Income Inequality among Regions and Metropolitan Statistical Areas: 2005 to 2015

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Abstract

Two main areas have received little attention in the income inequality literature recently. The first concerns where in the income distribution income inequality takes place. The second concerns how income inequality and changes in income inequality differ throughout the country. I address these concerns and differ from previous research in four main ways. First, I use an internal Census Bureau dataset, American Community Survey 1-year, which has rarely been used to study income inequality. Second, I examine income inequality, the effect of government programs, and how these have changed over time among regions and among small, medium, and large MSAs. Large MSAs, MSAs with populations over 1 million people, have been studied before while medium MSAs, MSAs with populations between 250,000 and 1 million people, and small MSAs, MSAs with populations less than 250,000 people have not been studied. Third, I use a unique set of income inequality measures that have rarely been used together in the same paper: the 90-10 ratio, the 99-90 ratio, the 90-50 ratio, and the 50-10 ratio. These measures are important because they allow me to examine income inequality at different points in the income distribution. Finally, I regress these income inequality ratios on a set of MSA variables in order to investigate what characteristics of MSAs are associated with higher or lower income inequality in different parts of the income distribution.

Introduction

        A number of income inequality studies were released in recent years and most of them have found that income inequality increased in the United States over the last several decades. There are, however, two areas that have received significantly less attention. The first concerns the segment of the income distribution where income inequality increased. When a summary measure of income inequality is used, nothing can be said about why income inequality increased. In other words, was the increase in income inequality due to changes in the top, middle, or bottom of the income distribution?

        The second concerns the area of the country that is experiencing increased income inequality. Were there regions that had higher income inequality and has that income inequality increased more or less over time? Were there particular Metropolitan Statistical Areas (MSAs) or types of MSAs that had higher income inequality than others?

        I address three related questions in this paper. First, how do government programs affect income inequality nationally, by region, and by MSA size and how has their impact changed over time? Second, what does income inequality look like in regions and among different MSA sizes and how has it changed over time? Third, what MSA characteristics are related to MSA income inequality? An important aspect of all these questions is comparing how the answers to these questions vary by income inequality ratio.

        This paper differs from previous research on income inequality in four main ways. First, I use an internal Census Bureau dataset, American Community Survey (ACS) 1-year, that has rarely been used to study income inequality. It is a relatively new dataset that only dates back to 2005. The ACS has advantages over IRS tax data due to the inclusion of non-tax filers and the ACS has an advantage over the Current Population Survey (CPS) Annual Social and Economic Supplement (ASEC) due to the sample size of the survey (about 3.5 million addresses in the ACS compared to 100,000 addresses in the CPS ASEC), which allows users to analyze smaller geographies. While the income data collected by the ACS is not as detailed as the data collected by the CPS ASEC, it does provide information about wages, self-employment income, interest and dividends, Social Security, Supplemental Security Income, public assistance, and retirement income.

        Second, I examine income inequality, the effect of government programs, and how these have changed over time in three Metropolitan Statistical Area (MSA) size categories: Large MSAs have populations over 1 million people, medium MSAs have populations between 250,000 and 1 million

people, and small MSAs have populations less than 250,000 people. In my review, I only found four other papers that have examined income inequality among MSAs. Two of these papers restricted their analysis to large MSAs: populations over 1 million people (Weinberg 2011) and the 100 most populous MSAs (Holmes and Berube 2016). This covers 14 percent and 26 percent of all MSAs respectively. These papers miss what happens with income inequality in the vast majority of MSAs. Cunningham (2015) included all MSAs, but only used the 90-10 ratio to measure inequality, only provided inequality figures for the year 2013, and focused on wage inequality. Glassman (2016) analyzed all MSAs, but MSAs were aggregated into groups based on whether income inequality increased, decreased, or stayed the same over time.

Third, I use a unique set of income inequality measures at the household level: the 90-10 ratio, the 99-90 ratio, the 50-10 ratio, and the 90-50 ratio. Most studies used summary measures (Gini Index, Theil Index, Mean Logarithmic Deviation) that fail to measure these distributional differences. While measures like the Gini Index are standard measures of income inequality, they do not allow one to examine where in the income distribution the income inequality occurs. Meyer and Sullivan (2013) and Heathcote et al. (2010) use the 90-50 ratio and 50-10 ratio, but both use CPS ASEC data and only analyze income inequality for the United States as a whole. Glassman (2016) includes all four of these income inequality measures, but the focus in that paper was on national income inequality and on whether MSA income inequality increased, decreased, or did not change significantly.

Finally, I investigate the relationship between MSA characteristics and income inequality by regressing the income inequality ratios on MSA variables. The purpose of this regression is to determine which MSA characteristics are related to higher or lower income inequality in different parts of the income distribution.

Literature Review

In order to undertake a study of income inequality, four important and interrelated decisions need to be made by the prospective researcher. I discuss each of these questions in turn.

A.   What level of geography will be the focus of the study?

In the literature, researchers have focused on the United States as a whole (Gindelsky 2015; Meyer and Sullivan 2013; McNichol et al. 2012; Burkhauser 2011; Congressional Budget Office 2011; Heathcote et al. 2009; Gottschalk and Danziger 2005; Piketty and Saez 2003), the United States as well

as Metropolitan Statistical Areas (Glassman 2016; Holmes and Berube 2016; Cunningham 2015; Weinberg 2011), and counties (Mather and Jarosz 2014).

Selection of geography is important because income distributions are not uniform throughout the country. While income inequality may be at a certain level nationally, this may miss significant differences by region. Similarly, income inequality in a region may miss differences between states in that region, income inequality in a state may miss differences between MSAs in the state, and so on.

In this paper, I focus on regions and three MSA size groups and I include income inequality in the U.S. as a whole to provide context. I select large, medium, and small MSAs in the four regions of the United States and examine how income inequality has changed over time from 2005 to 2015. In other studies, researchers have calculated and presented income inequality measures for MSAs with populations over one million people (Weinberg 2011), the 100 most populous MSAs (Holmes and Berube 2016), and all MSAs (Cunningham 2015; Glassman 2016). Cunningham (2015) focused on wage inequality and presented all MSAs in map form for 2013. Glassman (2016) aggregated MSAs into three categories based on changes over time: income inequality increased, decreased, or stayed the same.

B.   What measure of income should be used?

In this paper, I use both pre-tax, pre-transfer income and after-tax, after-transfer income in order to examine the effect of government programs and how these effects differ among MSAs of different sizes.

The main issue is whether to include taxes and transfers as a part of income or not. Some studies have focused on what income inequality looks like before the government is involved, i.e., without taxes or any kind of transfers (Gindelsky 2015; Gottshcalk and Danziger 2005: Piketty and Saez 2003). A number of studies have focused on income that includes cash transfers but not taxes (Holmes and Berube 2016; Mather and Jarosz 2014; Weinberg 2011; Burkhauser 2011). This was done either out of necessity due to the data or out of a genuine interest in pre-tax income. Finally, some research has been done comparing pre-tax, pre-transfer income to after-tax, after-transfer income (Glassman 2016; Meyer and Sullivan 2013; McNichol 2012; CBO 2011; Heathcote et al. 2009). Glassman (2016) and Meyer and Sullivan (2013) use federal and state income taxes while the other studies only use federal income taxes.

