage, and social benefits and costs not counted in GDP.

This study calculates Ohio's genuine progress indicator from 2009 to 2016, giving an

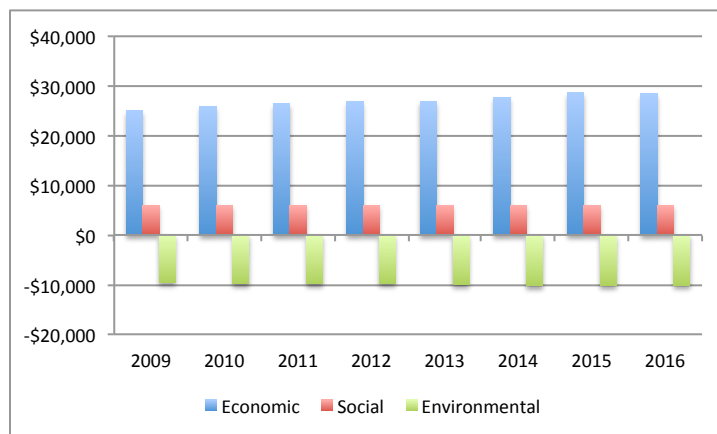


Figure 1: Per Capita Benefits and Costs of Major GPI Categories (2009 Dollars)

positive impact. More granularly, two indicators in particular, household consumption and the value of housework, consistently make up almost 90% of total benefits in every year from 2009 to 2016. On the negative side, two indicators, the cost of inequality and the cost of use of non-renewable

indication of what has driven Ohio's recovery from the Great Recession.

Figure 1 gives an overview of the three major categories of indicators used in calculating the genuine progress indicator. As can be seen here, economic indicators have the largest impact on the overall genuine progress indicator calculation, while environmental indicators have a negative impact and social indicators have a smaller

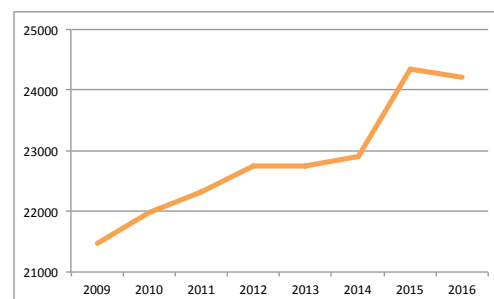


Figure 2: Ohio Per Capita GPI (2009 Dollars)

resources, make up over half of total costs every year.

From 2009 to 2016, the Ohio genuine progress indicator's per capita value has grown about \$2,735, representing a 13% increase in per capita welfare over that period.<sup>1</sup> This suggests that the recovery from the Great Recession has occurred as GDP figures have told us. Breaking down the recovery, we can see that traditional economic indicators have driven the recovery: household consumption and capital investment make up 81% of the gross growth over that period. On the negative side, though, inequality has only worsened since the great recession. Growth in inequality is costing Ohioans on average \$1,600 more in 2016 than in 2009, which is 39% of gross costs weighing down the recovery from the recession.

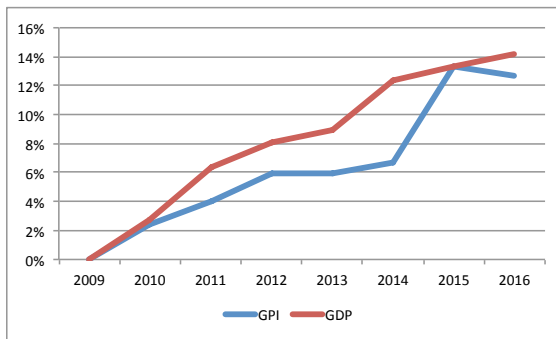


Figure 3: Ohio Cumulative GDP Per Capita Growth vs Per Capita GPI Growth (2009 Dollars)

Comparing per capita GDP to per capita GPI, we can see that the trend is generally the same: the recovery has improved welfare using both measures.<sup>2</sup> Notably, though, the GPI shows slower growth from 2010-2014 than GDP does.<sup>3</sup> If Ohio's inequality did not change over this period, GPI would have kept pace with GDP. Ohio also saw a *decrease* in per capita GPI in 2016, suggesting that, in GPI terms, Ohio was in recession in 2016. GPI would have tracked GDP this year, also, if it were not for increases in inequality.

## ECONOMIC INDICATORS

Five economic indicators provide the “base” for the calculation of the genuine progress indicator: personal consumption, inequality, the value of consumer durables, the cost of underemployment, and net capital investment.

Personal consumption expenditures and the adjustment for inequality exceed the other three indicators in absolute terms, having a combined impact on per-capita economic welfare that averages fourteen times the impact of underemployment, the value of consumer durables, and net capital investment over the time period studied.

<sup>1</sup> Throughout this paper, the word “welfare” is used in the traditional definition of the term, laid out in Oxford English Dictionary definition 1: “The state or condition of doing or being well; well-being, prosperity, success; the health, happiness, and fortunes of a person or group.” This draws from the field of welfare economics as pioneered by economist Arthur Pigou in his *Economics of Welfare*, of which the genuine progress indicator is an outgrowth of. It does not refer to the definition often used in United States political circles (OED definition 4), which is shorthand for programs designed to increase welfare for low-income individuals.

<sup>2</sup> “Real GDP By State: Ohio, Chained 2009 Dollars,” Regional Data: GDP & Personal Income, Bureau of Economic Analysis, <https://apps.bea.gov>.

<sup>3</sup> GPI per capita also grows slower in absolute terms from 2009 to 2016, \$2,800 per capita versus \$5,900 per capita GDP growth over the same period.

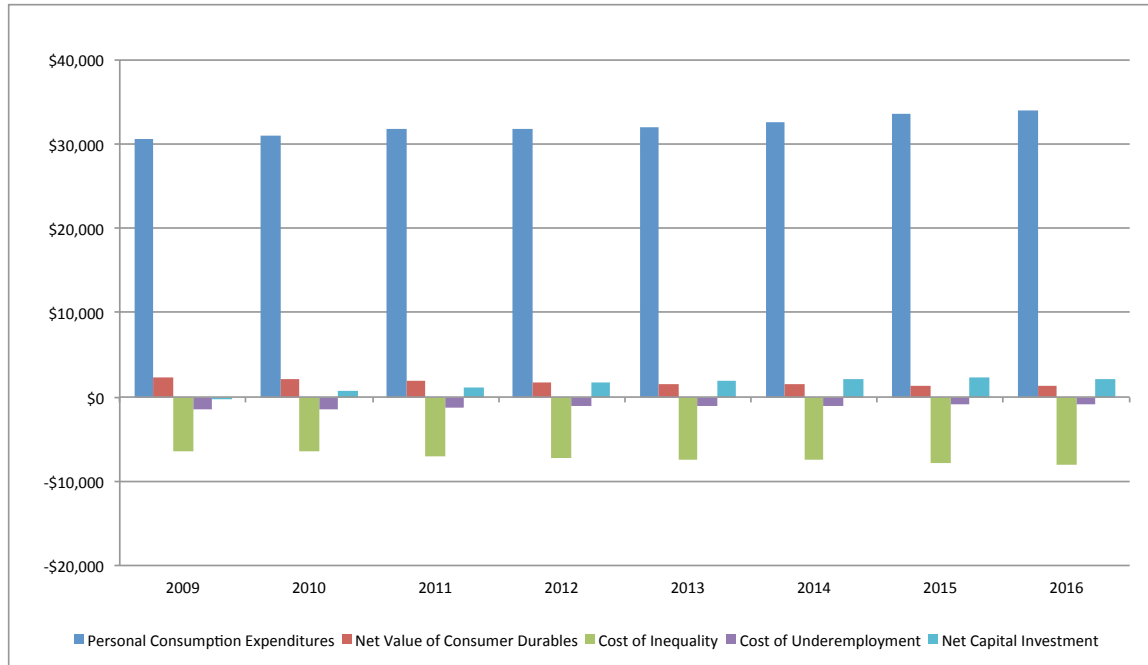


Figure 4: Per Capita Benefits and Costs of Economic GPI Indicators (2009 Dollars)

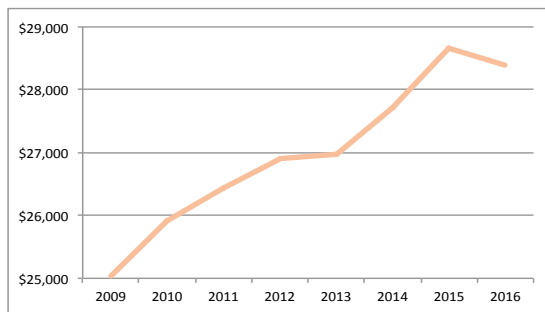


Figure 5: Per Capita Net Economic Welfare (2009 Dollars)

Figure 5 shows that the recovery from the recession has led to a growth in economic welfare, with 2016 per capita economic welfare \$3,400 higher in real terms than in 2009. Notably, though, 2016 showed a 1% decrease in economic welfare from 2015, with gains in personal consumption expenditures and reductions in underemployment canceled out by reductions in net value of consumer durables and net capital investment and growing income inequality.

## Adjusted Personal Consumption

Spending by households on goods and services is the starting point for calculation of the genuine progress indicator. This allows us to calculate how much value the economy is generating in the form of consumer goods and services.

The federal Bureau of Economic Analysis estimates personal consumption expenditures on a state-by-state basis. Combining this with American Community Survey data on Ohio's population, we can calculate the per-

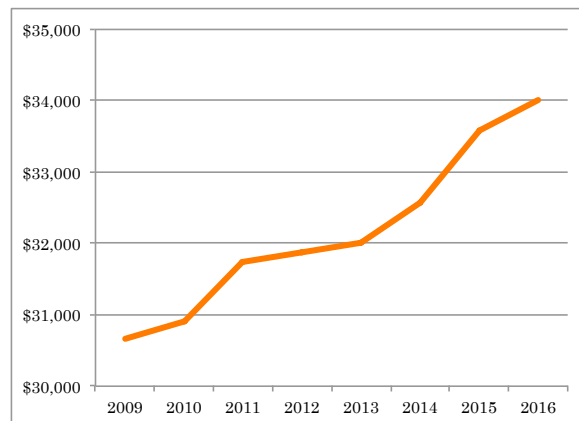


Figure 6: Personal Expenditures Per Capita (2009 Dollars)

capita consumption over the period of the recovery from the recession.

Personal consumption is up about \$3,300 per capita in real terms from 2009 to 2016, which represents about an 11% increase over that time period, an increase of 1.6% per year.

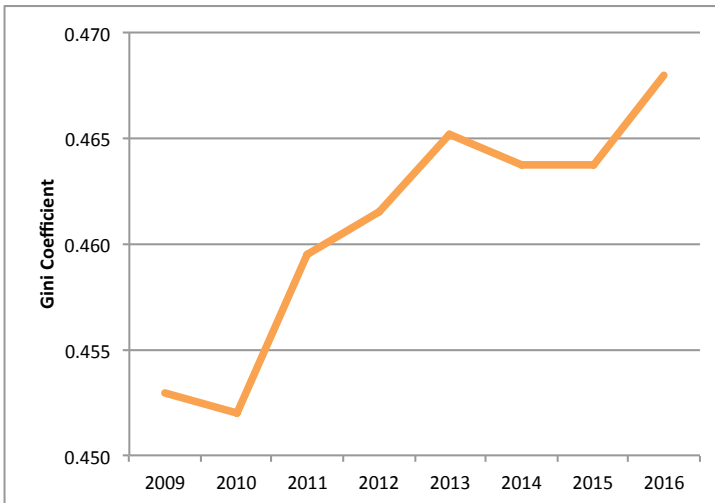


Figure 7: Inequality in Ohio

At the same time as consumption has increased, though, inequality has also increased. The standard measure of inequality is the “Gini coefficient”, a zero to one measure of how unequal the income distribution is, with a “zero” rating representing perfect equality of the income distribution and a “one” rating representing a situation in which one person in a state earns all the income and everyone else earns none of the income.

Ohio’s Gini coefficient was as low as 0.357 in 1970, a standard base year for genuine progress indicator inequality adjustments.<sup>4</sup> Forty years later, Ohio’s Gini coefficient was over 25% higher, ranging from 0.452 to 0.468 from 2009 to 2016.<sup>5</sup> Over this period, inequality also increased, with Ohio’s 2016 Gini coefficient 3.3% higher than it was in 2009.

