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EFFECTS OF GOVERNMENT POLICIES ON URBAN AND RURAL INCOME INEQUALITY

by Ximing Wu

Department of Agricultural Economics, Texas A&M University

Jeffrey M. Perloff*

Department of Agricultural and Resource Economics, University of California, Berkeley, and member of the Giannini Foundation

and

Amos Golan

Department of Economics, American University

We use three conventional inequality indices—the Gini, the coefficient of variation of income, and the relative mean deviation of income—and the Atkinson index to examine the effect of income tax rates, the minimum wage, and all the major government welfare and transfer programs on the evolution of income inequality for rural and urban areas by state from 1981 to 1997. We find that these programs have qualitatively similar but quantitatively different effects on urban and rural areas. Most importantly, taxes are more effective in redistributing income in urban than in rural areas, while welfare and other government transfer programs play a larger role in rural areas.

1. Introduction

Although income inequality has increased substantially in both urban and rural areas of the United States over the past two decades, the levels of inequality in these areas have evolved differently. We investigate whether these alternate paths are due to different responses to changes in taxes, minimum wage laws, social insurance policies, and transfer programs. We find that government policies have had qualitatively similar but quantitatively different effects on rural and urban areas.[1] Given these quantitative differences, some policies that effectively reduce inequality in urban areas do not work well in rural areas.

Using Current Population Survey data for 1981 through 1997, we examine the effects of eight major government policies on welfare using the Atkinson index as well three traditional inequality measures: the Gini index, coefficient of variation of income, and the relative mean deviation of income. In addition to examining the

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*Jeffrey M. Perloff, Department of Agricultural & Resource Economics, 207 Giannini Hall–MC 3310, University of California, Berkeley, CA 94720-3310, USA (perloff@are.berkeley.edu).

[1]Moreover, we show that our results are robust to the measure of inequality used. Dalton (1920) suggested that all common welfare measures would give the same rankings (level) across countries "in most practical cases." However, Atkinson (1970) demonstrated that they can give different rankings. Our claim is different. We show that changes in government policies (and macroeconomic and aggregate demographic variables) change the rankings of almost all measures in the same direction.

distributional impacts of government policy variables, we determine how changes in macro conditions and demographic variables over time and across the states affect inequality.

Our study differs from the literature in four ways. First, we examine the effects of many policies and macro variables at once. Most previous studies considered the effect of only a single policy, ignoring the influences of other government policies, market conditions, and demographics (see references in Moffitt, 1992).

Second, we examine the effects of policies on the entire income distribution rather than focusing on income effects of only low-paid workers as have most previous studies. Third, we examine policy effects on both pre-tax and post-tax income inequality in urban and rural areas.

Fourth, and most importantly, we contrast urban and rural policy effects across the nation.[2] As Freeman (1996) observed, "Because the benefits and costs of the minimum (wage)/other redistributive policies depend on the conditions of the labor market and the operation of the social welfare system, the same assessment calculus can yield different results in different settings." According to Whitener *et al*. (2001), although the impact of the recent welfare reform does not appear to differ greatly between rural and urban areas at the national level, some studies on individual states report that the impact of welfare reform on employment and earnings in the rural areas is smaller than in the urban areas.[3] Instead of studying a single state, we systematically examine the impacts of tax and welfare programs on family income distribution across all states for each year from 1981 through 1997.

We find that the government policies have qualitatively similar but quantitatively different impacts on the income inequality in rural and urban areas. Taxes have smaller equalizing effects and government welfare and transfer programs have larger equalizing effects in rural areas than in urban areas. These differential policy effects may be due to two main differences in the composition of the population in these two areas. First, the proportion of the population that needs to pay income tax and the proportion in the top tax bracket are higher in urban areas. Second, a larger proportion of the rural population is eligible for welfare and government transfer program (such as the low-income families and the elderly).

In the next section, we describe the data and the different government policies that we analyze. We discuss the inequality measures in Section 3. Next we briefly describe the trends in inequality in rural and urban areas. In Section 5, we use regressions to determine how policies and macroeconomic conditions affect inequality in rural and urban areas. In Section 6, we compare and contrast the rural and urban effects. We draw conclusions in the last section.

2. The Data

We construct a cross-section, time-series data set for the 50 U.S. states from 1981 through 1997. Our sample period starts in 1981, which is the year that the CPS started to impute the value of taxes and governmental transfers of sampled

[2]Wu *et al*. (2005) study the effects of government policies on aggregate U.S. income distribution.
[3]RUPRI (2001) provides state level welfare reform case studies.

families. Since the welfare reform started in 1997, the traditional welfare program (Aid to Families with Dependent Children, AFDC) was replaced by the Temporary Aid to Needy Families (TANF). We did not include more recent years because we do not have a consistent and reliable set of the explanatory policy variables that can capture the features of these two dramatically different programs. For example, the chief change under TANF is that the recipient can be on welfare for a lifetime maximum of five years. Consequently, people responded strategically to the change by moving in and out of welfare due to the lifetime restraint. This substantial change in policy requires carefully modeling of people's dynamic welfare usage, which is beyond the scope of this study. Therefore, our sample ends at 1997.

Our source of data for income and state demographic characteristics is the annual Current Population Survey (CPS) March Supplements. The March CPS for a given year contains labor market and income information for the previous year on between 50,000 and 62,000 households.

For each state, we calculate a range of inequality indices of annual family income for the urban and rural areas.[4] As these inequality indices are scale free, it is not necessary to deflate income. In some of the earlier years of our sample, the CPS did not cover both areas for some of the smaller states. Consequently, we have 796 observations for the urban areas and 718 observations for the rural areas.

The CPS total income measure, which is "the amount of money income received in the preceding calendar year," includes in-cash government transfers but not food stamps, other government in-kind transfers, income tax payments or tax credit received. Therefore, the CPS definition of income does not measure a family's entire disposable income.

Fortunately, beginning in the first year of our sample, 1981, the CPS imputed the value of government transfers, tax liability and credit for each family. The Census Bureau combined data from the American Housing Survey (AHS), the Income Survey Development Program (ISDP), and the Internal Revenue Service (IRS) with CPS data to simulate the taxes paid, number of tax filing units, adjusted gross income, and other tax characteristics for the March CPS.[5] The Census Bureau reported several definitions of income, ranging from the raw self-reported income, to most "comprehensive" income, which includes imputed government cash transfers, tax payments and credits and value of non-cash income, including food stamps, housing subsidies and medical benefits. The food stamps are valued at its face value. According to Weinberg (2004) and references therein, while calculation of equivalent market value of medical benefit is difficult, the microsimulation model used by the Census Bureau to impute the value of tax payment and credit is reasonably accurate. To minimize bias introduced by the imputation, we use a "conservative" definition of after-transfer, after-tax income, which adjusts for the value of food stamps, tax payment and credit of each family.

[4]Throughout this study, we define the central city and suburban areas as urban and the rest non-metropolitan areas as rural.

[5]For details, see "Measuring the Effect of Benefits and Taxes on Income and Poverty: 1979 to 1991," Current Population Reports Series P-60, No. 182. This series was not included in the official CPS March Supplement until 1992. The data for the earlier years were obtained from Unicon Research Corporation (http://www.unicon.com), to whom we are very grateful.

To control for family income variation due to family size, we divide family income by the total number of family members to obtain a per person measure of income. Two possible alternative normalizations are to divide family income by all the family members (including children) or to make no adjustment and use family income. Our qualitative results are not sensitive to these normalizations. The average correlation coefficient between our original Atkinson indexes and the two alternatives are 0.81 and 0.85 respectively and the estimated coefficients are virtually the same.