C. Which dataset should be used to conduct the study?

The question of what data source to use revolves around what information about incomes the source provides and for what years it provides it. The data sources used by previous researchers are IRS tax data (Congressional Budget Office 2011; Piketty and Saez 2003; Occupational Employment Statistics (Cunningham 2015), Current Population Survey Annual Social and Economic Supplement (Gindelsky 2015; Meyer and Sullivan 2013; McNichol et al. 2012; Burkhauser 2011; Heathcote et al. 2009; Gottschalk and Danziger 2005), American Community Survey 5-year estimates (Mather and Jarosz 2014; Weinberg 2011), and American Community Survey 1-year estimates (Glassman 2016; Holmes and Berube 2016).

IRS tax data is available back to 1913, but it lacks information on people who do not file or are not required to file their taxes. This data misses a significant number of people at the bottom of the income distribution, which is why those who have used IRS tax data focus on how income shares for the very top of the income distribution have changed. The Occupational Employment Statistics series has data for filers and non-filers alike, but it is wage data and has no information on cash transfer programs or other sources of income.

The CPS ASEC provides a lot of information about a number of different sources of incomes and includes filers and non-filers of taxes. Due to its small size, however, this survey has exclusively been used to measure income inequality at the national level. The ACS has been the main choice for researchers wanting to study sub-national areas. The ACS includes income from wages and salaries, retirement, self-employment, interests and dividends, and cash transfer programs (Social Security, Supplemental Security Income, and public assistance), includes information for tax filers and non-filers, and is large enough to allow for the analysis of metropolitan statistical areas of any size.

D. Which measures should be used to measure income inequality?

An extremely important question that gets relatively little attention in the literature is what is the best income inequality measure to use to study income inequality. There are numerous income inequality measures that have been used in the literature. Choice of a particular measure is meaningful and affects the magnitude of the change in income inequality at the national level and the magnitude and direction of the change in income inequality at smaller levels of geography (Glassman 2016).

Among the most recent research available on U.S. income inequality over time, studies which used only one measure used the Gini index (Mather and Jarosz 2012; Burkhauser 2011), the 90-10 ratio (Cunningham 2015; Gottschalk and Danziger 2005), and the 95-20 Ratio (Holmes and Berube 2016). For those using multiple measures, income shares of different deciles (Gindelsky 2015; Congressional Budget Office 2011; Piketty and Saez 2003), different income ratios (Meyer and Sullivan 2013; McNichol et al. 2012), and a mixture of income ratios and other measures (Glassman 2016; Weinberg 2011; Heathcote et al. 2009) have been used.

The measures of income inequality I use in this paper are the 90-10 ratio, the 99-90 ratio, the 50-10 ratio, and the 90-50 ratio. The 90-10 ratio is the 90th percentile income limit divided by the 10th percentile income limit. This compares how much richer the top 10 percent of households are compared to the bottom 10 percent of households. The 90-10 ratio is a description of what the overall income distribution looks like. It focuses on the extremes of the distribution as the rich becoming richer and the poor becoming poorer are drivers of increased income inequality.

The 99-90 ratio is the 99th percentile income limit divided by the 90th percentile income limit. This provides information about how much more well off the top on percent of the income distribution is compared to the top ten percent. Changes in the income distribution may not be uniform throughout the distribution. The 50-10 ratio compares households at the median of the income distribution to households at the bottom 10 percent of the income distribution. The 90-50 ratio compares households at the top 10 percent to households at the median of the distribution. These are useful tools in determining where in the income distribution income inequality is changing.

Data

The data in this paper come from the 2005 through 2015 1-year American Community Surveys.[1] The full national implementation of the ACS began in 2005 and the latest available data is for 2015.[2] All coefficients are calculated using household weights and standard errors are calculated using replicate weights. The main variable of interest throughout the paper is household income. Two measures of household income are used: pre-tax, pre-transfer income and after-tax, after-transfer income. Pre-tax, pre-transfer income includes wage and salary income, self-employment income, retirement income, and interests and dividends.

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[1] For more information on the ACS, see census.gov/acs.
[2] All households in Puerto Rico and group quarters in the U.S. are excluded.

After-tax, after-transfer income includes cash transfer payments (Supplemental Security Income, Social Security, and cash public assistance) and subtracts federal and state taxes using the National Bureau of Economic Research's TAXSIM program[3] for each year. Due to tax credits, it is possible for taxes to be negative, which means that income increases for these households after taxes are taken into account. For the purposes of this paper, government programs are defined as state and federal income taxes and cash transfer payments.[4]

The differences in household size are adjusted for by using the following three-parameter equivalence scale, which is the same equivalence scale used in the Supplemental Poverty Measure[5]:

$$\text{One and two adults: } scale = adults\char`^0.5$$

$$\text{Single parents: } scale = (adults\ +\ 0.8\ \times\ first\ child\ +\ 0.5\ \times\ other\ children)\char`^0.7$$

$$\text{All other families: } scale = (adults\ +\ 0.5\ \times\ children)\char`^0.7$$

where *adults* is the number of adults in the household, *first child* is equal to one if the household has at least one child, *other children* is equal to the number of children in the household minus one, and *children* is the number of children in the household. Income was divided by this scale variable to get a measure of equivalence adjusted household income.[6] This is done because resources are shared among people in a household resulting in economies of scale and children use less resources than adults.

Methodology

There were 381 Metropolitan Statistical Areas (MSAs)[7] in 2015 and 352 MSAs in 2005. Furthermore, some MSA delineations changed over time. Since I make direct MSA comparisons I want to ensure that I measure the change in the income inequality estimate rather than the change in MSA boundaries. To that end, I use the counties that make up the MSAs in 2015 to create those same MSAs in each previous year of data. Presenting income inequality information for 381 MSAs and performing any type of meaningful analysis without aggregation is not possible. However, presenting income inequality data and analyzing a useful subset of these MSAs is possible. I first separated the MSAs into

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[3] Feenberg, Daniel Richard, and Elizabeth Coutts. 1993. "An Introduction to the TAXSIM Model*". Journal of Policy Analysis and Management* 12(1): 189-194.   http://www.nber.org/taxsim/.

[4] SNAP/food stamp benefits are not included.

[5] Short, Kathleen. 2014. "The Supplemental Poverty Measure: 2013". *Current Population Reports*. U.S. Census Bureau.

[6] In previous iterations of this paper, Regional Price Parities were used to adjust for MSA cost of living differences. They were not used in this paper because my main focus was on inter-MSA differences rather than across MSA differences.

[7] For information on MSA assignment, see http://www.census.gov/population/metro/data/def.html.

each region of the country: Northeast, Midwest, South, and West.[8] I then divide MSAs in each region

into three groups based on size: Large MSAs include all MSAs with populations over 1 million in 2015;

Medium MSAs include all MSAs with populations between 250,000 and 1 million in 2015; and Small

MSAs include all MSAs with populations less than 250,000 in 2015. Despite different populations for

MSAs in previous years, I keep the categories the same for all years in order to make direct comparisons.

The number of MSAs in each category are presented in Table 1.

Table 1: Number of MSAs in Each Size Category	
Area	**Number of MSAs**
United States	**381**
Large MSAs	52
Medium MSAs	131
Small MSAs	198
Northeast	**49**
Large MSAs	8
Medium MSAs	19
Small MSAs	22
Midwest	**93**
Large MSAs	11
Medium MSAs	24
Small MSAs	58
South	**154**
Large MSAs	21
Medium MSAs	57
Small MSAs	76
West	**85**
Large MSAs	12
Medium MSAs	31
Small MSAs	42
Source: Author's calculations, 2015 American Community Survey. For more information on the ACS, see census.gov/acs.	