Research shows that inequality can drag down incomes.<sup>6</sup> This loss of income can then reduce consumption and along with it reduce economic efficiency in an economy. The genuine progress indicator corrects for this inefficiency caused by discounting personal consumption expenditures by the amount of inequality each year using an income distribution index.<sup>7</sup> Using 1970 as a base

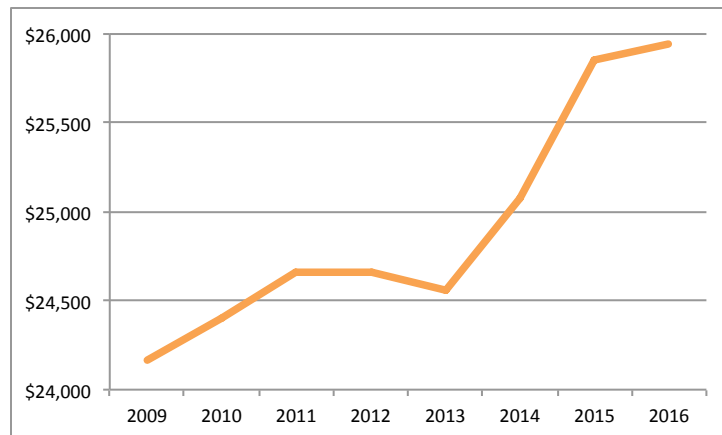


Figure 8: Inequality Adjusted Per Capita Personal Consumption Expenditures (2009 Dollars)

<sup>4</sup> Volscho, Thomas. 2009. "Measures of Income Distribution in the United States, 1970-2000." Department of Sociology, Anthropology, and Social Work, CUNY – College of Staten Island; Stiffler, Chris. "Colorado’s Genuine Progress Indicator (GPI): A Comprehensive Metric of Economic Well-Being in Colorado from 1960-2011," Colorado Fiscal Institute, January 7, 2014.

<sup>5</sup> "Gini Index of Income Inequality: 2009-2016 American Community Survey 1-Year Estimates, Ohio," American Fact Finder, United States Census Bureau.

<sup>6</sup> Thewissen, Stefan, et al, "Rising Income Inequality and Living Standards in OECD Countries: How Does the Middle Fare?" *Journal of Income Distribution*, Volume 26, No. 2, 2018.

<sup>7</sup> Stiffler, Chris, "Colorado’s Genuine Progress Indicator (GPI): A Comprehensive Metric of Economic Well-Being in Colorado from 1960-2011," Colorado Fiscal Institute, January 7, 2014.

inequality year and assuming that lower Gini coefficients lead to higher economic efficiency, the genuine progress indicator then discounts later years depending on how their inequality compares to 1970.

Accounting for inequality reveals some new trends. While adjusted levels of spending are lower than levels of spending before adjustment, the trend is still positive, with the average person spending \$1,800 in real terms more in 2016 than in 2009. This shows a slower rate of growth than the personal consumption expenditures before income inequality adjustment of only about 7.4% over the recovery period, or 1.1% annualized. This means that, according to this measure, inequality reduced personal consumption expenditure gains by about a third over this time period.

## Net Value of Consumer Durables

A major criticism of GDP is that it only counts the value of consumer durables (such as cars, mattresses, washing machines, and refrigerators) in their first year of purchase. The problem with this is that GDP counts repeated consumption of flimsy goods when reuse of sturdily-made goods would yield the same utility. For instance, a family that purchases a car that then breaks down, pays to repair the car, then ultimately purchases a new car would contribute more to GDP than a family that purchases a car that does not break down in the first place.

The genuine progress indicator corrects for this problem by estimating the annual value of the total state stock of consumer durables then subtracting annual state expenditures on consumer durables to avoid double counting. The Bureau of Economic Analysis estimates annual durable good personal expenditures.<sup>8</sup> The genuine progress indicator assumes (a) consumer durables last on average eight years, (b) depreciation is fixed and linear, and (c) a 7.5 percent foregone interest rate to capture the alternate investments consumers could be making if not spending on consumer durables. These assumptions lead to a 20% value of the state stock of consumer durables accrued to consumers every year.

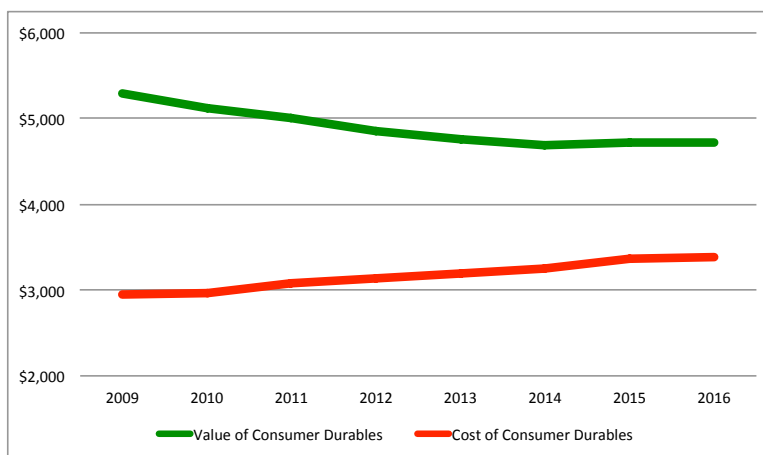


Figure 9: Per Capita Cost and Value of Consumer Durables (2009 Dollars)

capita from the depth of the recession to 2016, the value of consumer durables have slid over

2009 was a low point in consumer durable spending as consumers tightened their spending in the middle of the recession, putting off purchases of new cars and household equipment until incomes recovered. This means that spending was especially low and values accrued from past spending was especially high in 2009. While spending has rebounded, up 15% per

<sup>8</sup> "Total Personal Consumption Expenditures (PCE) by State (Millions of Dollars: Durable Goods, Ohio," Regional Data, GDP & Personal Income, Bureau of Economic Analysis, <https://apps.bea.gov>.



this period, down 11% from 2009 to 2016. This reflects the fact that old cars, household appliances, and other consumer durables were going out of commission but not being replaced as families stretched their budgets during the recession.

These two trends interacting have led to a drop in the net value of consumer durables from 2009 to 2016. The per capita net value of consumer durables in 2016 was \$1,000 (43%) lower than it was in 2009. This should not be surprising, though: durable consumer goods are an asset that households can continue to utilize during a recession while they reduce their consumption of new goods. This means that net value of consumer durables should be higher in the depths of a recession and lower when the general economy is stronger.

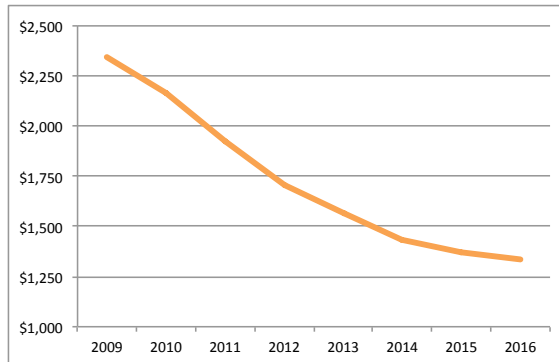


Figure 10: Per Capita Net Value of Consumer Durables (2009 Dollars)

### Cost of Underemployment

Gross underemployment is the total of all workers in a society who are working less than they would like to. This measure includes unemployed workers, marginally attached workers, and workers working part time for economic reasons.<sup>9</sup> Underemployment has social

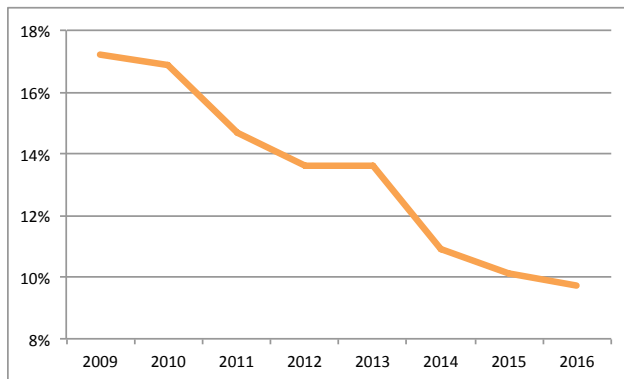


Figure 11: Ohio's Underemployment Rate

costs that range from decline in economic output and increased prevalence of drug abuse to loss of social values and community cohesion.<sup>10</sup> The genuine progress indicator multiplies total unused hours in society, or hours that would be worked in a scenario of full employment, by average wage levels to calculate the total cost to society of underemployment.

Underemployment levels are down significantly from the depths of the recession, down from a high of 17% in 2009 to 10% in 2016. Along with the reduction of underemployment rates, there has been a steady reduction in per-capita rates of the cost of underemployment (figure 12). Per capita rates of the cost of underemployment have fallen from \$1,400 in 2009 to \$900 in 2013.

Underemployment has social costs that range from decline in economic output and increased prevalence of drug abuse to loss of social values and community cohesion.<sup>10</sup> The genuine progress indicator multiplies total unused hours in society, or hours that would be worked in a scenario of full employment, by average wage levels to calculate the total cost to society of underemployment.

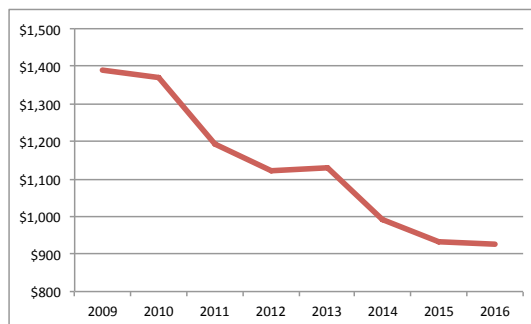


Figure 12: Per Capita Cost of Underemployment (2009 Dollars)

<sup>9</sup> "Alternative Measures of Labor Utilization for States, 2009," Local Area Unemployment Statistics, Bureau of Labor Statistics, April 22, 2011, <http://bls.gov>

<sup>10</sup> Stiffler, "Colorado's Genuine Progress Indicator."

This means that underemployment rates have fallen by 44% over the time period while the per capita cost of underemployment has fallen by 33%. These are both large reductions, though the cost of underemployment has not fallen as quickly as the underemployment rate. This is explained by improvements in average wages over this time period, which increase the per hour costs of underemployment.

## Net Capital Investment

Capital is a key component of a healthy economy. If an economy shifts its spending from capital to consumer goods, it can reduce the sustainability of an economy since there is less capital available for workers to make use of. Thus, the genuine progress indicator uses national estimates for net capital investment and scales them down to the state level to estimate how much capital is being invested into the Ohio economy.

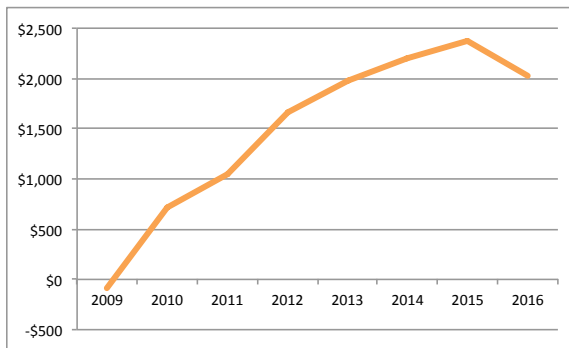


Figure 13: Per Capita Net Capital Investment (2009 Dollars)

Per capita net capital investment is up \$2,100 since it was negative in 2009.<sup>11</sup> Net capital investment showed a 14% dip from 2015 to 2016, but is still much higher than it was in the depths of the Great Recession.

## ENVIRONMENTAL INDICATORS

A limitation of GDP is that it leaves out key environmental indicators that have demonstrated economic impacts. Nine environmental indicators are used in calculating the genuine progress indicator: cost of water pollution, cost of air pollution, cost of noise pollution, loss of wetlands, loss of farmland, growth of forest acreage, carbon emissions, ozone depletion, and depletion of non-renewable resources.

The net per capita cost of environmental damage has been on the rise since 2009, with the 2016 per capita cost 6% higher than it was in 2009. The cost of environmental damage fell slightly, though, from 2014 to 2016, with reductions in non-renewable use, carbon emissions, and air pollution drowning out the loss of environmental welfare from reduction of farmland over that period.