Government Policies

All the government policy variables vary over time and across states except the federal income tax and disability insurance variables, which vary only over time. For detailed information on Government policies during this period, see Meyer and Rosenbaum (2001) and Wu *et al*. (2005). All nominal variables are deflated by the 1981 Consumer Price Index.

We use two variables, the federal marginal income tax rate for the top bracket (Top Tax) and for the tax bracket that has the largest share of taxpayers (Main Tax), to proxy the change of federal income tax over the observed period. The state-specific data on the minimum wage and maximum weekly unemployment insurance benefits are from the U.S. Bureau of Labor Statistics' *Monthly Labor Review*, which summarizes the previous year's state labor legislation. Our Unemployment Insurance variable is the maximum weekly benefit in a state (almost all the states set the maximum coverage period at 26 weeks during the relevant period).

Data on other public assistance programs are from the annual *Background Material and Data on Major Programs within the Jurisdiction of the Committee on Ways and Means* (the "Green Book"). Our minimum wage variable is the larger of the federal or the relevant state minimum wage. If the minimum wage changed during the year, we use a time-weighted average. Our Unemployment Insurance variable is the maximum weekly benefit in a state (almost all the states set the maximum coverage period at 26 weeks during the relevant period). Our disability (the inability to engage in "substantial gainful activity") insurance measure is the maximum annual benefit. The Supplement Security Income (SSI) variable is the maximum monthly benefits for individuals living independently. To qualify for SSI payment, a person must meet age, blindness or other disability standard and have an income below the federal maximum monthly SSI benefit.

The AFDC variable is the maximum monthly benefits for a single-parent, three-person family. The "AFDC need standard" variable is the maximum income a single-parent, three-person family can have and still be eligible for assistance. The AFDC need eligibility standard is used for the food stamps program as well. Our food stamps variable is the dollar value of the maximum monthly benefit.

The Earned Income Tax Credit (EITC) program is an earning subsidy for the low income working families. To receive an EITC, a family must have reported a positive earned income. The EITC maximum benefit is determined by two factors: the EITC credit rate and the minimum income requirement for maximum benefit.

Our EITC Benefits variable measures the maximum benefit, which is the product of these two factors. The EITC is phased out as a family's income rises. For example, in 1997, the phase-out income range was ($11,930, $25,750) for a one-child family. The credit is reduced by 15.98¢ for each extra dollar earned above $11,930 so that the benefit drops to zero at $25,750. Here, our EITC phase-out rate variable measures the rate, 15.98 percent, at which the EITC benefits is reduced over the phase-out range. Beginning in middle 1980s, some states offered their own state EITC, usually in the form of a fixed percent of the federal EITC credit. Our EITC benefit variable is adjusted by state supplements; hence this measure varies across both states and time.

Macroeconomic and Demographic Variables

We include two macroeconomic variables to control for economic conditions. The U.S. gross domestic product (GDP) and unemployment rates are from the Bureau of Labor Statistics' website.[6] In addition to state dummy variables, we include annual state-level demographic characteristics obtained from the CPS: the percentage of the population with a high school degree, the percentage of the population with at least a college degree, the percentage of female-headed families, the percentage of the state's population in various age groups (younger than 18, 18–29, the residual group, and older than 59), and the average family size.

Table 1 contains the summary statistics for the sample. Compared to the urban population, the rural population on average has a lower average education level, a smaller fraction of female-headed families, a larger average family size, and a larger proportion of elderly people.

3. Inequality Measures

We use the three traditional inequality measures as well as the Atkinson index. In defining our welfare measures, we let y reflect income normalized by the sample mean, y^* is the highest observed income, $f(y)$ is the density of income, $F(y)$ is the income distribution, μ is the empirical mean income, V is the standard deviation of y, and $\phi(y) = \int_0^y zf(z)\,dz$ is the Lorenz function. The three traditional welfare measures are:

- the coefficient of variation of income (COV): V/μ
- the relative mean deviation of income (RMD): $\int_0^{y^*} |y-1| f(y)\,dy$
- the Gini index: $\frac{1}{2}\int_0^{y^*} [yF(y) - \phi(y)] f(y)dy.$

Atkinson (1970) popularized a welfare measure that we refer to as "Atkinson index." This index has three strengths. First, the Atkinson index uses a single parameter to nest an entire family of welfare measures that range from very egalitarian to completely non-egalitarian. Second, it can be derived axiomatically

[6]Our policy impact results are little changed if we use state-level GDP and unemployment rates rather than federal-level indices. We report the federal-level analysis to avoid circularity in our regression analyses of income distributions.

TABLE 1
SUMMARY STATISTICS

Policy and Macro Variable	Unit	Mean	Std. Dev.	Min.	Max.
Main tax	Percent	0.14	0.02	0.11	0.15
Top tax	Percent	0.41	0.10	0.28	0.69
EITC benefits	$1,000/year	0.88	0.36	0.48	2.07
EITC phase-out rate	Percent	0.13	0.02	0.10	0.24
Minimum wage	$/year	3.07	0.25	2.70	4.24
Unemployment insurance	$1,000/week	0.19	0.08	0.06	0.72
SSI	$1,000/month	0.32	0.05	0.26	0.63
Disability insurance	$1,000/year	0.31	0.04	0.24	0.38
AFDC	$1,000/year	0.29	0.12	0.08	0.68
AFDC need standard	$1,000	0.43	0.15	0.17	1.30
Food stamps	$1,000/month	0.18	0.03	0.09	0.30
GDP	$1,000 billion	4.28	0.52	3.38	5.17
Unemployment rate	Percent	0.07	0.01	0.05	0.10
Urban demographics (796 observations)					
High school	Percent	0.70	0.19	0.24	0.93
College	Percent	0.17	0.07	0.03	0.41
Female-headed family	Percent	0.21	0.03	0.11	0.35
Family size	# of persons	3.24	0.21	2.74	4.15
Age <18	Percent	0.27	0.03	0.18	0.38
Age 18–29	Percent	0.19	0.03	0.11	0.30
Age >59	Percent	0.15	0.03	0.04	0.27
Rural demographics (718 observations)					
High school	Percent	0.62	0.21	0.14	0.92
College	Percent	0.11	0.05	0.02	0.34
Female-headed family	Percent	0.19	0.04	0.09	0.36
Family size	# of persons	3.28	0.25	2.27	4.52
Age <18	Percent	0.28	0.03	0.16	0.40
Age 18–29	Percent	0.16	0.03	0.06	0.27
Age >59	Percent	0.19	0.04	0.05	0.37

from several desirable properties (Atkinson, 1970; Cowell and Kuga, 1981). As Dalton (1920) and Atkinson (1970) argued compellingly, a measure of inequality should be premised on a social welfare concept. They contended that a social welfare function should be an additively separable and symmetric function of individual incomes. Atkinson imposed constant (relative) inequality aversion.

Third, the Atkinson index has a useful monetary interpretation. Corresponding to the Atkinson index is an equally distributed equivalent level of income, y_{EDE}, which is the level of income per head that, if income were equally distributed across the population, would give the same level of social welfare as the actual income distribution:

$$U(y_{EDE})\int_0^{y^*} f(y)dy = \int_0^{y^*} U(y)f(y)dy,$$

where $U(y)$ is an individual's utility function. This measure is invariant to linear transformations of the utility function. Atkinson's welfare index is

$$I = 1 - \frac{y_{EDE}}{\mu}, \tag{1}$$

where μ is the actual average income. We can use this index to determine the percentage welfare loss from inequality. For example, if $I = 0.1$, society could achieve the same level of social welfare with only 90 percent of the total income if incomes were equally distributed. Our measure of welfare loss from inequality, L, is the difference between the actual average income and the equally distributed equivalent level,

$$L = \mu - y_{EDE} \tag{2}$$

is a transformation of the Atkinson welfare index, Equation (1).