The effect of government programs: 2005 vs. 2015

Each income inequality measure was calculated for pre-tax, pre-transfer income and for after-

tax, after-transfer income for each region and MSA size for 2005 and 2015. The income inequality

estimates for each region include both MSAs and areas outside MSAs in the particular region. MSA

estimates were then grouped by region and by size. For example, to obtain the large MSA in the

Northeast estimate, I used the mean income inequality for the eight MSAs in that category with each

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[8] MSAs that cross regions are placed in the region that the majority of the population of the MSA resides in.

MSA in the category given an equal weight. The estimates listed in Tables 2A to 2C are the percentage change in income inequality when government programs are included in income (after-tax, after-transfer income ratio) versus when government programs are not included in income (pre-tax, pre-transfer income ratio) for 2015. A negative result means that after-tax, after-transfer income inequality was less than pre-tax, pre-transfer income inequality. Therefore, taxes and transfers acted to reduce income inequality.

In Table 2A, the effect of government programs is shown for each measure for the United States in 2015.[9] Regardless of region or MSA size, every measure showed decreases in income inequality due to government programs. However, the effect of government programs decreased as MSA size increased when income inequality was measured using the 90-10 ratio, the 50-10 ratio, and the 90-50 ratio. Therefore, government programs were most effective in reducing income inequality in smaller MSAs for households in the majority of the income distribution.

Furthermore, there was no statistically significant difference in the effect of government programs on the 99-90 ratio among the different size categories of MSAs. This means that there was no difference in effectiveness of government programs by MSA size in reducing income inequality in the top ten percent of the income distribution.

Table 2A: Percent Change in Income Inequality due to Government Programs: 2015				
	90-10	**99-90**	**50-10**	**90-50**
United States	-48.52*	-12.59*	-38.90*	-15.74*
	(0.0044)	(0.0045)	(0.0023)	(0.0022)
Large MSAs	-46.24*	-12.20*	-37.47*	-14.20*
	(0.0802)	(0.0836)	(0.0431)	(0.0375)
Medium MSAs	-49.44*	-12.43*	-40.33*	-15.30*
	(0.4171)	(0.4322)	(0.2271)	(0.1823)
Small MSAs	-53.58*	-12.02*	-44.41*	-16.38*
	(1.1893)	(1.1725)	(0.6670)	(0.5384)

Note: Estimates = 100*(pre-tax, pre-transfer income ratio/after-tax, after-transfer income ratio) - 1.
The United States includes all MSA and non-MSA areas in the region.
Numbers in parentheses are standard errors.
*Significant at the 90 percent confidence level
Source: Author's calculations, 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

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[9] TAXSIM only includes state and federal taxes. City income taxes are not included and larger cities are more likely to have income taxes. While transfers do vary at the local level, taxes do not, which is a limitation of this analysis.

In Table 2B, the effect of government programs on income inequality in the majority (90-10 ratio) and the top (99-90 ratio) of the income distribution is shown for the four regions of the United States in 2015. The largest effects of government programs on income inequality were in the Midwest for the 90-10 ratio and in the Northeast for the 99-90 ratio and the smallest effects of government programs on income inequality were in the West for the 90-10 ratio and the South for the 99-90 ratio.

The effect of government programs on the 90-10 ratio decreased as MSA size increased in the South and West, but not in the Northeast and Midwest. In the Northeast, the effect of government programs was not significantly different in medium and large MSAs and in the Midwest the effect of government programs was not significantly different in small and medium MSAs. The effect of government programs on the 99-90 ratio was higher in large MSAs than in medium MSAs in all four regions. There was no significant difference in the effect of government programs on the 99-90 ratio in medium and small MSAS in three of the regions and the effect government programs on the 99-90 ratio was higher in small MSAs than in medium MSAs in the West.

Table 2B: Percent Change in Income Inequality due to Government Programs: 2015

		Northeast	Midwest	South	West
90-10 ratio	Entire Region	-48.82* (0.0097)	-52.19* (0.0080)	-48.30* (0.0080)	-45.63* (0.0085)
	Large MSAs	-51.14* (0.0845)	-49.76* (0.0678)	-43.96* (0.0947)	-43.42* (0.0611)
	Medium MSAs	-50.73* (0.2715)	-51.69* (0.3006)	-50.20* (0.5079)	-45.08* (0.4105)
	Small MSAs	-55.95* (0.8860)	-52.96* (1.0100)	-54.84* (1.3429)	-50.47* (1.2631)
99-90 ratio	Entire Region	-14.26* (0.0077)	-11.90* (0.0094)	-11.43* (0.0082)	-13.26* (0.0092)
	Large MSAs	-12.66* (0.0776)	-13.32* (0.0797)	-11.19* (0.0096)	-12.81* (0.0684)
	Medium MSAs	-11.97* (0.3283)	-11.55* (0.3874)	-13.29* (0.5014)	-11.70* (0.3940)
	Small MSAs	-11.78* (0.8536)	-9.64* (1.1250)	-12.50* (1.2522)	-14.29* (1.2344)

Note: Estimates = 100*(pre-tax, pre-transfer income ratio/after-tax, after-transfer income ratio)-1.
The Northeast, Midwest, South, and West include all MSA and non-MSA areas in the region.
Numbers in parentheses are standard errors.
*Significant at the 90 percent confidence level
Source: Author's calculations, 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

In Table 2C, the effect of government programs on income inequality in the bottom half (50-10 ratio) and the top half (90-50 ratio) of the income distribution is shown for the four regions of the United States in 2015. The largest effects of government programs on income inequality were in the Midwest for the 50-10 ratio and in the West for the 90-50 ratio while the smallest effects were in the West for the 50-10 ratio and the Northeast for the 90-50 ratio.

The effect of government programs on the 50-10 ratio decreased as MSA size increased in the Midwest, South and West, but not in the Northeast. In the Northeast, the effect of government programs was lower in medium MSAs than in large MSAs.

The effect of government programs on the 90-50 ratio decreased as MSA size increases in the West and the South. In the Midwest, the effect of government programs was lower in large MSAs than in medium and small MSAs and in the Northeast, the effect of government programs was lower in large MSAs than in medium MSAs but there was no statistically significant difference between small and large MSAs and between small and medium MSAs..

Table 2C: Percent Change in Income Inequality due to Government Programs: 2015

		Northeast	Midwest	South	West
50-10 ratio	Entire Region	-40.21* (0.0047)	-43.28* (0.0043)	-39.24* (0.0041)	-34.80* (0.0046)
	Large MSAs	-43.41* (0.0415)	-40.85* (0.0343)	-35.24* (0.0526)	-33.48* (0.0347)
	Medium MSAs	-42.21* (0.1495)	-42.34* (0.1625)	-41.34* (0.2775)	-35.04* (0.2303)
	Small MSAs	-48.53* (0.5513)	-43.92* (0.5677)	-45.57* (0.7541)	-40.24* (0.6994)
90-50 ratio	Entire Region	-14.39* (0.0049)	-15.71* (0.0042)	-14.90* (0.0038)	-16.61* (0.0039)
	Large MSAs	-14.10* (0.0350)	-15.01* (0.0361)	-13.52* (0.0442)	-14.84* (0.0284)
	Medium MSAs	-14.59* (0.1391)	-16.17* (0.1485)	-15.17* (0.2121)	-15.34* (0.1759)
	Small MSAs	-14.37* (0.3586)	-16.17* (0.4748)	-16.81* (0.5836)	-16.79* (0.6175)

Note: Estimates = 100*(pre-tax, pre-transfer income ratio/after-tax, after-transfer income ratio)-1. The Northeast, Midwest, South, and West include all MSA and non-MSA areas in the region.
Numbers in parentheses are standard errors.
*Significant at the 90 percent confidence level
Source: Author's calculations, 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

In Table 3A, the percentage change in the effect of government programs from 2005 to 2015 is displayed for the United States. The effect of government programs on income inequality increased over time for each income ratio for the United States overall and for all MSA sizes except for the 99-90 ratio for small MSAs. The effect of government programs increased more in large MSAs than in medium MSAs for the 90-10 ratio and the 50-10 ratio and there were no significant differences in growth rates of the effect of government programs among MSA size for the 90-50 ratio and the 99-90 ratio.