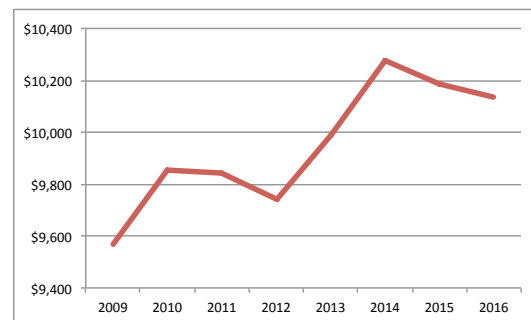


Figure 14: Per Capita Cost of Environmental Damage (2009 Dollars)

<sup>11</sup> U.S. Bureau of Economic Analysis, Real net private domestic investment [A557RX1A020NBEA], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/A557RX1A020NBEA>, October 15, 2018.

Every environmental indicator besides forest cover acreage represented a drag on Ohio's economy from 2009-2016. The negative impact of all of water pollution, air pollution, noise pollution, wetland loss, carbon emissions, and ozone depletion are exceeded by the cost of non-renewable depletion and farmland acreage lost, which together make up 85% of the total net economic loss from all environmental indicators. Non-renewable depletion on its own makes up more than half the total loss in every year from 2009 to 2016.

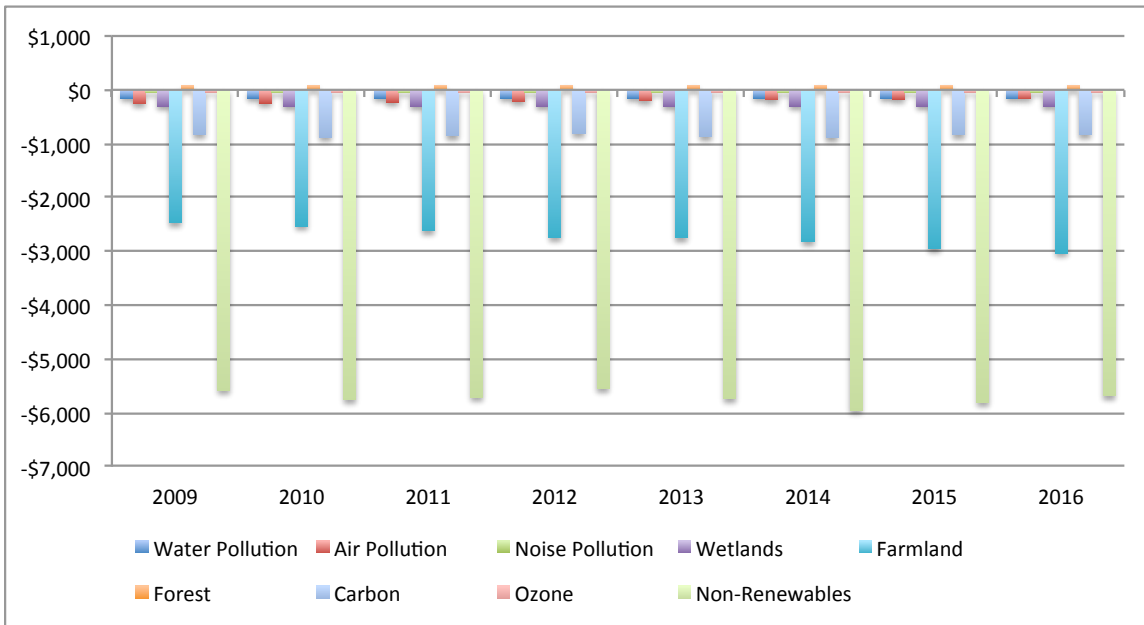


Figure 15: Per Capita Benefits and Costs of Environmental GPI Indicators (2009 Dollars)

### Cost of Water Pollution

Clean water has benefits that range from health to recreation to aesthetic beauty. The value of perfectly clean water in a state was estimated as \$130 per capita in 1982, which comes out to about \$162 in 2009 dollars. The genuine progress indicator measures the cost of degradation by multiplying the per capita cost by the percentage of waterways degraded, multiplying that number by the total population, and counting the degradation as a cost.

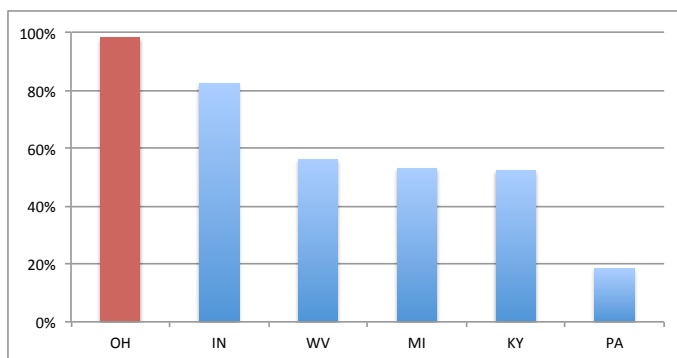


Figure 16: 2011 Rates of Water Body Degradation by State – Ohio and Neighboring States

Ohio has degraded a much larger percentage of its water bodies than most states, with only three states (Hawaii, New Hampshire, and Delaware) showing higher rates of degradation than Ohio in 2011 according to federal EPA data presented in a recent cross-state genuine progress indicator study.<sup>12</sup> This data suggested that 98% of Ohio's surface bodies were

<sup>12</sup> Fox, Mairi-Jane V., and Jon D. Erickson. "Genuine Economic Progress in the United States: A Fifty State Study and Comparative Assessment." *Ecological Economics* 147 (2018): 29-35.

degraded, much higher than the average state rate of 67%. Ohio also has higher levels of surface water degradation than its neighbors with a 16 percentage point higher rate of degradation than the next most-polluted state, Indiana, and rates of degradation five times higher than Pennsylvania.

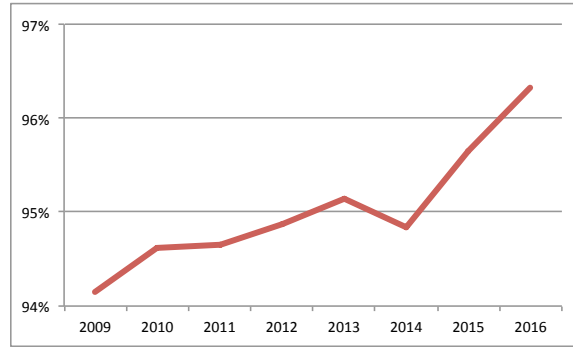


Figure 17: Percentage of Ohio Waterways Degraded

Data from the Ohio EPA suggests that surface water degradation in Ohio continues to get worse.<sup>13</sup> The percentage of surface water bodies degraded has increased from 94% to 96% from 2009 to 2016. This has led to a growing economic impact per person as well. The per capita cost for water pollution has increased 2.3% from 2009 to 2016.

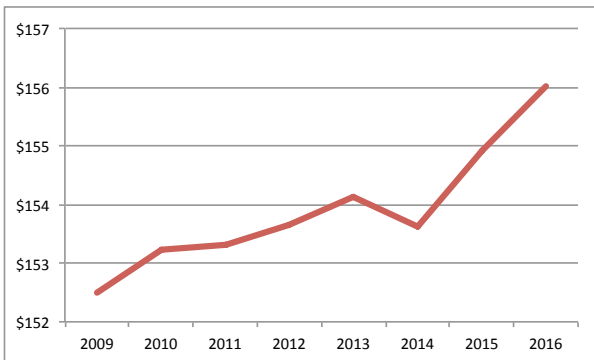


Figure 18: Per Capita Cost of Water Pollution (2009 Dollars)

Reducing degradation of Ohio’s waterways would lead to economic benefits for the general population. Bringing Ohio’s degradation levels down to that of Indiana, the next most polluted state bordering Ohio, would lead to \$230 million in additional economic benefits for Ohioans, or \$20 per capita. Reducing degradation levels to the median of neighboring states would generate \$750 million in additional economic benefits, or \$65 per capita.

Bringing Ohio’s levels of surface water degradation down to Pennsylvania levels, the lowest of Ohio’s neighboring states, would generate \$1.4 billion in economic benefits, or \$120 per person.

Scenario	Total Costs	Total Savings	Savings Per Capita
Indiana (82%)	\$1.5 Billion	\$0.2 Billion	\$20
Median (55%)	\$1.0 Billion	\$0.7 Billion	\$65
Pennsylvania (18%)	\$0.3 Billion	\$1.4 Billion	\$120

Table 1: Economic growth under alternative scenarios

## Cost of Air Pollution

The overwhelming majority of the cost of air pollution comes from the toll it takes on human health as poor air quality has been linked to respiratory problems, asthma, and increases in heart attacks.<sup>14</sup> Other costs come from visibility loss, reduced agricultural yield, reduced timber yield, accelerated depreciation of man-made material, and impaired forest health.<sup>15</sup>

<sup>13</sup> This study used data from the Ohio EPA Integrated Water Quality Monitoring and Assessment Reports from 2008 to 2016, available online at <http://epa.ohio.gov>. All waterways listed as “impaired” for human health, recreation, and aquatic life purposes were considered “degraded.” Since reports are only biannual, off year degradation rates were estimated using a line of best fit between available data and assuming missing years fell on that line of best fit.

<sup>14</sup> Muller, N.Z. & Mendelsohn, R. (2007). Measuring the damages of air pollution in the United States. *Journal of Environmental Economics and Management*, 54, 1 – 14.

<sup>15</sup> Stiffler, “Colorado’s Genuine Progress Indicator.”

The genuine progress indicator uses state-level triennial data from the EPA then interpolates for missing years using linear trends assuming that gap years fall on the line of best fit of available data.<sup>16</sup> Five standard air pollutants are tracked in the calculation: large (PM10) and fine (PM2.5) particulate matter, which can enter the lungs through nose and

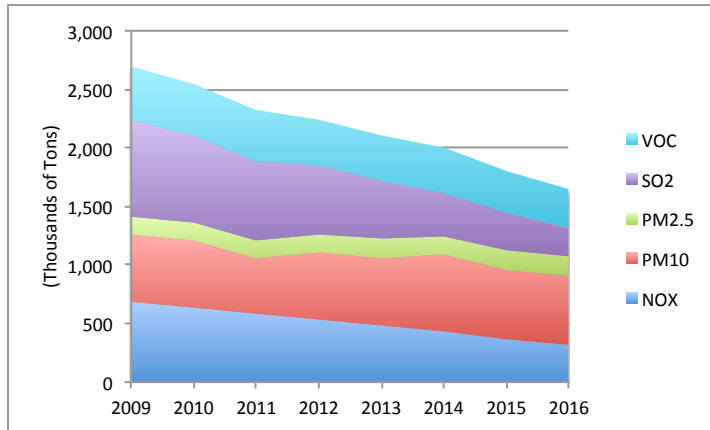


Figure 19: Air Pollution in Ohio

throat, nitrogen oxides (NOX), which are emitted by vehicles, sulfur oxide (SOX), which is generated in industrial processes, and volatile organic compounds (VOC), which are emitted from products such as paints, glues, and markers.<sup>17</sup> The respective costs per ton for PM10, PM2.5, SOX, NOX, and VOC were \$680, \$4,300, \$340, \$1,600, and \$840 in 2009 dollars.<sup>18</sup>

Air pollution has decreased from 2009 to 2016, with total tons of air pollution down 39% over this time period. This reduction was mainly driven by reductions in sulfur dioxide and nitrogen oxide, which were down 70% and 53% respectively over the period. Reductions in volatile organic compounds saw a 27% reduction over the period. Particulate matter, though, saw almost no change, with small particulate matter only down 2.7% over the period and large particulate matter actually increasing by 3.7% over the period.

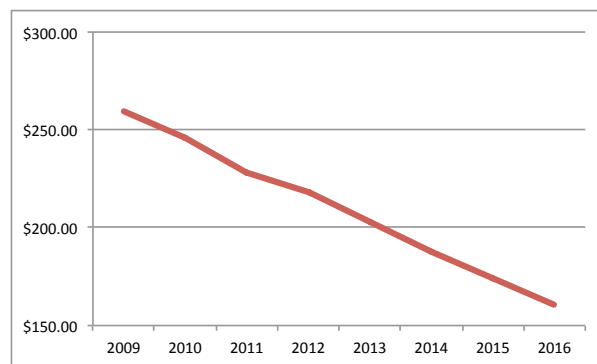


Figure 20: Per Capita Cost of Air Pollution (2009 Dollars)

The overall downward trend in air pollution in the state has led to a steady reduction in the cost of air pollution over the past decade. The per capita cost of air pollution is down \$100 from a high of \$260 per person in 2009 down to \$160 in 2016. This represents a 38% reduction in the per capita cost of air pollution over this time period.