To impose constant relative inequality-aversion, Atkinson chose the representative utility function

$$U(y) = \begin{cases} A + B\dfrac{y^{1-\varepsilon}}{1-\varepsilon} & \varepsilon \neq 1 \\ \ln(y) & \varepsilon = 1 \end{cases}$$

where $\varepsilon \geq 0$ for concavity and ε represents the degree of inequality aversion. After some algebraic manipulations, Atkinson obtained his welfare index for n people:

$$I_\varepsilon = \begin{cases} 1 - \left(\dfrac{1}{n} \sum_{i=1}^{n} \left(\dfrac{y_i}{\mu} \right)^{1-\varepsilon} \right)^{\frac{1}{1-\varepsilon}} & \varepsilon \neq 1 \\ 1 - \left(\prod_{i=1}^{n} \dfrac{y_i}{\mu} \right)^{\frac{1}{n}} & \varepsilon = 1 \end{cases} . \tag{3}$$

Atkinson's index equals zero when income are equally distributed and converges to (but never reaches) 1 as inequality increases. The index rises with ε. The larger is ε, the more weight the index attaches to transfers at the low end of the distribution and the less weight to transfers at the high end of the distribution. In the extreme case where $\varepsilon \to \infty$, the welfare measure becomes Rawlsian: welfare depends on the income of the poorest member of society. If $\varepsilon = 0$, the utility function is linear in income and the distribution of income does not affect the welfare index: $I_\varepsilon = 0$ for any income vector. Thus, we view $\varepsilon = 0$ as a degenerate case and only look at ε that are strictly positive. Following the suggestion in Atkinson (1970), we examine $\varepsilon \leq 2$.

In our sample, the correlations between the inequality rankings from Atkinson indices with ε in the range (0, 1) and the relative mean deviation, the coefficient of variation, and the Gini index are close to one.[7] Therefore, by choosing an appropriate value of ε, we could use I_ε to proxy the inequality ranking from the traditional inequality indices. Nonetheless, we report these traditional welfare measures in our analyses because of their familiarity.

[7]We also examined other inequality measures, such as the standard deviation of the logarithm of income, $\int_0^{y^*} [\log(y)]^2 f(y)dy$, but do not discuss them here to save space. The standard deviation of the logarithm is almost perfectly correlated with $I_{1.5}$.

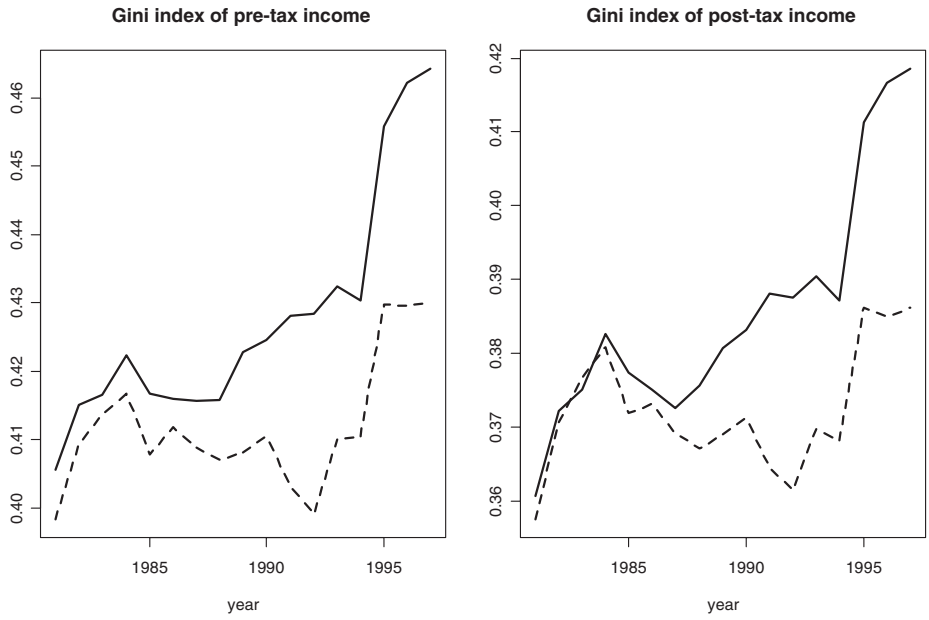

Figure 1. Gini Indices of Rural and Urban Areas (urban: solid; rural: dashed)

It is well known that sample estimates of inequality measures are subject to sample variation and various difficulties, such as outliers, top-coding or imputed values, which might lead to inefficient or even biased estimates. Cowell and Victoria-Feser (1996) note that the estimates can be sensitive to these problems. We examine systematically the impact of outliers and top-coding using the influence function approach proposed by Cowell and Victoria-Feser (1996). We found that inequality measures consistent with risk aversion can be sensitive to extremely low income values, while rather robust to top-coding (censoring at the high end of the distribution). We applied the trimming method suggested by Cowell and Victoria-Feser (1996). For details, see the original paper and the technical appendix of Wu *et al*. (2005). Nonetheless, in the regression analysis below, we test the hypothesis of structural break in 1995 due to the CPS redesign, which includes the change in top-coding procedure. The hypothesis is decisively rejected.

4. Trends in Inequality

Income inequality as measured by each of the inequality measures rose substantially during the sample period. However, the evolution of rural and urban inequality in individual states varies substantially. For example, for states having data on both rural and urban areas during the sample period, the average correlation between the rural and urban Gini indices is only 0.45 using pre-tax income and 0.46 using post-tax income.

To save space, we discuss only the Gini index for both rural and urban areas, though all measures show similar patterns. The left panel of Figure 1 plots the Gini

indices of pre-tax income for the urban (solid) and rural (dashed) areas from 1981 through 1997. The urban Gini inequality index is higher (less equal) in each year than the rural urban inequality and increases by more over the sample period. Rural inequality increases from 0.398 to 0.430, while urban inequality increases from 0.406 to 0.464. The Gini indices move together in the beginning of the period and thereafter diverge. In both areas, inequality increases between 1981 and 1984, and then declines slightly in the subsequent two or three years. Starting in 1988, urban inequality began to rise quickly while rural inequality remained stable for another two more years and then declined slightly between 1990 and 1992. Starting in 1994, both measures grew very rapidly for a couple of years and then leveled off between 1996 and 1997.

The right panel of Figure 1 shows the Gini indices of post-tax income for both areas. The post-tax Gini inequality measures are considerably smaller than the pre-tax measures: The Gini is 0.042 lower for the urban area on average and 0.040 for the rural area. As with the pre-tax indices, the post-tax Gini indices are nearly equal in the two areas from 1981 through 1984. Thereafter, the rural and urban indices diverge: the urban income distribution became much more unequal than the rural one.

We can calculate the value of the welfare loss using the Atkinson index. For example, the Atkinson index of pre-tax income with $\varepsilon = 1$ is 0.270 for urban areas and 0.261 for rural areas in 1981. Using Equation (2), the corresponding welfare losses due to inequality are \$1,912 and \$1,521 per person for this year. The same Atkinson index with $\varepsilon = 1$ increased to 0.340 for urban areas and 0.297 for rural areas by the end of the sample in 1997. The welfare losses (in 1981 dollars) increased to \$2,768 and \$1,924 respectively, 34.0 percent of urban and 29.7 percent of rural average income.

5. Regression Analysis

We use regressions to examine the impacts of government policies on pre-tax and post-tax rural and urban income inequality. We include in our model all the major government programs that directly or indirectly transfer income to low-income families. The government tax and transfer programs directly affect family income. The minimum wage, disability insurance, and unemployment insurance have direct effects on people's received income and indirect effects on their transferred income because other government transfer programs are contingent on earned income.