Table 3A: Percent Change in Effect of Government Programs from 2005 to 2015				
	90-10	**99-90**	**50-10**	**90-50**
United States	21.372*	24.492*	13.744*	21.468*
	(0.027)	(0.086)	(0.014)	(0.030)
Large MSAs	22.415*	29.922*	17.321*	15.594*
	(0.0539)	(1.697)	(0.314)	(0.519)
Medium MSAs	17.528*	26.382*	13.067*	16.003*
	(2.650)	(8.123)	(1.502)	(2.404)
Small MSAs	28.245*	18.369	23.291*	22.337*
	(7.633)	(18.146)	(4.339)	(6.451)

*Significant at the 90 percent confidence level
Note: The United States include all MSA and non-MSA areas in the region.
Numbers in parentheses are standard errors.
Source: Author's calculations, 2005 and 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

In Table 3B, the percent change in the effect of government programs on income inequality from 2005 to 2015 in the majority (90-10 ratio) and the top (99-90 ratio) of the income distribution is shown for the four regions of the United States. The largest increase was in the West for the 90-10 ratio and the Midwest for the 99-90 ratio. Furthermore, there was a larger increase for the 99-90 ratio than for the 90-10 ratio for each region.

There is significantly more variation when looking at MSA sizes.   The effect of government programs increased more in large MSAs than in medium MSAs for the 90-10 ratio in the Northeast and West, while the effect of government programs increase more in small MSAs than in medium and large MSAs in the South and there were no significant differences among MSA sizes in the Midwest. The effect of government programs on the 99-90 ratio increased more in large MSAs than in small MSAs in the Northeast and Midwest, more in large MSAs than in medium MSAs in the Midwest and West, and there were no significant differences among MSA sizes in the South.

Table 3B: Percent Change in Effect of Government Programs from 2005 to 2015		Northeast	Midwest	South	West
90-10 ratio	Entire Region	19.366* (0.063)	21.020* (0.046)	19.370* (0.048)	22.807* (0.059)
	Large MSAs	27.202* (0.495)	20.768* (0.423)	19.640* (0.678)	24.941* (0.456)
	Medium MSAs	23.996* (1.717)	18.227* (1.798)	14.957* (3.291)	18.706* (2.488)
	Small MSAs	21.778* (5.067)	21.517* (7.318)	36.061* (8.685)	25.775* (7.712)
99-90 ratio	Entire Region	27.938* (0.142)	42.242* (0.220)	23.821* (0.164)	40.746* (0.205)
	Large MSAs	17.892* (1.279)	42.49* (1.625)	15.961* (1.758)	56.838* (2.050)
	Medium MSAs	27.542* (5.868)	24.565* (7.610)	26.528* (9.221)	-32.768* (2.978)
	Small MSAs	-3.039 (9.524)	8.797 (20.110)	13.672 (16.342)	52.968* (27.063)

Note: The Northeast, Midwest, South, and West include all MSA and non-MSA areas in the region.
Numbers in parentheses are standard errors.
*Significant at the 90 percent confidence level
Source: Author's calculations, 2005 and 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

In Table 3C, the percent change in the effect of government programs on income inequality from 2005 to 2015 in the bottom half (50-10 ratio) and the top half (90-50 ratio) of the income distribution is shown for the four regions of the United States. For the regions overall, the largest increase was in the West for the 90-50 ratio and the Northeast for the 50-10 ratio. Furthermore, there was a larger increase for the 50-10 ratio than for the 90-50 ratio in the Northeast, while the reverse was true for the other three regions.

When looking at MSA sizes among the regions, the effect of government programs on the 50-10 ratio increased more in large MSAs than in medium MSAs for each region and more in small MSAs than in medium MSAs for each region except for the West. There was no real discernible pattern for the effect of government programs on the 90-50 ratio. There was a larger increase in the effect of government programs in large MSAs than in small MSAs in the Northeast, in large MSAs than in medium MSAs in the West, in medium MSAs than in large MSAs in the Midwest, and in small MSAs than in medium and large MSAs in the South.

Table 3C: Percent Change in Effect of Government Programs from 2005 to 2015		Northeast	Midwest	South	West
50-10 ratio	Entire Region	14.419*	12.689*	13.811*	11.657*
		(0.032)	(0.024)	(0.025)	(0.031)
	Large MSAs	22.495*	12.158*	16.918*	19.332*
		(0.280)	(0.223)	(0.418)	(0.280)
	Medium MSAs	19.134*	8.677*	12.415*	14.719*
		(0.991)	(0.928)	(1.828)	(1.747)
	Small MSAs	25.452*	17.103*	28.697*	20.356*
		(3.303)	(4.145)	(4.849)	(4.380)
90-50 ratio	Entire Region	12.092*	23.798*	17.906*	26.466*
		(0.065)	(0.053)	(0.048)	(0.063)
	Large MSAs	15.724*	19.562*	13.200*	16.030*
		(0.474)	(0.464)	(0.624)	(0.422)
	Medium MSAs	14.843*	27.094*	14.332*	12.213*
		(1.719)	(2.130)	(2.890)	(2.065)
	Small MSAs	0.067	22.756*	31.731*	16.932*
		(3.816)	(5.645)	(7.404)	(7.165)

Note: The Northeast, Midwest, South, and West include all MSA and non-MSA areas in the region.
Numbers in parentheses are standard errors.
*Significant at the 90 percent confidence level
Source: Author's calculations, 2005 and 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

There are three main conclusions from the results in this section. First, taxes and cash transfer programs had a greater impact on income inequality in smaller MSAs than in larger MSAs in the United States overall and in most (3 out of 4) regions for three out of four income ratios (90-10 ratio, 50-10 ratio, and 90-50 ratio). Second, taxes and cash transfer programs had a greater impact on income inequality in the top of the income distribution (99-90 ratio) in large MSAs than in medium MSAs in all four regions and there were no significant differences by MSA size for the U.S. overall. Third, while the effect of taxes and cash transfer programs was greater in smaller MSAs than in larger MSAs in most areas, the change over time in the effect of taxes and cash transfer programs was greater in larger MSAs than in smaller MSAs in two out of four regions for three of the ratios and in one out of four regions for the 50-10 ratio.

After-tax, after-transfer income inequality ratios over time: 2005 vs. 2015

In the final two sections of the paper, the analysis is done exclusively with after-tax, after-transfer household income. In Table 4A, the after-tax, after-transfer income inequality ratios are listed

for the United States and for three different sizes of MSAs in the United States for 2015. Income inequality was higher in large MSAs than in medium MSAs for each income inequality ratio. Income inequality in large MSAs was also higher than in small MSAs for the 90-10 ratio, the 50-10 ratio, and the 90-50 ratio. Unique to the 99-90 ratio was the fact that income inequality was higher in small MSAs than in medium MSAs.