## Cost of Noise Pollution

Noise pollution disrupts recreation and sleep and can have negative impacts on health. The genuine progress indicator estimates the cost of noise pollution in Ohio by scaling national estimates of the cost of noise pollution down to an Ohio estimate based off of the percentage of urban residents in the state. This is because most noise pollution is created in urban areas.

<sup>16</sup> Trends Data: EPA, <http://edap.epa.gov>.

<sup>17</sup> Stiffler, "Colorado's Genuine Progress Indicator."

<sup>18</sup> Numbers calculated by Stiffler, "Colorado's Genuine Progress Indicator," from Muller and Mendelsohn, "Measuring the Damages of Air Pollution."

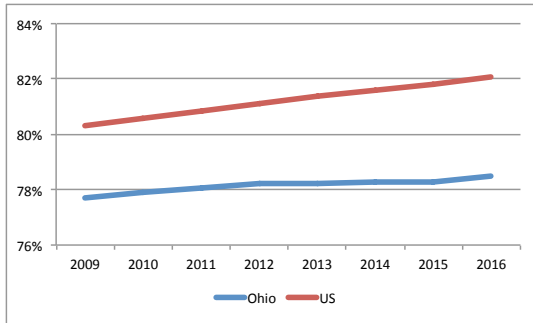


Figure 21: Percentage of Residents Living in Urban Areas

The percentage of urban residents is estimated using 2000 and 2010 census data and assuming linear trends between and after those censuses. In 2010, Ohio was slightly less urban than the country as a whole but was closer to the national urbanization rate than all but three states (Oregon, Pennsylvania, and Delaware).<sup>19</sup> From 2009 to 2016, both Ohio and the United States steadily urbanized, though Ohio urbanized at half the speed as the rest of the country.

To calculate the per capita cost of noise pollution in Ohio, Talbert’s calculation of the national cost of noise pollution at \$14.6 billion in 2000 is used then scaled to 2009 dollars and reduced using Ohio’s share of the national urban population.<sup>20</sup> This standard genuine progress indicator methodology results in a picture of steady decline in the cost of noise pollution in Ohio, down \$3.50 per person, or 6.2%, from 2009 to 2016. This reduction, though, comes mostly from Ohio’s lower share of the national urban population. Better data about noise pollution in the state could help give a better picture of the cost of noise pollution in Ohio.

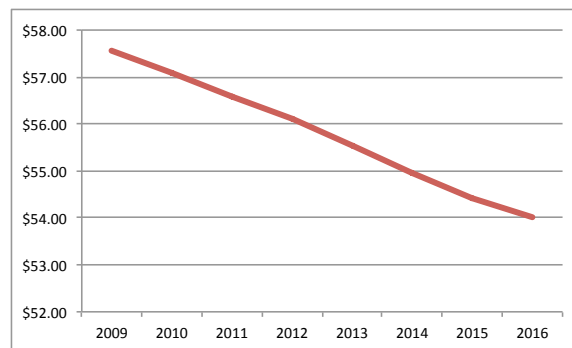


Figure 22: Per Capita Cost of Noise Pollution (2009 Dollars)

## Loss of Wetlands

Wetlands are important to a state since they recycle nutrients, regulate floodwaters, purify water, and provide habitat for birds, fish, and amphibians.<sup>21</sup> Ohio had about five million acres of wetland in 1780 but has lost almost 80% of that wetland area since then.<sup>22</sup>

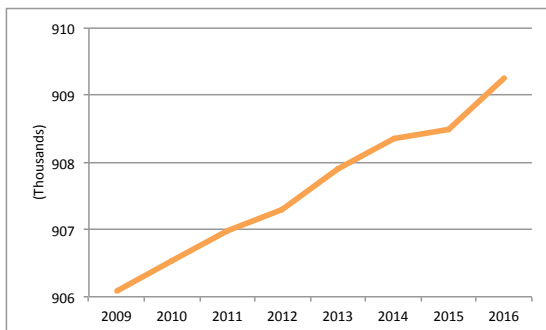


Figure 23: Wetland Acreage Growth in Ohio

The genuine progress indicator splits wetland loss into two categories: wetland lost before 1950 and wetland lost after 1950. Wetland loss before 1950 is valued at \$496 per acre and wetland loss after 1950 is valued at \$1,445 per acre following Fox and Erickson’s study earlier

<sup>19</sup> United States Census Bureau, 2010 Census of Population and Housing, Population and Housing Unit Counts, CPH-2-5. U.S. Government Printing Office, Washington, DC: U.S. Census Bureau. 2012. p. 1.

<sup>20</sup> Talberth, J., Cobb, C., & Slattery, N. (2007). *The Genuine Progress Indicator 2006: A tool for sustainable development*. Oakland, CA: Redefining Progress.

<sup>21</sup> Stiffler, “Colorado’s Genuine Progress Indicator.”

<sup>22</sup> Dahl, T.E. 1990. *Wetlands Losses in the United States 1780s to 1980s*: U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 13pp.; U.S. Department of Agriculture. 2018. *Summary Report: 2015 National Resources Inventory*, Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. <http://www.nrcs.usda.gov/technical/nri/15summary>

this year.<sup>23</sup> Pre-1950s wetland loss data comes from Fox and Erickson and loss post-1950s is taken from US Department of Agriculture studies.<sup>24</sup> Since US Department of Agriculture wetland data is only gathered periodically, a line of best fit was estimated using existing data and missing data was interpolated assuming it follows the trends available in the line of best fit.

Wetland acreage has rebounded slightly since the Great Recession: total acreage is up 3,200 from 2009 to 2016. This makes up only a small fraction, though, of the millions of acres of wetland loss that has occurred before and since 1950, and only represents a 0.3% growth in total wetland acreage over that time period.

The slight rebound in wetland acreage has brought a slight benefit to Ohioans as well. Per capita cost of wetland loss has decreased about \$2.20 from 2009 to 2016. This is a small overall decrease representing less than a one percent decrease in the cost of wetland loss to Ohioans. The bulk of this improvement occurred from 2012 to 2015, when the per capita cost of wetland loss was reduced by almost \$2.

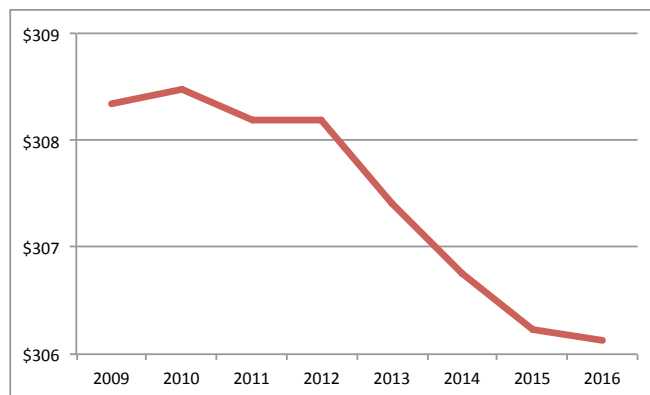


Figure 24: Per Capita Cost of Wetland Loss (2009 Dollars)

## Loss of Farmland

Farmland has benefits that range from sustainable food supply to flood prevention, scenery, and wildlife habitat.<sup>25</sup> The genuine progress indicator measures farmland losses using a baseline of 1950 acreage of farmland. It then multiplies the total lost acreage by market value of farmland acreage to estimate the cost of lost farmland in the state.

Acreage and value of an acre of farmland are each taken from the United States Department of Agriculture's Census of Agriculture.<sup>26</sup> Since the Census of Agriculture is only conducted every five years, a line of best fit technique is used to estimate acreage and prices on non-census years.

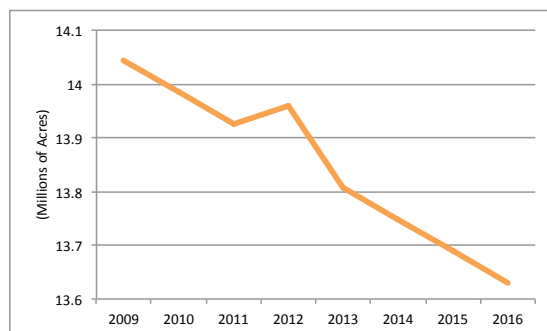


Figure 25: Farmland Acreage in Ohio

Ohio lost about 7 million acres of farmland from 1950 to 2009, about a third of total farmland in the state. Ohio is still losing farmland in the current decade, losing an estimated 400,000 acres in farmland between 2009 and 2016, a 3% decrease from 2009

<sup>23</sup> Fox, Mairi-Jane V., and Jon D. Erickson. "Genuine Economic Progress in the United States: A Fifty State Study and Comparative Assessment." *Ecological Economics* 147 (2018): 29-35.

<sup>24</sup> US Department of Agriculture, *Summary Report*.

<sup>25</sup> Stiffler, "Colorado's Genuine Progress Indicator."

<sup>26</sup> "2012 Census of Agriculture – State Data," United States Department of Agriculture, National Agricultural Statistics Service.

acreage. The technique of estimation gives this graph a straight, linear shape. Better collection of state agricultural acreage data could give more fine-grained information about year-to-year differences in farmland acreage.

Shrinking farmland and the growing value of farmland both have contributed to higher per capita costs for loss of farmland. Farmland losses cost Ohioans \$570 more on average in 2016 than in 2009. Much of this increase was due to the increasing value of farmland acreage, which grew 23% after adjusting for inflation from 2009 to 2016.

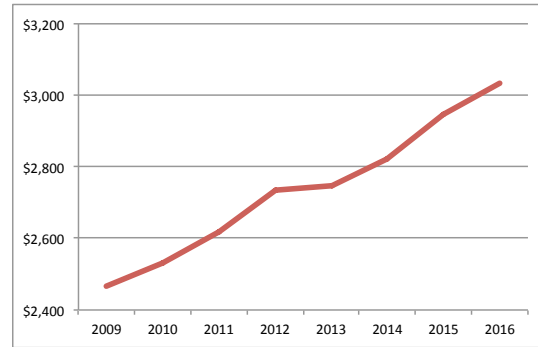


Figure 26: Per Capita Cost of Loss of Farmland (2009 Dollars)

## Growth of Forest Acreage

In addition to traditional economic purposes such as timber, forest land also has the benefit of controlling floods, purifying water and air, and providing areas for hunting, camping, hiking, and sightseeing.<sup>27</sup>

The genuine progress indicator measures the value of forest land by using the baseline year of 1950, then multiplying the change in forest land by \$318.50 in 2000 dollars, the value of non-timber uses for forest.<sup>28</sup> Change in forest land was estimated for missing years using point estimates from 1950, 2011, and 2016 and creating a line of best fit estimation technique for years without data.<sup>29</sup> Better data collection of forest land acreage in Ohio could give more precise measures of year-to-year variability in the value of forest land.

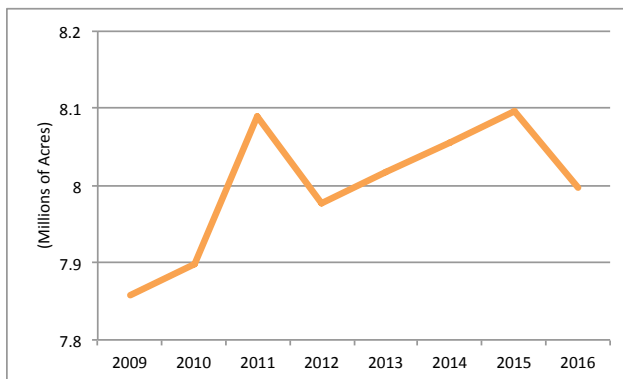


Figure 27: Forest Acreage in Ohio

Forest acreage in Ohio has been on the rise since the 1950s. Total forest acreage in Ohio was 7.9 million acres, up almost 50% from the 1950 forest cover level of 5.5 million acres. The direction of the trend from 2009 to 2016, though, depends heavily on estimation techniques. While a technique that uses the 1950 baseline (the technique used for this study) shows an improvement over the period, the two data points available for 2011 and 2016 suggest a downwards trend in forest cover over

<sup>27</sup> Stiffler, "Colorado's Genuine Progress Indicator."

<sup>28</sup> Pearce, D.W. (2001). The Economic Value of Forest Ecosystems. Available at <http://www.cbd.int/doc/external/academic/forest-es-2003-en.pdf>; The value of timber production should be captured in consumer activity.