In Ashenfelter's (1983) terminology, government policies have both "mechanical" and "behavioral" effects. The mechanical effect measures the difference between the pre-tax income and post-tax income due to tax payment to the government or transfers received from the government. On the other hand, the policies also have behavioral implications: people may respond to changes in these programs by changing their participation decision, hours of work, or other labor market decisions (see, for example, Hausman (1981) for the labor supply effects of tax and Moffitt (1992) for the incentive effects of welfare programs), which subsequently influences their earnings. Therefore, the government policies can impact

the income distribution through two channels and the effects on pre-tax income and post-tax income may differ.

We estimate cross-sectional, time-series regression models with first-order autoregressive error terms:

$$w_{it} = a + \mathbf{X}_{it}\boldsymbol{\beta} + u_i + e_{it},$$

where

$$e_{it} = \rho e_{it-1} + z_{it},$$

w_{it} is the inequality or welfare index for either the urban or rural area, $\mathbf{X}_{it}$ is a vector of the explanatory variables, the subscript i indexes the states, t indexes the year, $|\rho| < 1$, and z_{it} is independent and identically distributed (IID) with zero mean and variance σ_z. We estimate a random-effect model in which the state effects are captured by u_i, realization of an IID process with zero mean and variance σ_u.[8] Due to the unbalanced panel structure of our data, we use the methods derived in Baltagi and Wu (1999).

The explanatory variables included in $\mathbf{X}$ are: the percentages of the population finishing high school and finishing college; the percentage of female-headed families; average family size; the percentage of the population under age 18, between 18 and 29, and than 59; the marginal income tax rates for the lowest and the highest tax bracket; the EITC benefit and phase-out rate; the minimum wage; the UI benefit; the SSI benefit; the disability insurance benefit; the AFDC benefit and need standard; the food stamps benefit; the GDP; and the unemployment rate.

We estimated the model for each of our measures of inequality: the three traditional inequality measures and the Atkinson index for a wide range of values of the "inequality aversion" parameter ε. We report the Atkinson measure for only ε equal to 0.5, 1, and 2, which are social welfare functions with relatively low-, medium- and high-degrees of inequality aversion. We do not report the results for the deviation in logarithms and Atkinson indices for other values of ε because they are similar to those reported.

Although the policy effects are qualitatively similar in the rural and urban areas, we reject the hypothesis that the two sets of regression coefficients are equal using Chow tests. For each inequality measure, the restriction is rejected decisively (the p-values essentially equal zero). Thus, the policies and macro variables together seem to have quantitatively different effects across the two areas. However, a closer examination reveals a more nuanced picture. We test separately if the coefficients for the macro variables and policy variables are the same across the two areas. The Chow statistic for the test on macro variable has a p-value of 0.28, hence we fail to reject the hypothesis that the coefficients of macro variables are identical. At the same time, the Chow statistic for the test on policy variables has a p-value of 0.0016 when we assume identical coefficients for the macro

[8]The CPS does not cover both rural and urban areas for the entire sample period. For certain states we have only three observations for rural areas over the 17 years of our sample. Consequently, we use a random-effect model rather than a fixed-effect model, which have short panel lengths for some states. As a check, we also estimated a fixed-effect model and found that the results are very close to those of random-effects models.

variables. Not surprisingly, the p-value changes only slightly (to 0.0012) when we conduct the same test on the policy variables, allowing for different coefficients for macro variables.

Because the pattern of urban and rural inequality started to diverge in 1990, we test the hypothesis that the policy effects systematically changed in 1990. We cannot reject the null hypothesis of no structural break using a likelihood ratio test in which we compare the pooled regression to separate regressions for the period up to 1989 and from 1990 on. Similarly, we cannot reject the hypothesis of no structural break in 1995.

The Urban Areas

Tables 2 and 3 report the regression results for pre-tax and post-tax income inequality for the urban area. The coefficients are qualitatively similar across all the inequality measures for both pre-tax and post-tax income. The estimated auto-correlation coefficients are less than 0.3, indicating modest auto-correlation of income inequality. The share of the variation that is due to the random state effects, u_i, is around one third to one half, depending on the dependent variable. The R^2 ranges from 0.27 through 0.43. On the average, about 45 percent of the variation explained by the model is due to the policy variables for both pre-tax and post-tax inequality. For example, the R^2 of the pre-tax Gini regression is 0.39, of which 44 percent of the explained variation is attributed to the policy variables. The R^2 for the post-tax Gini is 0.38, and 46 percent of the variation explained by the model is due to the policy variables.

Most of the government policy variables have the expected signs as suggested by the literature (see, for example, Bishop *et al.*, 1994 and references therein). As expected, an increase in the marginal income tax rate for the main tax bracket has an equalizing effect on both pre-tax and post-tax income that is statistically significantly different from zero at the 0.05 level in all the post-tax regressions and most of the pre-tax ones. In contrast, the marginal income tax rate for the top tax bracket only has statistically significant equalizing effects for the post-tax income, as indicated by the Gini index and the Atkinson index with $\varepsilon = 0.5$ and 1. Compared with the Atkinson index with larger ε, these indices place relatively big weights on the high end of the distribution and are therefore more sensitive to changes at the high end of the distribution.

As we expected, the EITC benefit—which supplements the incomes of poor working families—does not statistically significantly affect pre-tax inequality but does statistically significantly affect the post-tax income inequality for all the reported inequality measures except for the coefficient of variation of income and I_2. This finding is consistent with the literature that the EITC plays an important role in increasing the income of the working poor and reduces income inequality (Neumark and Washer, 2001; Wu *et al.*, 2005).

The EITC phase-out rate is the marginal rate by which earnings above a specified threshold reduce the EITC benefit. An increase in the EITC phase-out rate reduces the labor supply of those people with earning above that threshold who are eligible for the EITC. Consequently, increases in the phase-out rate lower the earnings of some people in this group. Eissa and Hoynes (1998) and Wu (2003)

TABLE 2

REGRESSION RESULTS OF PRE-TAX INEQUALITY FOR THE URBAN AREAS

	Gini		RMD		COV		$I_{0.5}$		I_1		I_2	
Dependent Variable	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
High school	–0.032	–2.45	–0.055	–2.80	–0.064	–1.01	–0.021	–2.30	–0.036	–2.22	–0.051	–1.26
College	0.087	2.50	0.127	2.39	0.043	0.26	0.055	2.23	0.107	2.48	0.192	1.91
Female head	0.264	8.11	0.370	7.52	0.747	4.92	0.205	8.95	0.432	10.77	0.906	9.48
Family size	0.026	2.94	0.038	2.90	0.078	1.99	0.020	3.24	0.041	3.85	0.099	4.04
Age <18	0.178	2.59	0.251	2.40	0.430	1.33	0.122	2.50	0.212	2.48	0.117	0.58
Age 18–29	0.012	0.23	0.027	0.36	–0.191	–0.80	0.000	0.01	0.006	0.10	–0.073	–0.48
Age >59	0.072	1.35	0.097	1.20	0.050	0.20	0.045	1.19	0.086	1.31	0.055	0.35
Main tax	–0.002	–2.15	–0.002	–1.78	–0.007	–1.85	–0.001	–2.25	–0.002	–2.41	–0.006	–2.33
Top tax	–0.021	–1.12	–0.019	–0.67	0.018	0.19	–0.016	–1.23	–0.038	–1.63	–0.075	–1.28
EITC benefit	–0.011	–1.14	–0.017	–1.20	–0.046	–0.99	–0.009	–1.33	–0.014	–1.21	–0.010	–0.33
EITC phase-out	0.265	2.22	0.404	2.23	1.618	2.79	0.195	2.31	0.210	1.42	–0.219	–0.59
Minimum wage	0.018	3.07	0.024	2.75	0.105	3.73	0.013	3.22	0.019	2.60	0.022	1.26
Unemployment ins.	–0.001	–0.06	–0.001	–0.06	0.031	0.61	0.001	0.18	0.005	0.38	0.056	1.68
SSI	–0.019	–0.47	–0.022	–0.37	0.081	0.50	–0.012	–0.45	–0.019	–0.39	0.074	0.75
Disability ins.	–0.059	–2.63	–0.071	–2.12	–0.394	–3.47	–0.044	–2.77	–0.067	–2.42	–0.117	–1.58
AFDC/TANF///	–0.057	–2.56	–0.082	–2.41	–0.294	–3.4	–0.044	–2.88	–0.077	–2.84	–0.140	–2.63
AFDC need std.	0.009	1.05	0.012	0.97	0.006	0.16	0.005	0.87	0.012	1.17	0.020	0.88
Food stamps	0.026	0.42	0.031	0.33	–0.086	–0.33	0.021	0.47	0.088	1.15	0.403	2.49
GDP	0.033	4.34	0.051	4.50	0.154	4.00	0.024	4.46	0.039	4.13	0.059	2.36
Unemployment rate	0.002	0.90	0.004	1.41	–0.004	–0.41	0.001	0.83	0.003	1.40	0.008	1.45
Constant	0.045	0.77	0.029	0.32	–0.445	–1.59	–0.123	–2.95	–0.199	–2.74	–0.240	–1.34
ρ	0.289		0.300		0.206		0.281		0.295		0.117	
σ_u	0.016		0.025		0.045		0.011		0.019		0.028	
σ_z	0.018		0.027		0.088		0.013		0.022		0.057	
R^2	0.395		0.373		0.406		0.429		0.431		0.271	