Table 4A: After-tax, After-transfer Income Inequality: 2015				
	90-10	**99-90**	**50-10**	**90-50**
United States	7.525*	2.447*	3.174*	2.371*
	(0.0003)	(0.0001)	(0.0001)	(0.0001)
Large MSAs	7.160*	2.392*	3.128*	2.285*
	(0.0059)	(0.0015)	(0.0011)	(0.0006)
Medium MSAs	6.914*	2.303*	3.049*	2.263*
	(0.0292)	(0.0071)	(0.0064)	(0.0029)
Small MSAs	6.820*	2.387*	3.063*	2.215*
	(0.0889)	(0.0199)	(0.0202)	(0.0085)
*Significant at the 90 percent confidence level Note: The U.S. includes all MSA and non-MSA areas in the country. Numbers in parentheses are standard errors. Source: Author's calculations, 2015 American Community Survey. For more information on the ACS, see census.gov/acs.				

In Table 4B, after-tax, after-transfer income inequality results for the majority (90-10 ratio) and the top (99-90 ratio) of the income distribution are presented for the four regions of the United States in 2015. The highest income inequality was in the Northeast and the lowest income inequality was in the Midwest for both income ratios.

Income inequality among the regions showed different patterns than the United States as a whole with regard to MSA size. In the Northeast, income inequality increased as MSA size increased for both income ratios. This is not the case for the other regions. While income inequality in large MSAs was mostly higher than income inequality in medium MSAs, there was one exception (90-10 ratio in the South). Income inequality in large MSAs was higher than in small MSAs in most instances, but the reverse was true in two cases (99-90 ratio in South and the West) and there was no significant difference in three cases (90-10 ratio in the South and the 99-90 ratio in the Midwest and South).

Table 4B: After-tax, After-transfer Income Inequality: 2015					
		Northeast	**Midwest**	**South**	**West**
90-10 ratio	Entire Region	7.856*	6.562*	7.769*	7.673*
		(0.0007)	(0.0006)	(0.0006)	(0.0007)
	Large MSAs	7.521*	6.729*	7.201*	7.242*
		(0.0082)	(0.0044)	(0.0068)	(0.0042)
	Medium MSAs	6.577*	6.323*	7.353*	6.772*
		(0.0178)	(0.0196)	(0.0387)	(0.0262)
	Small MSAs	6.259*	6.464*	7.248*	6.832*
		(0.0657)	(0.0752)	(0.1065)	(0.0877)
99-90 ratio	Entire Region	2.581*	2.370*	2.446*	2.385*
		(0.0001)	(0.0002)	(0.0001)	(0.0001)
	Large MSAs	2.388*	2.382*	2.437*	2.324*
		(0.0014)	(0.0014)	(0.0017)	(0.0012)
	Medium MSAs	2.261*	2.284*	2.358*	2.241*
		(0.0054)	(0.0068)	(0.0083)	(0.0063)
	Small MSAs	2.170*	2.357*	2.469*	2.395*
		(0.0134)	(0.0177)	(0.0217)	(0.0234)

*Significant at the 90 percent confidence level
Note: The Northeast, Midwest, South, and West include all MSA and non-MSA areas in the region.
Numbers in parentheses are standard errors.
Source: Author's calculations, 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

In Table 4C, after-tax, after-transfer income inequality results for the bottom half (50-10 ratio) and the top half (90-50 ratio) of the income distribution are presented for the four regions of the United States in 2015. The highest income inequality was in the Northeast for the 50-10 ratio and the South for the 90-50 ratio and the lowest income inequality was in the Midwest for both income ratios.

In the Northeast, income inequality increased as MSA size increased for both income ratios. This is not the case for the other regions. While income inequality in large MSAs was mostly higher than income inequality in medium MSAs, there were a few exceptions (50-10 ratio and 90-50 ratio in the South). Income inequality in large MSAs was higher than in small MSAs in most instances, but there was no significant difference in some cases (50-10 ratio in the Midwest and in the South).

Table 4C: After-tax, After-transfer Income Inequality: 2015					
		Northeast	Midwest	South	West
50-10 ratio	Entire area	3.349*	2.992*	3.188*	3.165*
		(0.0001)	(0.0001)	(0.0001)	(0.0001)
	Large MSAs	3.375*	3.059*	3.082*	3.106*
		(0.0012)	(0.0009)	(0.0014)	(0.0009)
	Medium MSAs	3.068*	2.964*	3.140*	2.937*
		(0.0041)	(0.0043)	(0.0084)	(0.0059)
	Small MSAs	2.976*	3.060*	3.119*	3.011*
		(0.0177)	(0.0181)	(0.0236)	(0.0183)
90-50 ratio	Entire Area	2.346*	2.194*	2.437*	2.424*
		(0.0001)	(0.0001)	(0.0001)	(0.0001)
	Large MSAs	2.222*	2.196*	2.333*	2.325*
		(0.0005)	(0.0005)	(0.0007)	(0.0005)
	Medium MSAs	2.149*	2.129*	2.339*	2.298*
		(0.0021)	(0.0024)	(0.0033)	(0.0028)
	Small MSAs	2.091*	2.097*	2.314*	2.264*
		(0.0052)	(0.0076)	(0.0093)	(0.0101)

*Significant at the 90 percent confidence level
Note: The Northeast, Midwest, South, and West include all MSA and non-MSA areas in the region.
Numbers in parentheses are standard errors.
Source: Author's calculations, 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

In Table 5A, the percentage change in after-tax, after-transfer income inequality from 2005 to 2015 is listed for each income ratio for the United States as a whole. Income inequality increased more in large MSAs than in medium MSAs for the 90-10 ratio and the 99-90 ratio. Income inequality also increased more in small MSAs than in large MSAs for the 99-90 ratio.

Restricting analysis to between the 10th percentile and the 90th percentile, there was no significant difference in the change in income inequality among the different MSA sizes for the bottom half of the income distribution (50-10 ratio) while income inequality increased as MSA size increased for the top half of the income distribution (90-50 ratio). Futhermore, increases in income inequality over the majority of the income distribution (90-10 ratio) were driven more by changes in the top half of the income distribution (90-50 ratio) than in the bottom half of the income distribution (50-10 ratio) for large and medium size MSAs.

Table 5A: Percent Change in After-tax, After-transfer Income Inequality from 2005 to 2015				
	90-10	**99-90**	**50-10**	**90-50**
United States	5.329*	4.137*	1.363*	3.912*
	(0.007)	(0.006)	(0.003)	(0.002)
Large MSAs	5.571*	4.616*	1.543*	4.018*
	(0.127)	(0.102)	(0.0059)	(0.041)
Medium MSAs	4.261*	3.149*	1.464*	3.150*
	(0.672)	(0.502)	(0.324)	(0.197)
Small MSAs	3.346*	9.779*	1.737*	2.037*
	(2.017)	(1.332)	(1.030)	(0.522)

*Significant at the 90 percent confidence level
Note: The U.S. includes all MSA and non-MSA areas in the country.
Numbers in parentheses are standard errors.
Source: Author's calculations, 2005 and 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

In Table 5B, the percent change in after-tax, after-transfer income inequality from 2005 to 2015 for the majority (90-10 ratio) and the top (99-90 ratio) of the income distribution are presented for the four regions of the United States. For the regions as a whole, income inequality increased for both income ratios for all four regions. Furthermore, the largest increases in income inequality were in the West for the 90-10 ratio and in the Midwest for the 99-90 ratio, while the smallest increases in income inequality occurred in the South for both ratios.