<sup>29</sup> Widmann et al, *Ohio's Forests 2011*, United States Department of Agriculture, United States Forest Service, May 2014; Albright, Thomas A. 2017. Forests of Ohio, 2016 Resource Update FS-139. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p.



the period. Neither technique yields large differences in magnitude since overall changes are small, but they do impact the direction of the trend.

The estimation technique used shows the per capita value of forest growth at somewhere between \$80 and \$90 from 2009 to 2016. The two point estimates each fall within the \$85 to \$90 per capita range, suggesting the window could be even smaller. United States Department of Agriculture reports suggest that Ohio’s forest growth was slowed in the 1990s and 2000s, suggesting that a linear estimation technique could undersell earlier values of forest growth. Thus, the trend may be more flat than shown here and the earlier numbers may be underestimated. Better collection of forest cover acreage data would provide more fine-grained year-to-year data on the value of forest cover.

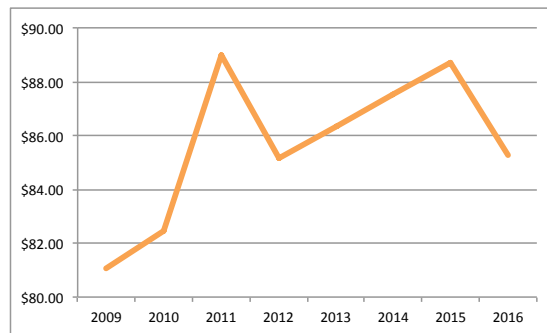


Figure 28: Per Capita Value of Forest Growth (2009 Dollars)

## Carbon Emissions

Much work has been done quantifying the impacts of carbon pollution on the climate and thus the economy. While climate change may have some benefits in the Midwest by decreasing cold-related mortality rates, the region is also projected to suffer greatly from decreased agricultural yields, increased cooling costs, and extreme weather events like droughts and flooding.<sup>30</sup>

The genuine progress indicator estimates the cost of carbon emissions by taking data of coal, natural gas, petroleum, and wood and waste consumption from the U.S. Energy Information Administration then estimating how many pounds of carbon dioxide this consumption created using estimates of how many pounds of carbon are released for every British

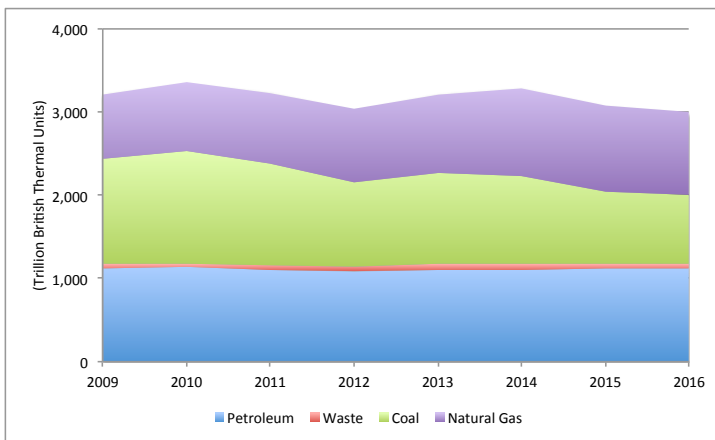


Figure 29: Carbon-Emitting Energy Consumption in Ohio

Thermal Unit of energy consumption.<sup>31</sup> This study then follows the lead of past studies by using a baseline that estimates the economic impact of a pound of carbon, then estimates a linear increase in cost per year as marginal increases in carbon have larger and larger environmental impacts.<sup>32</sup> This estimation technique may overstate the cost of carbon emission to Ohio

<sup>30</sup> GAO Analysis of Environmental Protection Agency, *Climate Change Impacts in the United States: Benefits of Global Action* (Washington, D.C.: 2015), and Solomon Hsiang et al, “Estimating Economic Damage from Climate Change in the United States,” *Science*, vol. 356 (2017): Map resources (map). | GAO-17-720

<sup>31</sup> “Primary Energy Consumption Estimates, 1960-2016, Ohio,” US Energy Information Administration, <http://eia.gov>; Stiffler, “Colorado’s Genuine Progress Indicator.”

<sup>32</sup> Stiffler, “Colorado’s Genuine Progress Indicator.”

because Ohio is likely to have a less-than-average impact of climate change due to its inland and northern location.

Total energy consumption among these four sources decreased 7% from 2009 to 2016. This was largely driven by reductions in coal consumption, which fell 35% over this time period and was largely replaced by natural gas consumption, which increased 29% over the time period. Petroleum consumption was basically flat over the time period while already low levels of wood and waste consumption increased 5%.

The cost of carbon emissions in Ohio has bounced between \$800 and \$900 per capita from 2009 to 2016, but in 2016 was only \$5 more than in 2009. Ohio's reduction in carbon-emitting energy sources shift from coal to natural gas has reduced Ohio's carbon emissions since natural gas produces 44% less carbon than coal. At the same time, the increasing cost of a pound of carbon has kept the per capita cost about even.

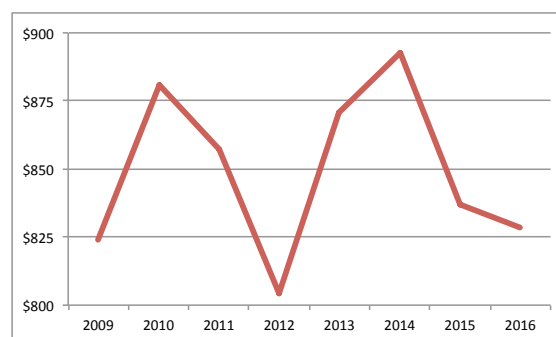


Figure 30: Per Capita Cost of Carbon Emissions (2009 Dollars)

## Cost of Ozone Depletion

Depletion of the ozone layer can lead to health and agricultural impacts for individuals and the broader economy. National release of ozone-depleting chemicals has fallen dramatically since the 1989 Montreal Protocol.<sup>33</sup> Because of these declines, the measure has been discussed for removal from genuine progress indicator calculations.<sup>34</sup>

The genuine progress indicator uses national data on the annual cost of the release of ozone-depleting materials as a baseline then scales down the costs to the state level. Since the national cost of ozone depletion is down to only \$13 million a year in 2009 dollars, the Ohio cost is only about half a million dollars total, or only about four cents per person for every year from 2009 to 2016. Cost of ozone depletion ends up being a very small factor in Ohio's genuine progress indicator.

## Depletion of Non-Renewable Resources

Non-renewable resources give a boost to local economies in the short run, but are not sustainable sources of income in the long run. The genuine progress indicator accounts for the temporary value of non-renewable resources by calculating the cost of replacing non-renewable resources with renewable sources of energy. This allows the cost of the use of non-renewable resources to be tied to the year in which they are consumed.<sup>35</sup>

<sup>33</sup> Ibid.

<sup>34</sup> Bagstad, Kenneth J., Günseli Berik, and Erica J. Brown Gaddis. "Methodological developments in US state-level genuine progress indicators: toward GPI 2.0." *Ecological Indicators* 45 (2014): 474-485.

<sup>35</sup> Ibid.

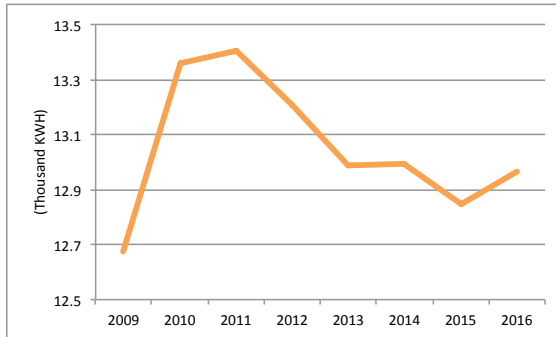


Figure 31: Per Capita Electricity Consumption

Per capita electricity consumption spiked in 2010 but has been declining since 2011, down 3.3% in 2016 from the 2011 high. This may reflect a rebound in consumption after the recession followed by the impact of energy efficiency measures since the recession.

The per capita cost of non-renewable resource depletion has bounced between \$5,500 and \$6,000 since the depths of the recession. The cost of non-renewable resource depletion in 2016 was about \$100 higher than it was in 2009, which was about 2% higher than the recession baseline.

The U.S. Energy Information Association provides annual data on Ohio's electric and non-electric energy consumption. Total electric non-renewable consumption is multiplied by 8.75 cents per kilowatt hour, the cost of solar/wind replacement, and total non-electric is multiplied by \$116 per barrel equivalent to account for the cost of other biofuel replacement.<sup>36</sup>

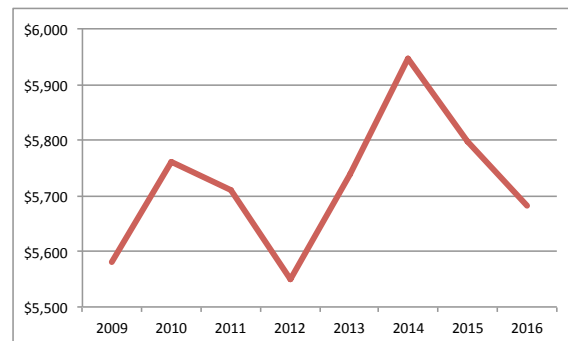


Figure 32: Per Capita Cost of Non-Renewable Resource Depletion (2009 Dollars)

## SOCIAL INDICATORS

After factoring in economic and environmental indicators, the genuine progress indicator then includes a handful of social indicators that have demonstrated economic impacts. Ten social indicators are used to calculate the genuine progress indicator: value of housework and parenting, cost of family breakdown, cost of crime, cost of household pollution abatement, value of volunteer work, loss of leisure time, value of higher education, value of highways and streets, cost of commuting, and the cost of motor vehicle crashes.

The overwhelmingly largest social indicator is the value of housework, which consistently made up around two-thirds of the total positive social value from 2009 to 2016. Higher education was another benefit, adding between 20% and 25% of the total value and growing over time. On the costs side, loss of leisure time was the greatest culprit, growing from 45% of total social costs to almost 60% of total social costs from 2009 to 2016. Other significant costs were the cost of commuting and auto crashes.

<sup>36</sup> Ibid.

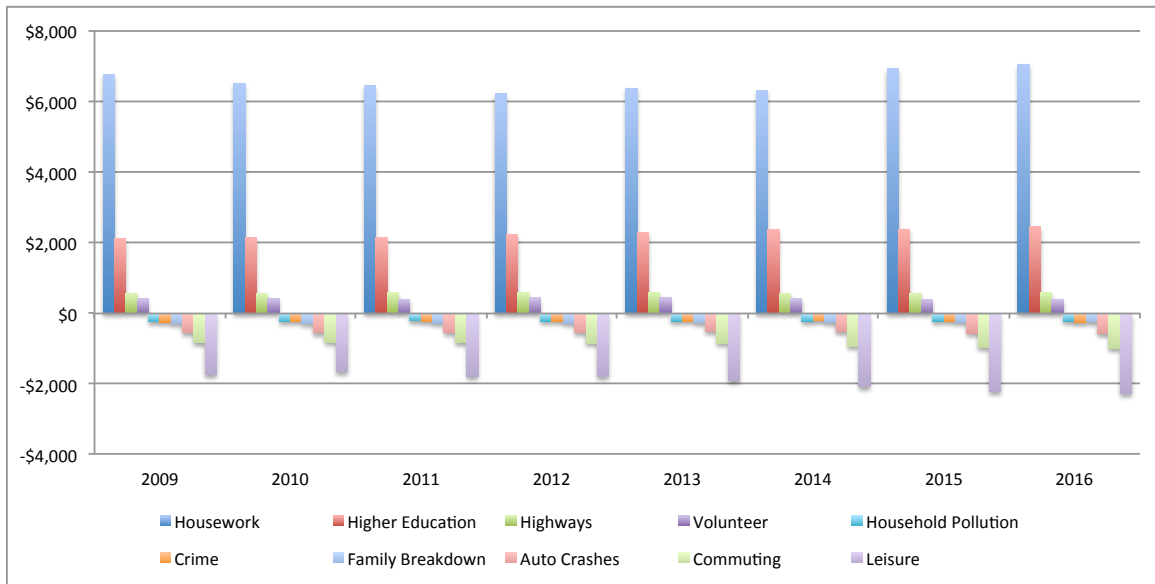


Figure 33: Per Capita Benefits and Costs of Social GPI Indicators (2009 Dollars)

The overall trend for social indicators follows a roughly U-shaped curve. Social welfare per capita decreases steadily from 2009 to 2014, dropping to \$500 below 2009 levels in 2014 in real terms. From 2014 to 2016, however, there is a quick recovery to the point where 2016 levels of social welfare only fall \$54 below 2009 levels, a \$350 per capita increase in just two years. These trends are especially sensitive to trends in housework, the largest single contributor to social welfare.