TABLE 3

REGRESSION RESULTS OF POST-TAX INEQUALITY FOR THE URBAN AREAS

	Gini		RMD		COV		$I_{0.5}$		I_1		I_2	
Dependent Variable	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
High school	–0.022	–1.85	–0.039	–2.21	–0.036	–0.66	–0.013	–1.72	–0.022	–1.65	–0.029	–0.76
College	0.072	2.31	0.103	2.20	0.037	0.27	0.039	1.97	0.071	2.00	0.063	0.67
Female head	0.232	7.99	0.328	7.52	0.568	4.39	0.159	8.59	0.343	10.27	0.846	9.47
Family size	0.021	2.68	0.030	2.54	0.065	1.94	0.015	3.08	0.033	3.65	0.088	3.91
Age <18	0.173	2.81	0.254	2.74	0.455	1.65	0.092	2.35	0.135	1.90	–0.127	–0.67
Age 18–29	0.012	0.28	0.038	0.56	–0.128	–0.63	–0.003	–0.10	–0.008	–0.16	–0.153	–1.09
Age >59	0.049	1.02	0.077	1.08	0.035	0.17	0.023	0.75	0.037	0.68	–0.089	–0.61
Main tax	–0.002	–2.99	–0.003	–2.61	–0.007	–2.05	–0.001	–3.11	–0.003	–3.42	–0.007	–3.11
Top tax	–0.038	–2.25	–0.046	–1.82	–0.036	–0.46	–0.023	–2.11	–0.044	–2.27	–0.060	–1.07
EITC benefit	–0.018	–2.17	–0.028	–2.27	–0.054	–1.35	–0.012	–2.24	–0.022	–2.31	–0.047	–1.57
EITC phase-out	0.297	2.79	0.445	2.78	1.572	3.18	0.192	2.82	0.247	2.01	0.031	0.09
Minimum wage	0.015	2.84	0.020	2.58	0.086	3.59	0.010	3.01	0.014	2.38	0.024	1.43
Unemployment ins.	0.001	0.12	0.001	0.05	0.026	0.61	0.002	0.39	0.007	0.64	0.042	1.29
SSI	–0.018	–0.51	–0.022	–0.41	0.026	0.19	–0.011	–0.49	–0.013	–0.31	0.092	1.03
Disability ins.	–0.043	–2.13	–0.051	–1.72	–0.278	–2.87	–0.029	–2.25	–0.044	–1.89	–0.060	–0.83
AFDC/TANF///	–0.057	–2.85	–0.083	–2.74	–0.233	–3.14	–0.037	–2.95	–0.060	–2.69	–0.063	–1.30
AFDC need std.	0.008	1.08	0.010	0.93	0.021	0.66	0.005	0.98	0.009	1.07	0.016	0.78
Food stamps	0.023	0.41	0.025	0.30	–0.009	–0.04	0.012	0.34	0.054	0.85	0.364	2.48
GDP	0.029	4.36	0.046	4.55	0.132	4.03	0.020	4.57	0.035	4.43	0.083	3.40
Unemployment rate	0.001	0.51	0.003	1.09	–0.004	–0.48	0.000	0.47	0.002	1.09	0.009	1.65
Constant	0.067	1.28	0.063	0.80	–0.392	–1.64	–0.083	–2.45	–0.134	–2.20	–0.295	–1.73
ρ	0.274		0.281		0.203		0.260		0.249		0.050	
σ_u	0.015		0.023		0.039		0.009		0.016		0.024	
σ_z	0.016		0.024		0.075		0.010		0.018		0.055	
R^2	0.382		0.360		0.412		0.407		0.427		0.327	

found that the EITC phase-out rate has substantial disincentive effects on the labor supply of the affected population, and therefore may reduce their pre-tax and post-tax income. Because EITC recipients tend to be low-income families whose primary source of income is earnings, the resulting drop in their income may have substantially reduced equality. In most of our regressions, the EITC phase-out variable statistically significantly raises inequality for both pre-tax and post-tax income distributions.

Although an increase in minimum wage raises the wage floor, individuals who were previously earning a wage between the original and new minimum wage rate may lose their jobs or be forced to reduce their hours because of the unemployment effects of the minimum wage. Moreover, the minimum wage is not a means-tested program. Unlike the welfare and other government transfer programs, all workers are entitled to earn at least the minimum wage. Burkhauser *et al*. (1996) observe that minimum wage workers are evenly distributed across all family income groups, in large part because many of them are teenage workers from relatively well-off families. However, the disemployment effect is disproportionately concentrated among low-income families. Therefore, raising the minimum wage may raise inequality (Neumark *et al*., 1998; Wu *et al*., 2005). In our regression, an increase in our minimum wage variable, which is the higher of the federal and state minimum wages in each state in each year, raises both pre-tax and post-tax income inequality (the effect is statistically significant for all inequality measures except I_2).

The disability insurance and AFDC program reduce both the pre-tax and post-tax income inequality (statistically significantly in most equations). Unlike tax payments and the EITC benefit, the value of AFDC is included in the CPS's pre-tax income measure. Therefore, we expect to see similar effects of the AFDC benefit variable on both pre-tax and post-tax income. The remaining policy variables—unemployment insurance, supplemental social insurance, the need standard for the AFDC program, and food stamps—do not have statistically significant effects on pre-tax or post-tax income inequality.

Some of the demographic characteristics have statistically significant effects on inequality. Consistent with the literature, we find that a rise in the share of female-headed families plays an important role in increasing income inequality. For both the pre-tax and post-tax income distribution, the percentage of female-headed family shows the most statistically significant effects among all the explanatory variables. States with a high proportion of large families have less equal income distributions. States with a large share of families with heads who are younger than 18 tend to have less equal incomes. However, age of the family head does not otherwise have statistically significantly effects on inequality.

The larger the percentage of the population with at least a high school education, the less income inequality (though this effect is statistically significant in only some of the regressions). A larger percentage of college graduates makes the income distribution less equal (statistically significantly in most equations). These finding are consistent with the hypothesis of skill-based technological change (SBTC) in the literature: the wage/income premium for college graduates compared to low-skilled workers has been increasing during the last two decades, partially due to the shift in labor demand away from unskilled work-

ers.[9] (See Card and DiNardo (2002) for a critical review of this literature.) A rise in GDP leads to greater income inequality. Surprisingly, shifts in the unemployment rate have little effect.