Unlike the regions as a whole, there were a few MSA sizes in which income inequality did not change significantly (90-10 ratio for small MSAs in the Midwest and the South and the 99-90 ratio for medium MSAs in the South). Income inequality covering the majority of the income distribution (90-10 Ratio) increased more in large MSAs than in small MSAs in the West and the Midwest and there was no significant difference in the magnitudes of the changes in income inequality among the different MSA sizes in the Northeast and South. For the top of the income distribution in the U.S. (99-90 ratio), income inequality increased more in large MSAs than in medium MSAs for two of the regions and the reverse was true for the West. [10] Income inequality also increased more in small MSAs than in large MSAs for three of the regions and the reverse was true for the Northeast.

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[10] There was no significant difference in change in income inequality between large and medium MSAs in the Midwest.

		Northeast	Midwest	South	West
	Table 5B: Percent Change in After-tax, After-transfer Income Inequality from 2005 to 2015				
90-10 ratio	Entire Region	6.895* (0.015)	5.986* (0.012)	2.181* (0.011)	9.921* (0.014)
	Large MSAs	8.169* (0.142)	7.251* (0.103)	2.652* (0.148)	7.672* (0.100)
	Medium MSAs	8.069* (0.405)	4.355* (0.479)	2.637* (0.862)	5.309* (0.575)
	Small MSAs	6.633* (1.441)	3.021 (2.460)	0.704 (1.980)	7.618* (1.880)
99-90 ratio	Entire Region	4.309* (0.011)	5.645* (0.011)	4.011* (0.010)	1.835* (0.011)
	Large MSAs	7.210* (0.100)	6.389* (0.094)	5.307* (0.117)	0.181* (0.085)
	Medium MSAs	4.646* (0.355)	6.272* (0.506)	0.038 (0.565)	6.130* (0.459)
	Small MSAs	4.827* (0.841)	11.756* (1.404)	11.705* (1.321)	6.191* (1.518)

*Significant at the 90 percent confidence level
Note: The Northeast, Midwest, South, and West include all MSA and non-MSA areas in the region.
Numbers in parentheses are standard errors.
Source: Author's calculations, 2005 and 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

In Table 5C, the change in income inequality results are restricted to between the 10th percentile and the 90th percentile. Income inequality increased for both the 50-10 ratio and the 90-50 ratio for each region as a whole, except for the 50-10 ratio in the South. The largest increase in income inequality was in the West for both income ratios and the smallest increase (a decrease for the 50-10 ratio) was in the South for both ratios.

For the bottom half of the income distribution (50-10 ratio), income inequality increased more in small MSAs than in medium and large MSAs in the Northeast and West and income inequality increased more in large MSAs than in medium MSAs in the Midwest. The South was an interesting case in that there was a decrease in income inequality among large and small MSAs and an increase in income inequality in medium MSAs.

For the top half of the income distribution in the U.S. (90-50 ratio), income inequality increased as MSA size increased in the Northeast and Midwest, increased more in large MSAs than medium MSAs

in the South and more in large MSAs than in small MSAs in the West. Unlike the other two regions, income inequality increased more in small MSAs than medium MSAs in the South and more in medium MSAs than large MSAs in the West.

Comparing across income ratios, increases in income inequality over the majority of the income distribution (90-10 ratio) was driven more by changes in the top half of the income distribution (90-50 ratio) than in the bottom half of the income distribution (50-10 ratio) in the Northeast, Midwest, and South while the reverse was true for the West. Breaking this down by MSA size, the 90-50 ratio increased more than the 50-10 ratio for large MSAs and medium MSAs in the Midwest and West and for large and small MSAs in the South. Conversely, the 50-10 ratio increased more than the 90-50 ratio for MSAs of all sizes in the Northeast and for small MSAs in the West.

Table 5C: Percent Change in After-tax, After-transfer Income Inequality from 2005 to 2015					
		Northeast	Midwest	South	West
50-10 ratio	Entire Region	2.719* (0.007)	2.168* (0.006)	-1.403* (0.005)	5.504* (0.006)
	Large MSAs	4.214* (0.054)	1.607* (0.047)	-0.419* (0.073)	3.098* (0.048)
	Medium MSAs	5.230* (0.201)	0.418* (0.227)	1.307* (0.421)	0.287 (0.288)
	Small MSAs	6.725* (0.821)	2.823* (1.244)	-2.369* (1.023)	5.953* (0.895)
90-50 ratio	Entire Region	4.065* (0.006)	3.737* (0.004)	3.635* (0.004)	4.187* (0.005)
	Large MSAs	3.899* (0.036)	5.542* (0.037)	3.164* (0.047)	4.308* (0.035)
	Medium MSAs	3.288* (0.138)	3.943* (0.166)	1.946* (0.233)	4.815* (0.186)
	Small MSAs	-0.032 (0.342)	1.711* (0.474)	3.127* (0.545)	1.487* (0.635)

*Significant at the 90 percent confidence level
Note: The Northeast, Midwest, South, and West include all MSA and non-MSA areas in the region. Numbers in parentheses are standard errors.
Source: Author's calculations, 2005 and 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

There are three main conclusions from this section. Income inequality was higher in larger MSAs than in smaller MSAs in the Northeast for all four ratios, in the Midwest for the 90-50 ratio, and in the West for the 90-10 ratio and the 90-50 ratio. Second, income inequality was not higher in smaller

MSAs than in larger MSAS for any income inequality ratio in any region. In this respect, the summary results in this section differ significantly from the results in the previous section. A number of income inequality results in 2015 (this section) were higher in larger MSAs than in smaller MSAs, while the majority of the effect of government programs results in 2015 (previous section) were higher in smaller MSAs than in larger MSAs. There was no clear pattern for the change in income inequality, though, the change in income inequality decreased as MSA size increased in only two cases.
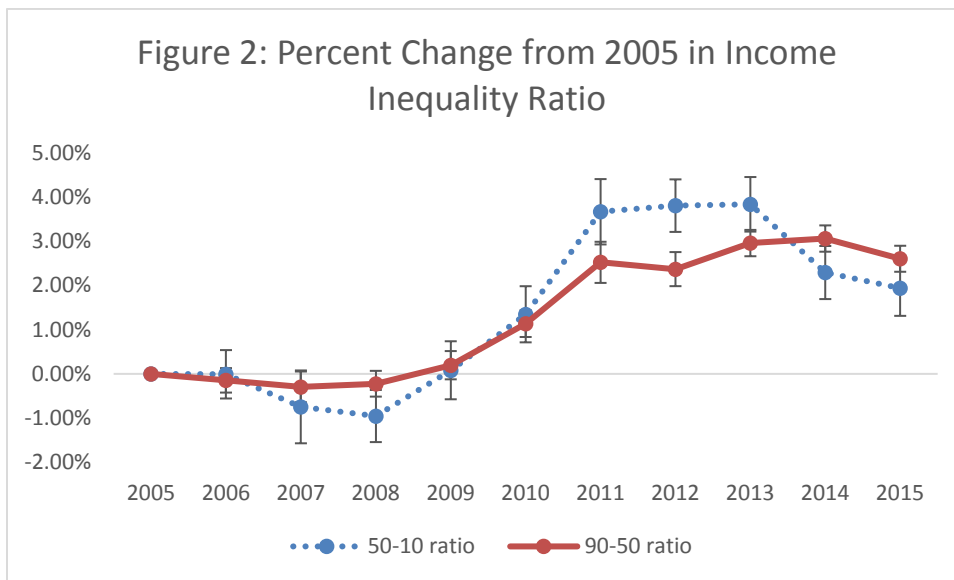
MSA characteristics and Income Inequality: 2005 through 2015

In this section, I use all eleven years of data, from 2005 to 2015, for two main purposes. First, I regress income inequality on years, region, and MSA size to show how income inequality changed over time while holding region and MSA size constant. The dependent variable in each case is the log of the income inequality ratio and standard errors are clustered at the MSA level. The year 2005 is the reference period so each subsequent year is graphed as some amount greater than, less than, or not significantly different from income inequality in 2005. The results for the 90-10 ratio and the 99-90 ratio are graphed in Figure 1 and the results for the 50-10 ratio and the 90-50 ratio are graphed in Figure 2.