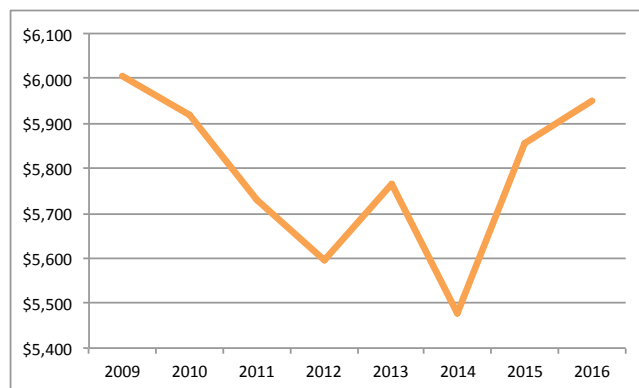


Figure 34: Per Capita Net Social Welfare (2009 Dollars)

## Value of Housework and Parenting

A major limitation of GDP is its exclusion of housework and parenting. If a child care worker cares for a child or a maid cleans a house and is paid for it, those dollars are included in the calculation of GDP. If someone cares for his own child or cleans his own bathroom, however, that time is not counted by GDP. By including the value of housework and parenting, we can avoid shifts from family labor to market labor that make the economy look like it is growing more than it actually is.

Unfortunately, state-level data about time use is not available, so American Time Use Survey data is used to estimate the amount of time Americans spend on housework and caring for others per day.<sup>37</sup> This data is then multiplied by Ohio’s age fifteen plus population to estimate the total hours spent on housework and caring for others per day. These hours

<sup>37</sup> American Time Use Survey, Bureau of Labor Statistics, 2009-2016, <http://bls.gov>.

are then multiplied by wage rates for maids and child care workers to determine what the market value of those hours spent are.

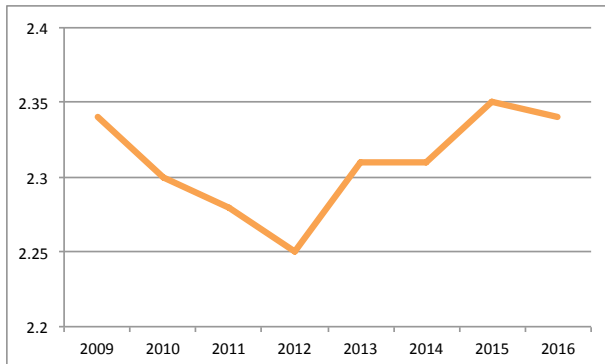


Figure 35: Hours of US Housework and Caretaking Per Capita Per Day

Hours of housework and caretaking nationally follow a “V” shape, with a linear decline in hours spent from 2009 to 2012 followed by a more or less linear increase from 2012 to 2016. This may be explained by a reduction of the number of young children in the house since birth rates decline during a recession.<sup>38</sup> Whatever the explanation, the average number of hours spent on these two activities was identical in 2009 and 2016.

The per capita value of housework in Ohio, then, follows a similar trend. The value falls \$550 (8%) from 2009 to 2012. The per-capita value of housework then grows \$830 (13%) from 2012 to 2016, representing a net per capita increase of \$270 (4%).

This increase can partly be attributed to an increase in real wages: the average wage of a housekeeper or child care worker grew by \$1.14 (12%) in real terms over that time period. It can also partly be explained, though, by substitution in time use from child care hours to housekeeping hours. While the average housekeeper’s wages went up \$1.84 (19%) over this period, the average child care worker’s wage only improved by \$0.43 (4%). Thus, while the average child care worker was making almost a dollar more than the average housekeeper in 2009, she was making about forty cents less than a housekeeper per hour in 2016. Therefore, substitution towards housekeeping hours represents more value for households.

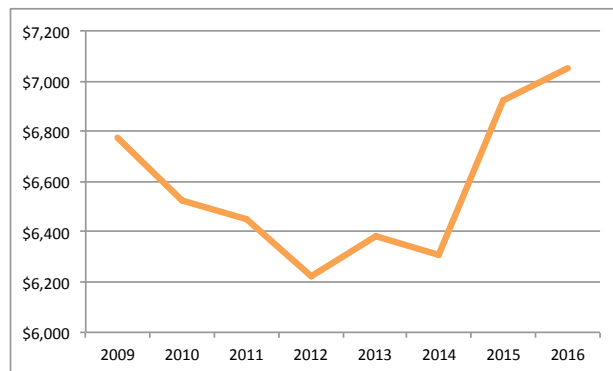


Figure 36: Per Capita Value of Housework and Parenting (2009)

## Cost of Family Breakdown

GDP generally grows as families dissolve. For instance, GDP grows with higher divorce rates as divorcees have to pay for legal fees, buy separate houses, and take part in the other expenses necessary in a divorce. As families cook together less and spend time together less, their activities move into the market and GDP grows, but many families would rather stay together and do not experience former family activities entering the market as a benefit to their welfare.

<sup>38</sup> Livingston, Gretchen, and D. Cohn. "US birth rate decline linked to recession." *Pew Social and Demographic Trends* (2010).

The genuine progress indicator estimates the cost of family breakdown by looking at two proxies: divorces and hours watching television. Divorce rates by state are reported by the Centers for Disease Control and Prevention.<sup>39</sup> The state of Ohio does not report how many children are affected by a divorce on average, so data from neighboring Michigan was used.<sup>40</sup> A value of \$11,212 per adult and \$16,671 per child in 2009 dollars was used, following past

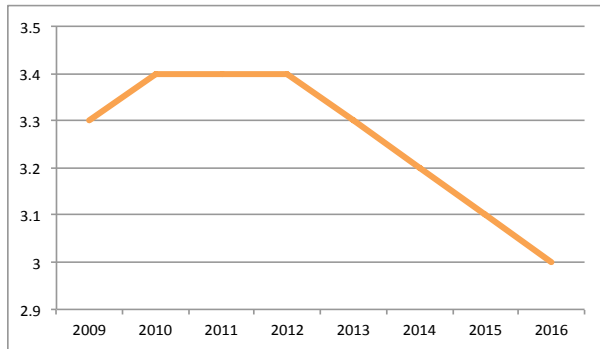


Figure 37: Ohio Divorces per 1000 People

GPI studies.<sup>41</sup> As for television viewing, Ohio does not collect state-level data, so national Nielsen data as reported in *The Atlantic* was used to approximate television viewing in the state.<sup>42</sup> A value of \$0.54 per hour was used.<sup>43</sup>

Divorce rates are down in Ohio. The rate of divorce in the state stayed fairly steady from 2009 to 2012, then dropped steadily every year since then, to the point where 2016 divorce rates were 9% below 2009

levels. The Michigan data on children affected per divorce looks similar with numbers spiking in 2010, staying steady until 2013, then declining after that.

Television watching is also on the decline, though more steadily than divorce. According to Nielsen data, the average family watched an hour less television in 2016 compared to 2009, a 12% decrease in television viewing. This change, though, may be driven by consumption of alternate forms of media that may also indicate family breakdown such as computers, phones, and tablets. An update of this proxy may be in order soon.

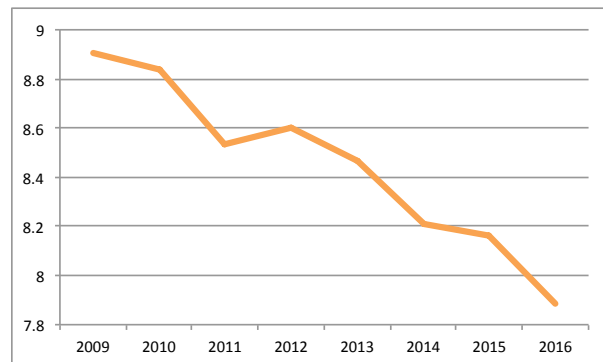


Figure 38: National Television Viewing Hours per Household per day

The reduction of these two proxies for family breakdown have led to a reduction in the per capita cost of family breakdown in Ohio since the recession. Cost of family breakdown per capita inched up \$3 in 2010 driven by the uptick in the state divorce rate but has fallen steadily each year since then, bottoming out in 2016 at \$44 (15%) below the 2009 cost of family breakdown.

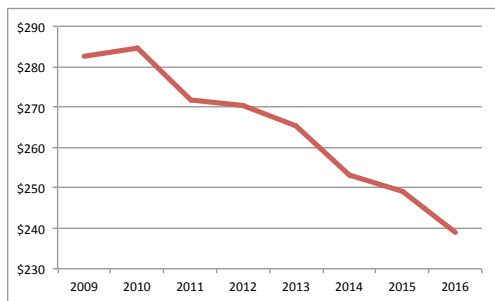


Figure 39: Per Capita Cost of Family Breakdown (2009 Dollars)

<sup>39</sup> “Divorce Rates by State: 1990, 1995, and 1999-2016,” CDC/NCHS, National Vital Statistics System, <http://cdc.gov>.

<sup>40</sup> 2016 Michigan Occurrence Divorce Files, Division for Vital Records & Health Statistics, Michigan Department of Health & Human Services; Population Estimate (latest update 9/2014), National Center for Health Statistics, [U.S. Census Populations With Bridged Race Categories](https://www.cdc.gov/nchs/data/series/sr_18/sr_18_011.pdf).

<sup>41</sup> Stiffler, “Colorado’s Genuine Progress Indicator.”

<sup>42</sup> Madrigal, Alexis, “When Did TV Watching Peak?” *The Atlantic*, May 30, 2018. <http://atlantic.com>

<sup>43</sup> Stiffler, “Colorado’s Genuine Progress Indicator.”

## Cost of Crime

Crime harms its victims financially, physically, and mentally. Standard GDP measurements do not factor the cost of crime into their calculations, thus counting purchases of crime victims ranging from security systems to corrections spending to funeral expenses as economic benefits without capturing the costs that crime exacts.

The genuine progress indicator uses FBI Unified Crime Reporting data for Ohio combined with estimates of the cost of crime calculated by the National Institute of Justice to calculate the cost of crime for Ohio for each year.<sup>44</sup> The 2009 estimated costs of each crime were \$2.8 million per murder, \$120,000 per rape, \$9,800 per robbery, \$12,000 per aggravated assault, \$1,900 per burglary, \$400 per larceny, and \$5,400 per motor vehicle theft.

The high cost associated with murder means that it is a large driver of the cost of crime. Indeed, even though murder never made up as much as 0.2% of total statewide crimes from 2009 to 2016, the cost of murder exceeded the cost of all other crimes combined in each of those years. Annual murders were on a steady decline from 2009 to 2014, but then numbers rose quickly in 2015 and 2016. In 2016, there were 127 more murders in Ohio than in 2009, a 24% increase in total murders.

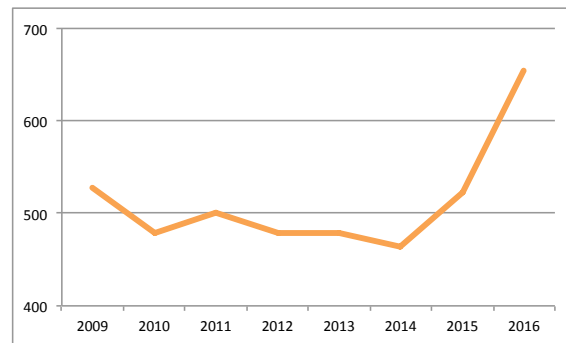


Figure 40: Annual Murders in Ohio

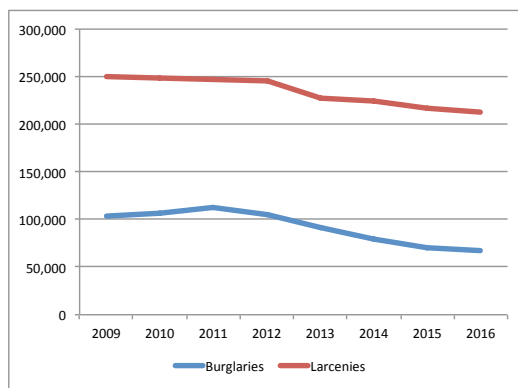


Figure 41: Annual Burglaries and Larcenies in Ohio

Other crime categories showed reductions from 2009 to 2016. In 2016, motor vehicle thefts were down 13%, larceny thefts were down 15%, robberies were down 29%, and burglaries were down 36% from 2009 levels. Rape and assault were basically flat over this period, with each within 1% of their 2009 levels in 2016. These trends follow the longer-term trend of decreasing crime levels nationwide and mean that, despite the recent uptick in murders, Ohio had 82,000 less crimes in 2016 than in 2009, a 20% decrease over the period. This decrease was largely driven by significant decreases in the numbers of burglaries and larceny thefts, which together led to 74,000 less crimes in Ohio in 2016 than in 2009.