The Rural Areas

Tables 4 and 5 report the corresponding results for rural areas. The regression results on the rural area are similar to the urban ones across the various inequality measures for both the pre-tax and post-tax income distributions. The autocorrelation coefficients, ρ, lie between 0.12 to 0.23. The share of the residual variation that is attributed to the random state effects is between one-fifth and slightly over one-third. The R^2 ranges from 0.17 through 0.4. On average, about 40 percent of the variation explained by the model is due to the policy variables for both pre-tax and post-tax inequality. For example, the R^2 of the pre-tax Gini regression is 0.38, of which 39 percent of the explained variation is due to the policy variables. The R^2 for post-tax Gini is 0.36, and 42 percent of the variation explained by the model is due to the policy variables.

The statistically significant qualitative government policy effects are similar to those in the urban areas. The marginal income tax rate for the main tax bracket has a statistically significant equalizing effect on both the pre-tax and post-tax income distributions, while the tax rate for the top income bracket does not have a statistically significant effect.

For most of the inequality measures for both pre-tax and post-tax income, a larger EITC benefit decreases the income inequality while its phase-out rate increases inequality. The minimum wage variable has little effect. Of the remaining government policy variables, only the AFDC benefit has a statistically significant (equalizing) effect on the income distribution.

The demographic and macro economic indicator variables generally have the same qualitative effects as in the urban areas. The income inequality decreases as the share of the population that finished high school increases or as the share of college graduates decreases. The percentage of female-head families has statistically significantly increases inequality. The average family size has little effect. Again, inequality is greater, the larger the share of families headed by people younger than 18. However, age otherwise has little effect. Finally, income inequality increases with the GDP, but does not appear to respond to changes in unemployment rate.

6. Urban and Rural Comparison

To see how the variables with statistically significant effects—marginal income tax rates, EITC variables, the minimum wage, and GDP—affect various

[9]According to the SBTC, the supply of educated workers cannot explain an increase in inequality and that the main source of the surge of inequality is from demand factors. Studying the pattern of worker migration across states, Dalh (2002) finds that highly educated workers are more mobile and migrate to states where the expected return to education is higher. His work implies that demand, rather than supply, factors are responsible for the positive association between a larger portion of highly educated workers and a higher income inequality at the state level, which is consistent with our results.

TABLE 4

REGRESSION RESULTS OF PRE-TAX INEQUALITY FOR THE RURAL AREAS

	Gini		RMD		COV		$I_{0.5}$		I_1		I_2	
Dependent Variable	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
High school	–0.052	–3.81	–0.080	–3.86	–0.157	–2.11	–0.034	–3.53	–0.057	–3.39	–0.084	–2.06
College	0.144	3.45	0.211	3.29	0.446	2.16	0.095	3.25	0.171	3.31	0.301	2.57
Female head	0.234	7.11	0.339	6.69	0.520	3.26	0.171	7.37	0.336	8.27	0.543	5.94
Family size	0.013	1.47	0.023	1.71	0.033	0.74	0.009	1.46	0.012	1.13	–0.017	–0.68
Age <18	0.138	1.88	0.167	1.49	0.670	1.81	0.107	2.07	0.224	2.47	0.651	3.12
Age 18–29	0.061	1.17	0.082	1.02	0.237	0.85	0.050	1.33	0.103	1.58	0.241	1.58
Age >59	–0.022	–0.44	–0.013	–0.17	0.117	0.49	–0.012	–0.35	–0.036	–0.59	–0.097	–0.71
Main tax	–0.002	–2.07	–0.003	–1.95	–0.006	–1.09	–0.001	–2.02	–0.003	–2.34	–0.006	–2.15
Top tax	–0.001	–0.04	0.009	0.22	0.038	0.27	–0.001	–0.03	–0.016	–0.50	–0.131	–1.68
EITC benefit	–0.033	–2.75	–0.044	–2.40	–0.060	–0.89	–0.022	–2.61	–0.041	–2.72	–0.069	–1.87
EITC phase-out	0.451	2.74	0.638	2.53	1.876	2.11	0.292	2.50	0.439	2.15	0.713	1.46
Minimum wage	–0.004	–0.59	–0.009	–0.81	–0.020	–0.52	–0.002	–0.30	–0.000	–0.03	0.035	1.60
Unemployment ins.	0.016	1.16	0.024	1.14	–0.036	–0.47	0.007	0.69	0.012	0.69	–0.046	–1.10
SSI	–0.009	–0.21	–0.007	–0.11	0.210	1.21	0.007	0.23	–0.014	–0.27	–0.116	–1.11
Disability ins.	–0.008	–0.28	–0.008	–0.18	–0.079	–0.46	–0.008	–0.37	–0.015	–0.39	0.044	0.47
AFDC/TANF///	–0.063	–2.68	–0.078	–2.14	–0.355	–3.68	–0.055	–3.42	–0.094	–3.25	–0.135	–2.32
AFDC need std.	0.018	1.85	0.025	1.62	0.110	2.42	0.016	2.26	0.024	1.97	0.018	0.68
Food stamps	0.071	1.04	0.139	1.32	–0.029	–0.10	0.028	0.60	0.079	0.94	0.139	0.81
GDP	0.031	2.94	0.045	2.84	0.086	1.46	0.023	3.07	0.040	3.06	0.057	1.79
Unemployment rate	0.002	0.65	0.003	0.82	–0.009	–0.68	0.001	0.69	0.003	1.08	0.004	0.55
Constant	0.159	2.18	0.201	1.80	0.117	0.30	–0.046	–0.89	–0.049	–0.54	0.082	0.38
ρ	0.211		0.223		0.137		0.206		0.209		0.135	
σ_u	0.012		0.019		0.030		0.008		0.015		0.023	
σ_z	0.022		0.034		0.125		0.016		0.028		0.068	
R^2	0.385		0.368		0.254		0.397		0.423		0.273	