There are three main takeaways from Figure 1. First, income inequality increased between 2005 to 2015 for both income ratios. Second, these overall increases in income inequality did not differ significantly from each other. Third, the path from 2005 to 2015 did differ significantly by income ratio. There are four distinct periods in Figure 1. From 2006 to 2008, the 99-90 ratio was greater than it was in 2005 and it increased from 2005 to 2007. In contrast, the 90-10 ratio was less than (2006, 2008) or not significantly different (2007) than it was in 2005 and the ratio decreased from 2005 to 2006. From 2008 to 2009, the 99-90 ratio decreased, while the 90-10 ratio increased. This period, during the Great Recession, had depressed incomes at the top of the distribution but greater separation between the top and bottom of the income distribution. From 2009 to 2012, the 90-10 ratio was greater than it was in 2005 and it increased from 2009 to 2011, while the 99-90 ratio was not significantly different than it was in 2005 during this period. The slow recovery following the great recession was uneven, with households at the bottom of the income distribution recovering slower than households at the top of the income distribution. Finally, from 2013 to 2015, both income ratios were greater than their respective 2005 levels.

Figure 1: Percent Change from 2005 in Income Inequality Ratio
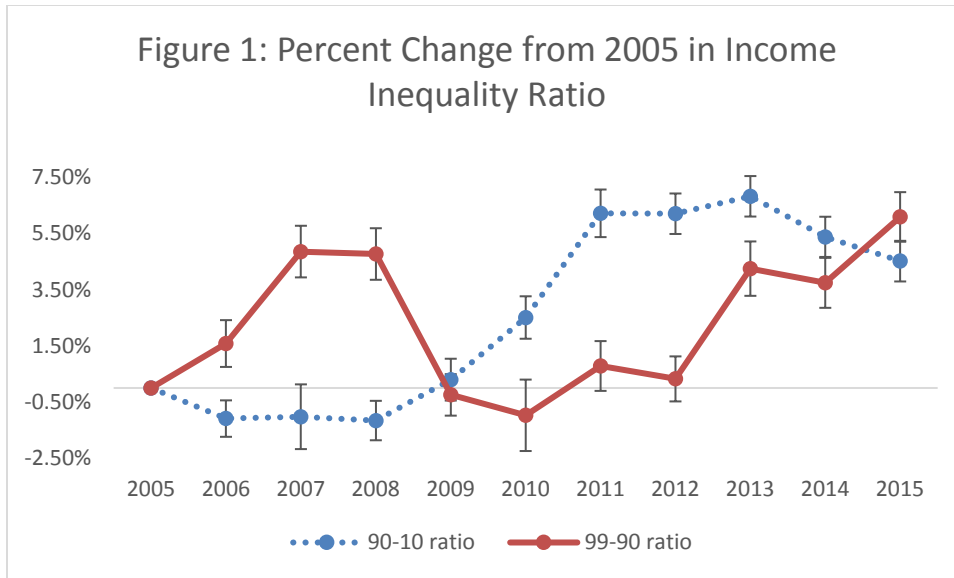
There are also three main takeaways from Figure 2. First, income inequality increased between 2005 to 2015 for both income ratios. Second, these overall increases in income inequality did not differ significantly from each other. Third, the path from 2005 to 2015 was similar for both ratios unlike in Figure 1. There are three distinct periods in Figure 2. From 2006 to 2009, both income ratios were not significantly different from their respective 2005 levels. From 2009 to 2011, however, both income ratios increased. This period, during the Great Recession and slow recovery from the Great Recession, had uneven effects both between the top and middle and between the middle and bottom of the income distribution. From 2011 to 2015, both income ratios were above their respective 2005 levels.

Figure 2: Percent Change from 2005 in Income Inequality Ratio

Second, I regress income inequality on years, regions, and MSA characteristics in order to determine how income inequality is related to MSA characteristics. In Table 6, I list the descriptive statistics of the independent variables I use in the regressions. These descriptive statistics are for all 381 MSAs across all years in the study, 2005 through 2015. The education variables, college graduates and without high school degree, are the share of people 25 and over with a college degree and without a high school degree, respectively.

I group industries into ten categories based on the Occupational Safety and Health Administration's Standard Industrial Classification division structure[11]. Each category represents the share of the workforce employed in that particular industrial grouping in each MSA. Five of those categories were included as controls in the model.[12] Five industry categories (finance, wholesale trade, transportation and utilities, services, and public administration) were not included in the model because they did not have a significant effect on the income inequality ratios and they reduced adjusted R^2.

Table 6: Descriptive Statistics of MSA Variables				
MSA Characteristic	Mean	Std. Dev.	Minimum	Maximum
Unemployment Rate	7.82	2.92	1.70	21.60
Poverty Rate	15.19	4.51	4.34	41.23
Percent College Graduates	25.97	8.07	10.20	60.57
Percent Without HS Degree	13.35	5.57	2.95	41.74
Population (hundred thousand)	6.73	15.56	0.52	197.69
Mean Age	37.54	2.92	27.75	60.51[13]
Percent Male	48.93	0.92	43.47	54.00
Percent Black	10.06	10.67	0.00[14]	53.58
Percent Hispanic (any race)	12.28	15.41	0.02	95.98
Percent Urban	72.98	13.36	27.35	99.64
Agriculture and Mining	2.47	2.92	0.00	21.59
Construction	6.96	1.72	2.73	18.67
Manufacturing	11.05	5.57	0.69	45.43
Retail	12.39	1.61	6.65	20.75
Source: Author's calculations, 2005 through 2015 American Community Survey. For more information on the ACS, see census.gov/acs.				

I present the results of regressions for each income inequality ratio in Tables 7. The dependent variable in each case is the log of the after-tax, after-transfer income inequality ratio listed at the top of

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[11] See https://www.osha.gov/pls/imis/sic_manual.html for details.
[12] The agriculture and mining sector were combined due to the small size of both sectors in many MSAs.
[13] Average age of 60.51 is for The Villages, FL MSA which is a retirement community.
[14] St. George, UT and Longview, WA had no black population in sample in 2005 and 2010, respectively.

the column and standard errors are clustered at the MSA level. The independent variables include the variables in Table 6, year fixed effects and region fixed effects. Region fixed effects were used in place of state fixed effects because a number of MSAs cross state borders.

In Table 7, I present the results of regressions of each income ratio on MSA variables, year dummies, and regional dummies. In the first column, the results for a regression of the log of after-tax, after-transfer 90-10 ratio on MSA characteristics are presented. This regression can provide a description of what types of MSAs have higher or lower income inequality along the majority of the income distribution. The second column has the results of a regression of log of the after-tax, after-transfer 99-90 ratio on MSA characteristics. This can be informative about what types of MSAs have significant separation among households at the top of the income distribution. These two ratios are an interesting comparison because they measure different parts of the income distribution.