The per capita cost trend looks very similar to the total murders trend because of the large cost of murder. The per capita cost of crime declines \$32 (13%) from 2009 to 2014, only to rebound in 2015 and 2016. By 2016, the per capita cost of crime is \$17 higher than 2009 after adjusting for inflation, 7% higher than in the depths of the Great Recession.

<sup>44</sup> Ibid., "Ohio Population and Number of Crimes: 1960-2016," <http://disastercenter.com>

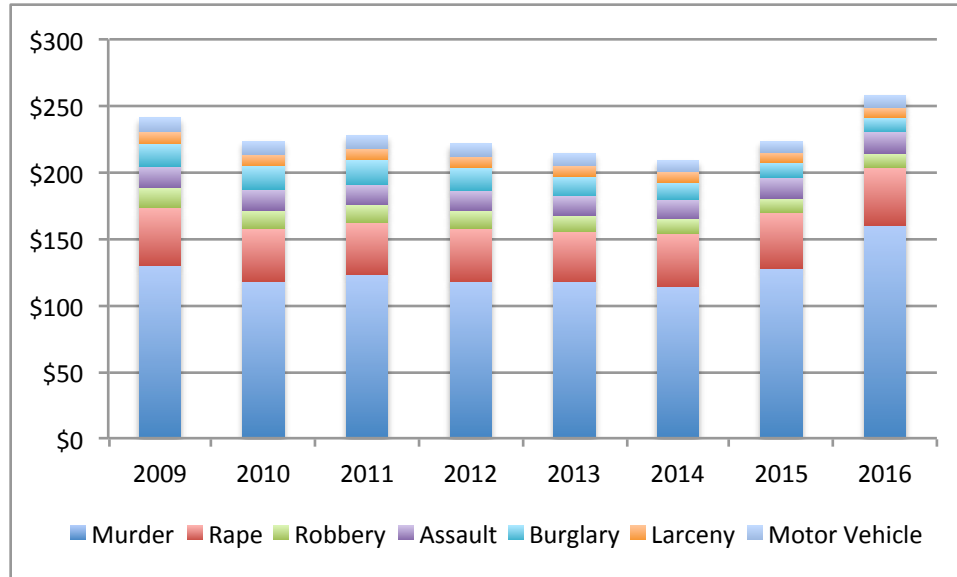


Figure 42: Per Capita Cost of Crime (2009 Dollars)

## Cost of Household Pollution Abatement

Another way that GDP grows as pollution grows is through greater consumer spending on household pollution abatement such as catalytic converters and air filters in cars and household septic and sewer systems.

Data was used from the Office of Highway Policy Information to find vehicle registration numbers for Ohio for 2009-2015, then line of best fit extrapolation was used to estimate the registration number for 2016.<sup>45</sup> The estimated total number of new vehicles was determined by the differences in vehicles from year to year added to one thirteenth the previous year's registrations, assuming each vehicle has an average life of thirteen years. The number of new cars is then multiplied by the cost of air filters (\$11 in 2009 dollars) and the cost of catalytic converters (\$125 in 2009 dollars) to estimate the total cost of household air pollution abatement.<sup>46</sup>

To calculate the costs of waste abatement, the genuine progress indicator uses 1990 data on the breakdown in Ohio between sewer and septic systems, with 78% of Ohio households with sewer systems and 22% with septic systems.<sup>47</sup> Total houses with sewer and septic systems were then estimated using annual data for number of houses from the American Community Survey. Each household using sewer was estimated to use 91,000 gallons of water per year, which means that the sewer cost per household per year was about \$450 using estimates for the cost of sewer.<sup>48</sup> Septic costs were split into septic cleaning costs, which were estimated at \$50 per year, and new septic costs, which were estimated at about \$5,000 per year. New septic systems were estimated by subtracting the previous year's estimated number of septic systems from the current year's estimated number of septic systems.

<sup>45</sup> "State Statistical Abstracts, Ohio: 2009-2015," Office of Highway Policy Information, Policy and Governmental Affairs, Federal Highway Association, U.S. Department of Transportation, <http://fhwa.dot.gov>.

<sup>46</sup> Stiffler, "Colorado's Genuine Progress Indicator."

<sup>47</sup> "Historical Census of Housing Tables: Sewage Disposal," <http://census.gov>

<sup>48</sup> Stiffler, "Colorado's Genuine Progress Indicator."



Solid waste tonnage (trash sent to landfills) was then estimated by scaling national solid waste projections down to Ohio’s level in proportion to Ohio’s population.<sup>49</sup> Tonnage was then multiplied by \$125 to estimate the cost.<sup>50</sup>

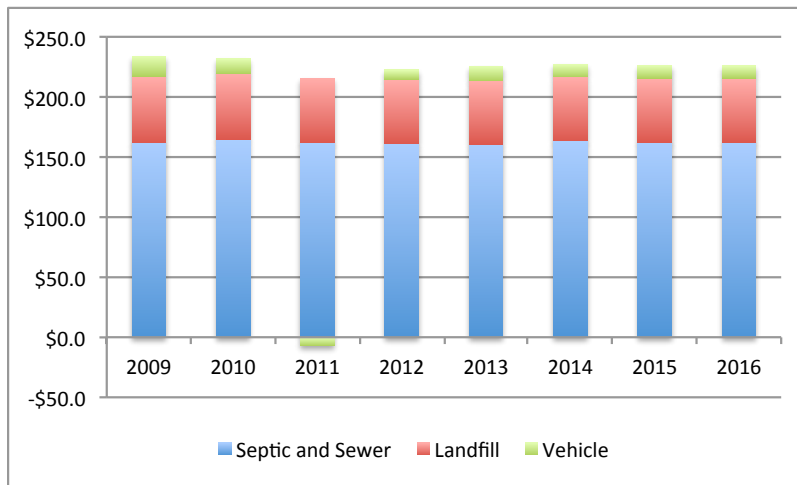


Figure 43: Per Capita Cost of Household Pollution Abatement (2009 Dollars)

Septic and sewer pollution abatement makes up the bulk of the cost of household pollution abatement over the period, making up over two-thirds of the cost of household pollution abatement in every year from 2009 to 2016. The cost of household pollution abatement falls slightly from 2009 to 2016, mostly driven by lower number of vehicle registrations.

## Value of Volunteer Work

Volunteer work, as unpaid work, is excluded from GDP calculations even though it can strengthen social ties in the community and otherwise support the economy. The genuine progress indicator uses state level data from the Corporation for National and Community Service on statewide volunteer hours in Ohio to estimate the number of hours people volunteer every year.<sup>51</sup> The number of hours in a given year was then multiplied by Independent Sector’s 2009 value of a volunteer hour in Ohio: \$18.54.<sup>52</sup>

Volunteer hours are sometimes referred to as “a nation’s informal safety net.”<sup>53</sup> If that is the case for Ohio, though, it did not work well at kicking in during the Great Recession. Volunteer hours peaked at 24 hours per capita in 2013, at a value of about \$450 per capita.<sup>54</sup> This is about \$40 (9.6%) higher than it was at the depths of the recession. By 2016, volunteer hours per capita had dropped to 22 hours, at a

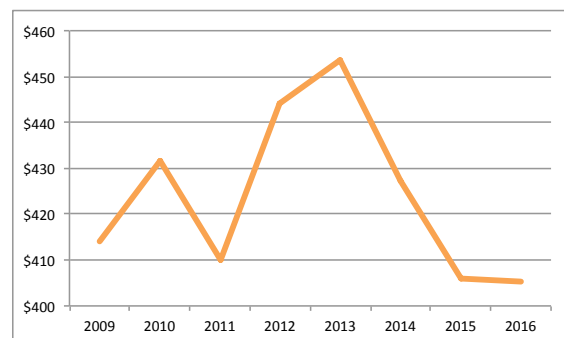


Figure 44: Per Capita Value of Volunteer Hours (2009 Dollars)

<sup>49</sup> “Advancing Sustainable Materials Management: Facts and Figures Report,” United States Environmental Protection Agency; data was not available for 2009 so it was extrapolated linearly and 2016 was extrapolated using line of best fit estimation.

<sup>50</sup> Stiffler, “Colorado’s Genuine Progress Indicator.”

<sup>51</sup> “Ohio,” Corporation for National and Community Service, <https://data.nationalservice.gov>; Data was not available for 2016 so it was extrapolated using a line of best fit technique.

<sup>52</sup> “Value of Volunteer Time/Indexed,” Independent Sector, <https://independentsector.org>

<sup>53</sup> Berik, G. & Gaddis, E. (2011). The Utah Genuine Progress Indicator, 1990 to 2007: A report to the people of Utah. Available at <http://www.dnr.maryland.gov/mdgpi/pdfs/GPIUtah.pdf>.

<sup>54</sup> The Corporation for National and Community Service reports that Ohio is 33<sup>rd</sup> in the country in volunteer hours per capita, though it exceeds all of its neighboring states besides Pennsylvania.

value of \$405, about \$9 lower than it was in 2009.

## Loss of Leisure Time

GDP counts increased market hours as a benefit, but does not factor in the loss of leisure hours for households. Thus, more people working more hours grows GDP even though people are losing leisure hours in order to work in the market.

The genuine progress indicator measures the cost of lost leisure time using a baseline of hours worked per worker in 1969, which was about 34 hours per week nationally.<sup>55</sup> Annual hours worked numbers are then multiplied by the number of unconstrained workers (those who have the work hours they want) and then by the hourly wage each year to find the total cost of lost leisure time.<sup>56</sup>

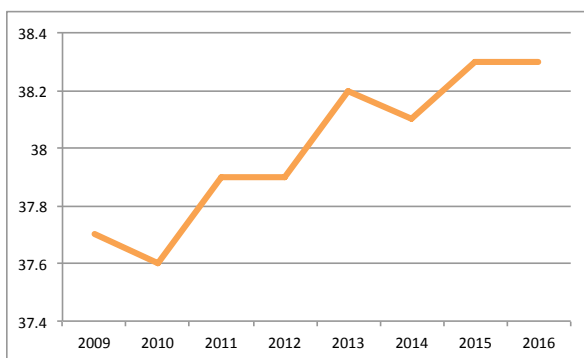


Figure 45: Average Hours Worked Per Ohio Worker Per Week

The average Ohio worker was working 36 more minutes a week in 2016 than in 2009. After slightly decreasing work hours in 2010, the number of minutes worked a week per worker has slowly increased since then. This may be a sign of more opportunities to work due to an improving state economy, though the hours worked per week in 2016 was only 1.6% higher than it was in 2009.<sup>57</sup>

Despite the fairly modest reduction in leisure hours since the Great Recession, the cumulative decrease in leisure hours suffered by workers over the same time period has exacted a fairly substantial toll on Ohio's economy. In 2009, in the depths of the Great Recession, lost leisure time cost the average Ohio resident over \$1,700. This number grew during the recovery, as higher wages combined with more people in the workforce and more minutes worked per worker ballooned this number to \$2,300 per capita, a 32% increase from 2009. This demonstrates that part of the recovery from the Great Recession was paid for through reductions in leisure time by workers.

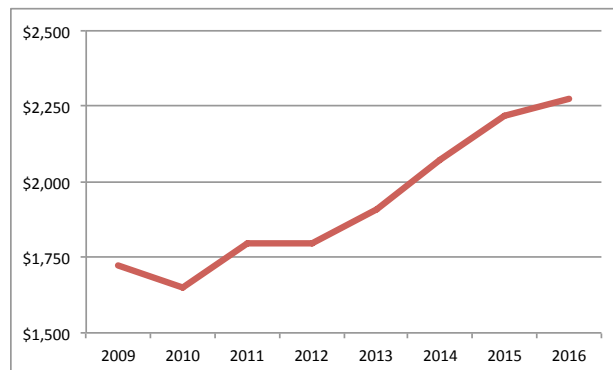


Figure 46: Per Capita Cost of Lost Leisure Time (2009 Dollars)

<sup>55</sup> Leete-Guy, Laura and Juliet B. Schor, "The Great American Time Squeeze: Trends in Work and Leisure, 1969-1989," Briefing Paper, Economic Policy Institute, 1992; Ohio's rate that year is assumed to be the same.