TABLE 5

REGRESSION RESULTS OF POST-TAX INEQUALITY FOR THE RURAL AREAS

	Gini		RMD		COV		$I_{0.5}$		I_1		I_2	
Dependent Variable	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
High school	–0.039	–3.32	–0.059	–3.3	–0.122	–2.18	–0.022	–2.99	–0.037	–2.69	–0.038	–0.93
College	0.116	3.21	0.164	2.94	0.308	1.96	0.068	2.93	0.127	2.98	0.209	1.80
Female head	0.184	6.43	0.258	5.89	0.320	2.63	0.117	6.43	0.244	7.25	0.457	5.03
Family size	0.010	1.3	0.018	1.56	0.011	0.32	0.006	1.21	0.010	1.10	0.000	–0.01
Age <18	0.136	2.15	0.174	1.79	0.672	2.40	0.092	2.27	0.170	2.28	0.409	1.97
Age 18–29	0.062	1.38	0.085	1.22	0.251	1.20	0.048	1.66	0.101	1.89	0.278	1.82
Age >59	–0.018	–0.42	–0.006	–0.09	0.093	0.51	–0.010	–0.36	–0.025	–0.49	–0.094	–0.69
Main tax	–0.002	–2.7	–0.004	–2.67	–0.006	–1.33	–0.001	–2.55	–0.003	–2.79	–0.007	–2.30
Top tax	–0.018	–0.83	–0.019	–0.55	0.013	0.12	–0.010	–0.67	–0.028	–1.06	–0.107	–1.37
EITC benefit	–0.037	–3.6	–0.050	–3.14	–0.079	–1.56	–0.022	–3.27	–0.040	–3.23	–0.056	–1.51
EITC phase-out	0.437	3.08	0.597	2.75	1.639	2.45	0.246	2.71	0.380	2.27	0.478	0.98
Minimum wage	–0.004	–0.58	–0.007	–0.71	–0.005	–0.17	–0.001	–0.17	0.000	0.00	0.020	0.90
Unemployment ins.	0.014	1.19	0.023	1.27	–0.040	–0.71	0.005	0.60	0.008	0.57	–0.070	–1.66
SSI	0.009	0.25	0.011	0.19	0.220	1.64	0.015	0.63	0.008	0.18	–0.070	–0.67
Disability ins.	–0.007	–0.26	–0.010	–0.25	–0.019	–0.15	–0.005	–0.28	–0.009	–0.29	0.063	0.68
AFDC/TANF///	–0.066	–3.16	–0.084	–2.63	–0.311	–4.16	–0.047	–3.59	–0.074	–3.08	–0.072	–1.25
AFDC need std.	0.015	1.69	0.020	1.47	0.097	2.78	0.011	2.05	0.016	1.62	0.019	0.73
Food stamps	0.046	0.77	0.100	1.09	0.011	0.05	0.010	0.28	0.035	0.51	0.093	0.55
GDP	0.027	2.96	0.039	2.89	0.094	2.16	0.018	3.15	0.031	2.92	0.044	1.38
Unemployment rate	0.001	0.35	0.002	0.53	–0.004	–0.40	0.001	0.42	0.001	0.62	0.000	–0.01
Constant	0.171	2.72	0.225	2.34	–0.003	–0.01	–0.023	–0.56	–0.011	–0.15	0.121	0.56
ρ	0.230		0.241		0.169		0.231		0.220		0.122	
σ_u	0.011		0.017		0.024		0.007		0.013		0.023	
σ_z	0.019		0.030		0.093		0.012		0.023		0.067	
R^2	0.362		0.348		0.278		0.359		0.352		0.171	

TABLE 6
ELASTICITIES OF INEQUALITY TO POLICY VARIABLES

	Gini	RMD	COV	$I_{0.5}$	I_1	I_2
Urban pre-tax						
Main tax	–0.067*	–0.047	–0.110	–0.097*	–0.111*	–0.144*
Top tax	–0.021	–0.013	0.008	–0.046	–0.055	–0.054
EITC benefit	–0.024	–0.026	–0.046	–0.056	–0.043	–0.016
EITC phase-out	0.084*	0.090*	0.241*	0.179*	0.098	–0.050
Minimum wage	0.135*	0.126*	0.369*	0.282*	0.208*	0.119
AFDC	–0.041*	–0.041*	–0.098*	–0.090*	–0.080*	–0.071*
GDP	0.349*	0.378*	0.763*	0.734*	0.605*	0.361*
Urban post-tax						
Main tax	–0.074*	–0.078*	–0.127*	–0.119*	–0.180*	–0.196*
Top tax	–0.042*	–0.036	–0.019	–0.082*	–0.078*	–0.050
EITC benefit	–0.043*	–0.047*	–0.063	–0.092*	–0.085*	–0.085
EITC phase-out	0.105*	0.110*	0.271*	0.218*	0.141*	0.008
Minimum wage	0.125*	0.117*	0.351*	0.268*	0.192*	0.151
AFDC	–0.045*	–0.046*	–0.090*	–0.094*	–0.076*	–0.037
GDP	0.340*	0.378*	0.758*	0.756*	0.661*	0.734*
Rural pre-tax						
Main tax	–0.068*	–0.071	–0.094	–0.100*	–0.153*	–0.151*
Top tax	–0.001	0.006	0.018	–0.003	–0.024	–0.098
EITC benefit	–0.071*	–0.066*	–0.060	–0.140*	–0.132*	–0.111
EITC phase-out	0.144*	0.142*	0.277*	0.273*	0.210*	0.169
Minimum wage	–0.030	–0.048	–0.071	–0.045	–0.002	0.198
AFDC	–0.045*	–0.039*	–0.118*	–0.115*	–0.101*	–0.072*
GDP	0.332*	0.337*	0.428	0.724*	0.644*	0.454*
Rural post-tax						
Main tax	–0.075*	–0.105*	–0.110	–0.124*	–0.187*	–0.208*
Top tax	–0.020	–0.015	0.007	–0.037	–0.052	–0.094
EITC benefit	–0.089*	–0.084*	–0.092	–0.173*	–0.160*	–0.106
EITC phase-out	0.155*	0.147*	0.282*	0.286*	0.223*	0.133
Minimum wage	–0.034	–0.041	–0.021	–0.028	–0.0001	0.133
AFDC	–0.052*	–0.046*	–0.120*	–0.122*	–0.097*	–0.045
GDP	0.321*	0.324*	0.544*	0.703*	0.613*	0.413

Note: *We can reject the hypothesis that the elasticity is zero at the 5% level.

measures of inequality, we first calculate the elasticities of inequality for each policy variable evaluated at the sample averages. Next, we calculate the dollar value of the welfare effects.

Elasticities

The top panel of Table 6 reports the estimated urban elasticities, and the bottom panel lists the rural elasticities. For example, the sixth cell in the first column of numbers (post-tax panel) of Table 6 shows that that the post-tax, urban Gini elasticity with respect to minimum wage is 0.14. That is, when the minimum wage rises by 1 percent, the urban Gini increases by 0.14 percent. In both tables, the post-tax elasticity is almost always larger in absolute value than is the pre-tax elasticity (and more likely to be statistically significantly different from zero).

Increasing the marginal rate on the main tax bracket or the rate on the top bracket tends to reduce inequality in both areas. The Main Tax has statistically significant effects (except for the coefficient of variation of income measure) on both pre- and post-tax inequality in urban and rural areas. The effects in rural

areas are slightly larger in absolute value. In urban areas, the Top Tax does not have statistically significant effects on the pre-tax inequality, but does have statistically significant equalizing effects on the post-tax urban Gini, the relative mean deviation of income, and the $I_{0.5}$ inequality measures. The pre-tax and post-tax Top Tax effects are not statistically significant in rural areas. One possible explanation for why Top Tax has more of an effect in equalizing income in urban than in rural areas is that relatively few rural dwellers are in the top tax bracket.[10]

Transfer programs tend to have bigger effects in rural areas where relatively more families are eligible for government transfers because of low income or age. For the same reason as with taxes, the post-tax effects of government transfer programs are generally larger (in absolute value) than pre-tax effects.

The two EITC elasticities are considerably larger in rural than in urban areas, especially the EITC benefit. The EITC benefit has a statistically significant effect on both pre- and post-tax inequality in rural areas (except for the coefficient of variation of income and I_2). In urban areas, the EITC benefit does not have a statistically significant effect on pre-tax inequality, but does have a statistically significant equalizing effect on the post-tax Gini, relative mean deviation of income, and the $I_{0.5}$ inequality measures. The EITC phase-out rate increases both pre-tax and post-tax inequality, with a larger effect in the rural areas.

One major difference between the urban and rural areas is that the minimum wage has large, statistically significant effects in urban areas, but does not have a statistically significant effect in the rural areas. A plausible explanation is that the minimum wage law is less likely to be enforced in rural areas. Moretti and Perloff (2000) find that many agriculture workers are paid less than the minimum wage (unlike most other workers). Because the minimum wage directly influences the earned income and does not involve any transfer from the government, the urban pre-tax and post-tax minimum wage effects are close. The post-tax effects are slightly smaller, possibly because losses in income due to an increase in the minimum wage induced unemployment are offset by government transfers.

Growth of the economy (GDP) causes inequality to increase substantially. The effects are roughly equal in rural and urban areas for all the welfare measures. A 10 percent increase in GDP causes the pre- and post-tax Gini to rise by roughly 3 percent and I_1 to increase by 6–7 percent in both areas.