MSAs with higher poverty rates had higher income inequality and there was no significant effect of the unemployment rate on income inequality between households at the 90th percentile and households at the 10th percentile in the income distribution. Conversely, MSAs with higher unemployment rates had lower income inequality and there was no significant relationship between poverty and income inequality between the 99th percentile and 90th percentile households.

Using the 90-10 ratio, MSAs with more college graduates and with more people without a high school degree had higher income inequality. These act on the opposite ends of the 90-10 ratio; more college graduates increased the 90th percentile of household income and more people without a high school degree decreased the 10th percentile of household income. For inequality in the top of the distribution (99-90 ratio), there was no significant relationship between income inequality and percent of people without a high school degree and though the estimated impact for college graduates was positive, the magnitude was significantly less than for the 90-10 ratio.

For demographic variables, MSAs with higher percentages of male and black populations had higher income inequality using the 90-10 ratio, but there was no significant relationship between these variables and income inequality in the top of the income distribution (99-90 ratio).

Finally, the industrial make-up of an MSA was significantly related to income inequality. MSAs with larger manufacturing and retail sectors had lower income inequality when income inequality is measured using the 90-10 ratio. For the 99-90 ratio, the agriculture, construction, and retail industries were all positively related to income inequality.

Table 8: Regression of Log After-tax, After-transfer Income Inequality on MSA Characteristics

	90-10 ratio	99-90 ratio	50-10 ratio	90-50 ratio
Unemployment rate	Z	-0.0044*	-0.0015	0.0015*
	(0.0014)	(0.0016)	(0.0012)	(0.0008)
Poverty rate	0.0319*	0.0006	0.0234*	0.0085*
	(0.0016)	(0.0012)	(0.0013)	(0.0006)
Percent college graduates	0.0117*	0.0044*	0.0077*	0.0039*
	(0.0008)	(0.0008)	(0.0006)	(0.0004)
Percent without high school degree	0.0037*	0.0009	0.0015	0.0023*
	(0.0017)	(0.0016)	(0.0014)	(0.0007)
MSA population size (hundred thousand)	0.0009*	0.0007*	0.0005*	0.0004*
	(0.0002)	(0.0001)	(0.0001)	(0.0001)
Age	0.0098*	0.0089*	0.0055*	0.0042*
	(0.0023)	(0.0025)	(0.0018)	(0.0011)
Percent male	0.0130*	-0.0013	0.0137*	-0.0007
	(0.0052)	(0.0049)	(0.0042)	(0.0021)
Percent Black	0.0029*	-0.0001	0.0020*	0.0009*
	(0.0005)	(0.0006)	(0.0005)	(0.0002)
Percent Hispanic	-0.0004	0.0004	-0.0016*	0.0012*
	(0.0006)	(0.0005)	(0.0005)	(0.0002)
Percent urban	0.0012*	0.0019*	0.0007*	0.0005*
	(0.0004)	(0.0004)	(0.0003)	(0.0002)
Agriculture and mining share of labor force	0.0023	0.0080*	-0.0014	0.0037*
	(0.0023)	(0.0020)	(0.0016)	(0.0011)
Construction share of labor force	0.0011	0.0107*	-0.0029	0.0040*
	(0.0023)	(0.0029)	(0.0019)	(0.0012)
Manufacturing share of labor force	-0.0023*	0.0010	-0.0024*	0.0001
	(0.0010)	(0.0010)	(0.0009)	(0.0004)
Retail share of labor force	-0.0064*	0.0062*	-0.0076*	0.0012
	(0.0019)	(0.0021)	(0.0016)	(0.0008)
Year fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	.7035	.1606	.5910	.6572

*significant at the 90 percent confidence level
Note: Z Represents or rounds to zero.
Numbers in parentheses are standard errors.
Source: Author's calculations, 2005 through 2015 American Community Survey. For more information on the ACS, see census.gov/acs.

When focusing on the majority of the income distribution and breaking the 90-10 ratio into two of its component parts, a number of results for the 50-10 ratio and the 90-50 ratio differ from each other. MSAs with higher poverty rates, more college graduates, and more black residents had higher income inequality in both the top half (90-50 ratio) and the bottom half (50-10 ratio) of the income

distribution, but a marginal increase in each of these cases had a larger effect on income inequality in the bottom half than in the top half of the income distribution.

MSAs with a larger percentage of adults without a high school degree had higher income inequality in the top half of the income distribution (90-50 ratio) and there was no relationship with income inequality in the bottom half of the income distribution (50-10 ratio). MSAs with higher unemployment rates and a larger percentage of Hispanics had higher income inequality in the top half of the income distribution (90-50 ratio) and no significant relationship and lower income inequality in the bottom half of the income distribution (50-10 ratio), respectively. MSAs with larger agricultural and mining and construction sectors had higher income inequality in the top half of the income distribution (90-50 ratio), while MSAs with larger manufacturing and retail sectors had lower income inequality in the bottom half of the income distribution (50-10 ratio).

Conclusion

The focus of this paper was in three main areas. First, what is the effect of government programs on income inequality and how has this effect changed over time? The simple answer to part one of this question is that government programs act to decrease income inequality, but the magnitude varies significantly by region, MSA size, and income inequality ratio. Over time, the effect of government programs increased for each income ratio for all regions, though the size of the increase varied by region and income ratio. There was significantly more variation when breaking down regions into MSA sizes.

Second, how has income inequality changed over time? Income inequality increased for each income ratio for each region except for income inequality in the bottom half of the distribution (50-10 ratio) in the South. Once again, there was significantly more variation when breaking down regions into MSA sizes.

Third, what characteristics of MSAs are associated with higher income inequality? To answer this question, I regressed a number of MSA characteristics on each of the income inequality ratios. The main takeaway was that MSAs with higher 90-10 ratios and higher 99-90 ratios look different from one another and MSAs with higher 90-50 ratios and 50-10 ratios look different from one another.

MSAs that have higher income inequality throughout the majority of the income distribution (90-10 ratio) have higher poverty, a higher share of people with college degrees and people without high school degrees, larger overall populations, higher shares of black, male, and urban populations, and an older population. Some of these same characteristics are shared by MSAs with higher income inequality in the top of the income distribution (99-90 ratio), however there are a number of differences. MSAs with higher 99-90 ratios have lower unemployment and there is no relationship between higher income inequality in the top of the income distribution in MSAs and the poverty rate, the share of people without a high school degree, or the male and black shares of the population.

Relationships between MSA characteristics and Income inequality in the top half (90-50 ratio) and the bottom half (50-10 ratio) of the income distribution differed in two main ways. First, the unemployment rate and the Hispanic share of the population were positively related to income inequality in the top half of the income distribution and not significantly related to and negatively related to income inequality in the bottom half of the income distribution, respectively. Second, MSAs with higher income inequality in the bottom half of the income distribution (50-10 ratio) had smaller manufacturing and retail sectors, while MSAs with higher income inequality in the top half of the income distribution had larger agricultural and mining and construction sectors.

A limitation of this paper is that government programs only include cash transfers. In-kind transfer are excluded due to data limitations. However, the U.S. Census Bureau is currently working on creating a supplemental poverty measure using the ACS, which includes non-cash benefits like housing subsidies and food stamps. I plan to extend this research by using the value of in-kind transfers, which will give a more complete accounting of the effect of government programs.

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