<sup>56</sup> "Mean Usual Hours Worked in the Past 12 Months for Workers 16 to 64 Years," American Community Survey, United States Census Bureau, <http://factfinder.census.gov>; "Occupational Employment Statistics," Bureau of Labor Statistics, <https://bls.gov>.

<sup>57</sup> While hours worked may cause decreases in GPI through the lost leisure time component, these can also be balanced out by increases in consumption.

## Value of Higher Education

Higher education attainment has benefits that go beyond wage boosts, benefits that include greater civic engagement, longer life expectancy, better child education, and more optimal family sizes.<sup>58</sup> The genuine progress indicator takes American Community Survey data about the number of people in the state with bachelor's degrees or more then multiplies it by \$13,000, the value of a bachelor's degree in 2009.<sup>59</sup>

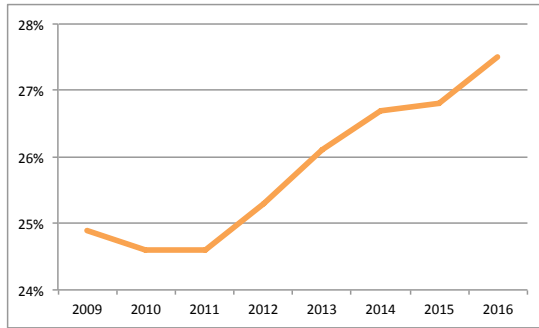


Figure 47: Ohio Residents Age 25 or Older with A Bachelor's, Graduate, or Professional Degree

Over the same period, the per capita value of a bachelor's degree has also grown, up \$340, or 16%, 2009 to 2016. The dip in bachelor's degree attainment in 2010 and 2011 was not matched by a dip in value of higher education since population gains wiped out the decrease in attainment. The state of Ohio has set a goal of increasing bachelor's degree attainment to 65% by 2025.<sup>60</sup> If the state reaches this goal, it will be able to increase its per capita genuine progress indicator by over \$3,300 even without population growth, more than doubling the per capita value of higher education.

After dipping briefly in 2010 and 2011, the percentage of Ohio residents age 25 and older with at least a bachelor's degree has steadily risen every year. By 2016, the percentage of Ohio residents age 25 and older with a bachelor's degree had almost reached 28%, a few percentage points higher than 2009, where less than a 25% of the same population had a bachelor's degree or more.

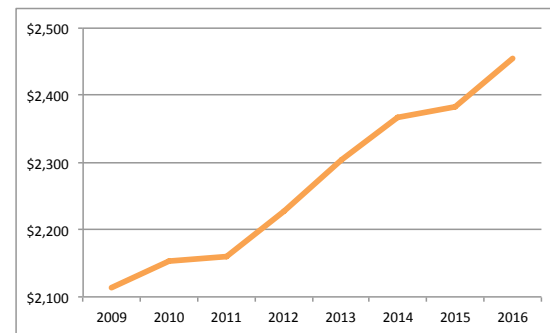


Figure 48: Per Capita Value of Higher Education (2009 Dollars)

## Value of Highways and Streets

Highways and streets are public goods that provide benefits to businesses and consumers. Since drivers do not generally pay to use them, their value is generally excluded from GDP calculations.

The genuine progress indicator uses Federal Highway Administration data on the miles of highway in the United States and the miles of highway in Ohio to determine a ratio of Ohio highway miles to total highway miles across the country.<sup>61</sup> It then uses Bureau of Economic

<sup>58</sup> McMahon, W.W. (2010). The Private and Societal Benefits of Higher Education: The Evidence, Their Value, and Policy Implications. TIAA-CREF Institute. Available at:

[http://www1.tiaacref.org/ucm/groups/content/@ap\\_ucm\\_p\\_tcp\\_docs/documents/document/tiaa02029326.pdf](http://www1.tiaacref.org/ucm/groups/content/@ap_ucm_p_tcp_docs/documents/document/tiaa02029326.pdf)

<sup>59</sup> Compared to other states, Ohio tends to have lower levels of bachelor's degree attainment. For instance, in 2010, Ohio ranked 37<sup>th</sup> in the country in bachelor's degree attainment, a couple points behind median state Pennsylvania.

<sup>60</sup> Jackson, Victoria, "Ohio Promise: Equitable Free College," Policy Matters Ohio, October 18, 2018.

<sup>61</sup> "Public Road Length – 2016, Miles by Ownership," Office of Highway Policy Information, Policy and Government Affairs, Federal Highway Administration, US Department of Transportation, <http://fhwa.dot.gov>.

Analysis data to estimate the federal value of the stock of highways and streets and scales that down to determine Ohio's stock.<sup>62</sup> We assume that the value of Ohio's highways and streets are ten percent of their net stock. Thus, assuming 25% of road use is for commuting, the value of the services of highways and streets comes out to 7.5% of the total stock.

The value of highways and streets using this estimation method have increased slightly over this time period, mostly owing to increases in the federal value of streets and highways. Ohio has only gained one mile of highways and streets over the period from 2009 to 2016 and more use of highways and streets may be increasing their economic value, but the change over this period is not likely to be large.<sup>63</sup>

## Cost of Commuting

Commuting exacts costs on households such as maintenance costs for vehicles, public transportation spending, and lost time. While GDP would count a business moving to the other side of town and increasing commute times as an economic benefit, the genuine progress indicator would subtract these commuting costs from the estimate of total economic value.

Three components make up the genuine progress indicator's measure of the cost of commuting: public transit spending, commuting cost of privately-owned vehicles, and lost time spent commuting. Public transit spending data comes from the Federal Transit Administration.<sup>64</sup> Data on mean travel time and types of private commuting come from the American Community Survey and are multiplied by the federal mileage reimbursement, \$0.55 per mile. Time spent commuting is then multiplied by BLS wage data to determine the opportunity cost of commuting.

Per capita spending on public transportation peaked in 2012, when the average Ohioan was spending 51 cents more on public transportation than in 2009. Since then, spending on public transportation has fallen in each succeeding year. By 2016, the average Ohioan was spending 42 cents less on public transportation than she was in 2009 after adjusting for inflation.

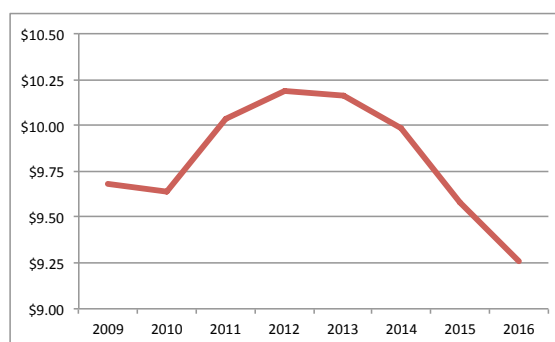


Figure 49: Per Capita Spending on Public Transportation

<sup>62</sup> "BEA Current Net Stock of Government Fixed Assets," National Data: Fixed Assets Accounts Tables, Bureau of Economic Analysis, <http://apps.bea.gov>.

<sup>63</sup> The change is likely to be larger than one mile but differences in reporting by year mean this measure is likely not completely accurate. Better reporting of mileage could make this year-to-year measure more accurate.

<sup>64</sup> "Operating Funding Time Series," Federal Transit Administration, Department of Transportation, <http://transit.dot.gov>.

At the same time, commute times have steadily risen in Ohio, not falling in any year from 2009 to 2016.<sup>65</sup> The average commuter in Ohio spent five more total hours in the car in 2016 than in 2009, representing a 2.6% increase from 2009 levels. The bulk of this increase occurred from 2010 to 2012, but there was an additional increase in commute times that occurred from 2014 to 2015. Cost of lost time is the largest factor contributing to the cost of commuting, making up over 98% of the cost of commuting in every year from 2009 to 2016.

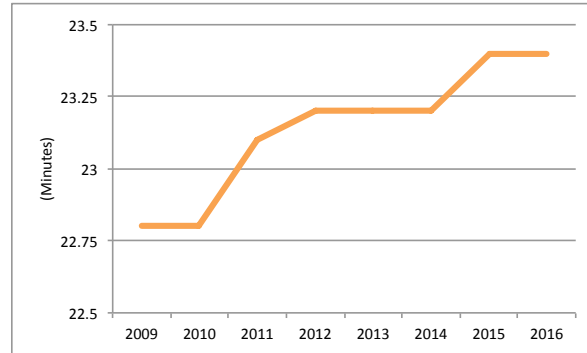


Figure 50: Average Ohio Commute Time in Minutes

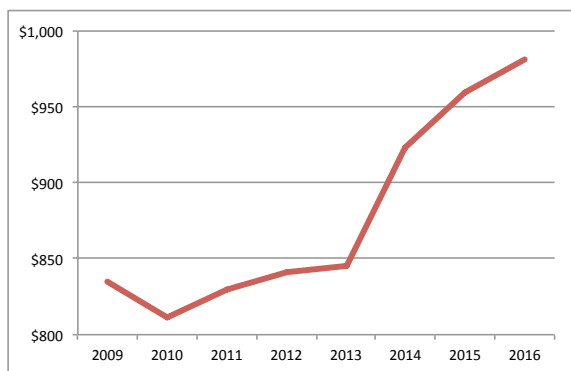


Figure 51: Per Capita Cost of Commuting (2009 Dollars)

Over this period, more people commuting combined with higher wages and longer commute times have driven up the per capita cost of commuting. In 2016, commuting cost the average Ohioan \$150 more than it did in 2009, an 18% increase over the 2009 cost of commuting. The cost of commuting dipped briefly in 2010, driven partly by stagnant real wages and lower overall commuting levels that year, but the cost of commuting has grown every year since then, especially taking off after 2014.

This shows that part of the recovery from the recession was achieved by driving up the cost of commuting in the state.

## Cost of Motor Vehicle Crashes

When a car crash happens and someone has to pay for car repairs, a new car, or health care expenses, GDP increases. These costs do not lead to higher welfare, though, so the genuine progress indicator subtracts costs associated with auto crashes.

Data on the number of motor vehicle fatality crashes, injury crashes, and non-injury crashes are taken

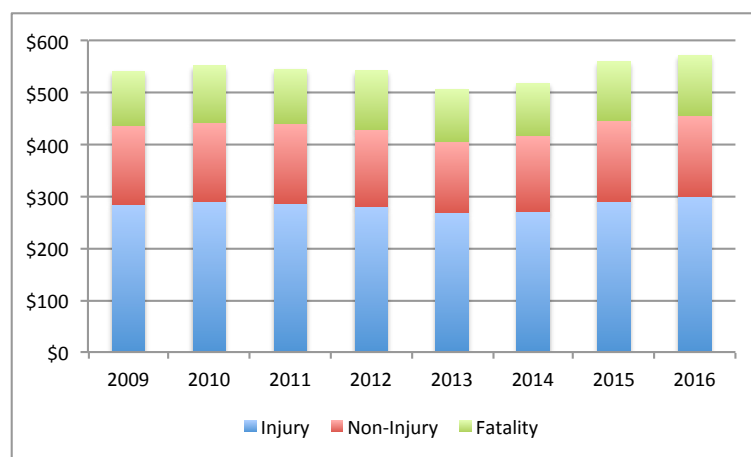


Figure 52: Per Capita Cost of Motor Vehicle Crashes in Ohio (2009 Dollars)

<sup>65</sup> Commute times in Ohio are a bit lower than the average state, with the average Ohioan spending a minute less in the car per day than the average North Carolinian in 2011, the median state for travel time.

from the Ohio Traffic Safety Office. Estimates for the cost of fatality, injury, and non-injury crashes are taken from the National Safety Council's "Injury Facts" publication.

All three categories of crashes are up since 2009: non-injury crashes have increased by 2.9% per capita, injury crashes have increased by 5.2% per capita, and fatality crashes have increased by 10.8% per capita. Ohio saw a reduction in motor vehicle crashes per capita in 2013, but crashes have been on the rise since then, so much that the cost of motor vehicle crashes in 2016 was \$30 (5.6%) more than it was in 2009. Injury crashes consistently made up more than half the cost of motor vehicle crashes in Ohio over this time period.

## ACKNOWLEDGEMENTS

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