Magnitude of Policy Effects

We can also compare the magnitude of policy effects using the dollar-value interpretation of the Atkinson measures. (There is no simple way to compare the magnitude of these effects using traditional measures.) We illustrate the magnitude of the welfare effects of some key government policy and other variables in our analysis using the change in the welfare loss, $L = \mu - y_{EDE}$, Equation (2), which is the actual average income, μ, less the equally distributed equivalent level of income, y_{EDE}.

[10]For example, in 1997, 44.3 percent of the tax filers in urban areas in the CPS March files were in the main tax bracket while 1.2% of them were in the top tax bracket, compared to 50.7% and 0.5% for rural areas.

TABLE 7
WELFARE LOSSES FROM A 10% INCREASE IN POLICY VARIABLES

	Urban			Rural		
	$I_{0.5}$	I_1	I_2	$I_{0.5}$	I_1	I_2
Pre-tax						
Main tax	–21.6*	–43.2*	–129.6*	–17.2*	–51.6*	–103.1*
Top tax	–9.1	–21.7	–42.8	–0.5	–7.3	–59.4
EITC benefit	–18.4	–28.7	–20.5	–35.4*	–65.9*	–110.9
EITC phase-out	46.4*	49.9	–52.1	54.5*	81.9*	133.0
Minimum wage	57.6*	84.2*	97.5	–7.0	–0.1	123.3
AFDC maximum benefit	–15.7*	–27.5*	–50.1*	–15.3*	–26.2*	–37.6*
Post-tax						
Main tax	–19.3*	–58.0*	–135.2*	–15.8*	–47.5*	–110.7*
Top tax	–11.7*	–22.4*	–30.6	–4.2	–11.7	–44.7
EITC benefit	–22.0*	–40.3*	–86.1	–32.5*	–59.2*	–82.8
EITC phase-out rate	40.8*	52.5*	6.6	42.2*	65.2*	82.0
Minimum wage	39.6*	55.5*	95.1	–3.2	0.1	64.8
AFDC maximum benefit	–11.8*	–19.2*	–20.2	–12.0*	–19.0*	–18.4

Notes: *We can reject the hypothesis that these welfare effects are zero at 5% level.

Our measure of a policy's welfare effect is a dollar value interpretation of the change in the aggregate social welfare and depends on the choice of ε: the degree of inequality aversion. This estimate is based on the distribution of family disposable income, which reflects the impact of policy changes on both the benefit calculation (the direct/mechanical effect) and the induced responses in labor market behavior (the indirect/behavioral effect). Therefore, the reported welfare benefit/cost should not be confused with the traditional benefit/cost analysis, which does not take into account either the social welfare function or the potential behavior effects of changes in policies.

If we raise the 1997 level of the Main Tax rate by 10 percent, from 15 percent to 16.5 percent, the Atkinson index changes to $\hat{I}'_\varepsilon = \hat{I}_\varepsilon + 0.165 \times \hat{\beta}_{\text{Main Tax}}$, where $\hat{I}_\varepsilon$ is the estimated actual Atkinson index for 1997 family income and $\hat{\beta}_{\text{Main Tax}}$ is the estimated coefficient for the Main Tax. Assuming that the change in taxes does not have general equilibrium effects, the change in welfare loss due to lack of equality is (using Equation (2)):

$$\Delta L = (\mu_{97} - \hat{y}_{EDE}) - (\mu_{97} - \hat{y}'_{EDE}) = \mu_{97}\left[\left(1 - \hat{I}_\varepsilon\right) - \left(1 - \hat{I}'_\varepsilon\right)\right] = \mu_{97}\left(\hat{I}'_\varepsilon - \hat{I}_\varepsilon\right),$$

where the urban μ_{97}, the arithmetic mean in 1997 dollars of family income per person, is \$14,405, pre-tax, and \$11,458, post-tax, while the corresponding rural averages are \$12,878 and \$10,545.

Table 7 shows the average welfare losses (or gains) for $\varepsilon = 0.5$, 1, and 2 when we increase each policy variable by 10 percent. Across the ε's, the largest equalizing welfare effects is for the marginal tax rate for the main tax bracket. For example, when $\varepsilon = 0.5$, a 10 percent increase in this marginal tax rate increases the average pretax welfare by \$22 in urban areas and \$17 in rural areas, and the corresponding post-tax welfare effects are \$19 and \$16. To calculate the overall effects, we

multiply by the corresponding urban or rural population in 1997. We find that this tax changes increases pretax welfare by $4.69 and $0.92 billion dollars in urban and rural areas and post-tax welfare by $4.05 and $0.87 billion dollars. Strikingly, this welfare effect is larger than the direct effect from a 10 percent increase in AFDC payment.

A 10 percent increase in the minimum wage has the greatest disequalizing effect in urban areas. For $\varepsilon = 0.5$, a 10 percent increase in the minimum wage leads to a per person urban welfare loss of $58 pretax and $40 post-tax but has no effect on rural welfare, or $12.3 and $8.5 billion respectively at the aggregated level.

7. Summary and Conclusions

This study is the first to investigate and compare the effects of all major income redistribution policies on inequality in the urban and rural areas using data from across the United States. During the past two decades, income inequality has increased considerably in both rural and urban areas in response to changes in these policies, shifts in demographics, and macro conditions.

We systematically examine the effects of income tax rates, the minimum wage, and all the major government welfare and transfer programs on family income inequality. We find that it is feasible to study welfare effects of policies because the qualitative results are generally the same across most major inequality measures. Slightly less than half of the explained variation in our regression analyses is due to policy variables (rather than to macro conditions and demographic characteristics).

To our knowledge, this study is the first to clearly distinguish between pre-tax and post-tax results for a variety of policies. To the degree that many earlier studies have ignored taxes, they may consequently be biased. Pre-tax policy effects on the inequality level differ from post-tax effects. The impacts of the policies involving income transfers between the government and the individuals, such as tax rates and the Earned Income Tax Credit, are larger for the post-tax income inequality. However, we also observe substantial changes in pre-tax inequality for other policies that have substantial incentive effects on individual labor market behavior. For policies that do not involve direct transfers, such as the minimum wage, we observe comparable effects on pre-tax and post-tax income inequality.

Studies that do not distinguish between the effects of policies in rural and urban areas may not be adequately informative. We find that, although the effects of welfare reform and other policies on income inequality are qualitatively similar across rural and urban areas, they differ quantitatively. This difference in impact plays a large role in explaining why the average correlation between the rural and urban Gini indices over a couple of decades is less than half.

Our results show that policy evaluation should be conducted at the appropriate level of aggregation because over-aggregation gives misleading results. In particular, we find that if researchers ignore difference between rural and urban areas and aggregate across these areas, they may falsely conclude those policies that are effective in urban areas also work in rural areas and vice versa or those policies that have significant effects at a regional level do not have an effect at a national level.

Some policies, such as the marginal tax rate on the main tax bracket and the Earned Income Tax Credit have as large or larger effects on equalizing income in rural areas as in urban areas. However, the marginal tax rate on the highest income bracket has an important effect on inequality only in urban areas. This difference may be due to the relatively small fraction families with high incomes in rural areas. The minimum wage has large, statistically significant effects in urban areas, but does not have a statistically significant effect in rural areas. In contrast, the EITC has a greater impact in rural than in urban areas.

Currently, Republicans often call for tax cuts whereas Democrats often emphasize using minimum wage laws and direct welfare programs. These leaders may not realize the differential impacts that their programs have for urban versus rural areas. Provided that a leader wants a more equitable income distribution in his or her district, a representative with an urban constituency should advocate adjusting taxes or the minimum wage, whereas a rural representative should emphasize direct assistance such as the EITC.

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