# INCOME INEQUALITY AND URBAN/RURAL MIGRATION

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## Introduction

Recent population shifts from the Northeast and North Central (snowbelt) states to the South and West (sunbelt) states have been well-documented.[1] Furthermore, within these regions there has been a change in centers of population growth. Between 1970 and 1980, rural areas in the Northeast and North Central regions as defined by the Bureau of the Census have had population growth at a rate higher than the urban areas in those regions. The reverse has been true for the West and South regions.[2]

The causes of these shifts have been analyzed in depth. They have been grouped into five classes by Chalmers and Greenwood (1980): (1) changes in relative business costs, (2) growth of resource-based industries, (3) growth in income and wealth and concurrent increased demand for location specific amenities, (4) changes in the demographic structure of the population and labor force, and (5) government policies.

Of course, there are consequences of these migration patterns. As population shifts, so does income and employment. Economic development becomes increasingly viable in the South and West and probably less so in the Northeast and North Central regions. Declining urban areas in the Northeast and North Central may be particularly severly impacted by this migration as the economic base departs for "greener pastures."

The purpose of this paper is to examine some of the consequences of the migration trends from 1970 to 1980, focusing on the relationship of income inequality within a state with population shifts within and across states. Furthermore, we wish to determine if the movement of wealth and the changing employment opportunities has had any affect on the distribution of income within the four census regions and for urban and rural populations across all fifty states.

## The Model

The analysis will proceed as follows. We begin by constructing a measure of income inequality for each state and for the urban and rural population in each state. To see if population shifts are correlated with inequality, we present the results of regression analysis of the relationship between changes in (1) population, (2) income, and (3) unemployment and these measures of inequality.

The first step, then, is to calculate income inequality across states and for the urban and rural populations in each state. With a view to the practical application and flexibility of the functional form chosen, this study utilizes a beta distribution of the second kind. This functional form has performed well in approximating actual income data of McDonald (1984) and Slottje (1984, 1986). The beta distribution of the second kind is a three parameter distribution that allows for extraction of the marginal distribution of the ith state's income from the joint distribution of income for all fifty states. Similarly, the marginal distribution of income for the urban (rural) population in the ith state can be extracted. A unique feature of the beta distribution of the second kind is that the summation of the parameters (of the joint distribution) yields a marginal distribution that retains the same form as the joint distribution. Since the joint distribution of income for all the states is hypothesized to be distributed as a beta of the second kind, the marginal distribution of (say) urban income in the ith state is also assumed to be distributed as a beta of the second kind. By deriving a measure of inequality (in this case, the Gini measure) and assuming this particular functional form, the framework will be developed to analyze income inequality for the urban and rural population within each state as well as to make comparisons between states and, of course, within states. Consider the following model:

Let

$$(1)\ g(s_1, \ldots, s_{50}; c_1, \ldots, c_{50}, b^*, k)_{t,z} = \frac{k^{b^*} s_1^{c_1-1} \cdots s_{50}^{c_{50}-1}}{B(c_1, \ldots, c_{50})\,[k+s]^{b^*+c}}$$

$= 0$ otherwise

$t = 1970, 1980$

$z =$ sociodemographic attributes

where $c = c_1 + \ldots + c_{50}$ $\quad s = s_1 + \ldots + s_{50}$

$c_j > 0 \quad j = 1, \ldots, 50$

and $s_i$ is defined as income in the ith state. The k is the lower terminal k. The b* is called the Pareto parameter because under certain restrictions on the $c_i$'s

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and b*, equation (1) becomes the well-known pareto distribution. The $c_i$'s are called interincome inequality parameters for reasons that will be clear shortly. In general, z can be a vector of the characteristics. For this study g ( . ) is calculated for urban, rural and total state populations. Thus, z can be defined as urban, rural or total state population. The marginal density of state i's income takes the form:

$$(2)\ g(.)_i = \frac{k^{b^*} s_i^{c_i^{-1}}}{B(c_i, b^*)\,[k+s_i]^{b^*+c_i}} \qquad c_i > 0$$

Similarly, the marginal distribution of income for the ith state's urban population takes the form:

$$(3)\ g(.)_{iu} = \frac{k^{b^*} s_{iu}^{c_{iu}-1}}{B(c_{iu}, b^*)\,[k+s_{iu}]^{b^*+c_{iu}}}$$

$$= 0 \quad \text{otherwise} \qquad c_{iu} > 0$$

$$c_{iu} + c_{ir} = c_i$$

Now from equation (2) and equation (3) Gini measures of inequality are derived which (for state i income) take the form:

$$(4)\ G(c_i, b^*) = \frac{\Gamma(c_i+1/2)\,\Gamma(b^*+1/2)\,\Gamma(b^*+c_i)}{\Gamma(1/2)\,\Gamma(b^*+c_i+1/2)\,\Gamma(c_i+1)\,\Gamma(b^*)} \times \left[1 + \frac{2c_i}{2b^* - 1}\right]$$

To derive the Gini measure for the marginal distributions of urban (rural) income by individual state, simply change the $c_i$ to $c_{iu}$ ($c_{ir}$) in (4). From equation (4) it can be seen that inequality in the various marginal distributions is solely a function of the interincome inequality parameters $c_i$ ($c_{iu}$, $c_{ir}$) and the b*. The b* and $c_i$ ($c_{iu}$ , $c_{ir}$) are estimated from data by the method of moments, cf. Elderton (1938). The lower terminal k is found by locating the individual in the survey with the lowest income level. This income figure is the k.

The data utilized in this study is from the Bureau of the Census for 1970 and 1980. The income data were collected in frequency form for all fifty states as well as for urban and rural population for each state. By using equations (1) - (4), the marginal distribution of the urban/rural mix as well as the joint distribution for each state are derived. Means of the Gini measures for 1970 and 1980 are given in Table 1 for the urban/rural mix as well as for each state's total population.

Given the Gini measures of inequality, we now proceed to the second stage. In the second stage of our empirical work, we will test to determine if inequality (as measured by the Gini coefficients) has been affected by population, income, level of unemployment and state dummy for regional population shift.

Because the value of the Gini is between 0 and 1 estimation using OLS would violate the assumptions of the General Linear Hypothesis, i.e. we have a truncated normal disturbance.[3] To correct this violation, a logistic function as discussed in Amemiya (1973) is specified:

$$(6)\ G(.) = \frac{1}{1 + e^{-[\sum_i \beta_i X + e]}}$$

where X is a vector of exogeneous variables, ß is a vector of parameters to be estimated and e is the error term. The logistic model reduces to

$$(7) \ln \frac{(1-G(.))}{G(.)} = -\sum \beta_i X - e$$

$$e \sim \text{iid } N(0, \sigma^2 \varepsilon)$$

The estimates of this model are reported and discussed in section three below.

## Empirical Results

The Data are from the 1970 and 1980 Census of the Population. As shown in Table 1, inequality on average has been most severe in the South. However, in all states and for urban and rural populations, inequality has declined slightly between 1970 and 1980. We wish to determine if the population movement from the Snowbelt to the Sunbelt as well as the urban/rural population shifts have had any impact on the level of inequality. Concurrent with these population shifts are also changes in the patterns of wealth and changes in employment centers. According to Table 1, per capita income grew faster in the South and West than U.S. average per capita income. Income in the urban snowbelt grew at the slowest rate, 1970-1980, no doubt due partially to the slower growth in population.

Thus, we hypothesized that inequality in each state (and inequality within the states' urban and rural populations) is related to population changes, income growth and employment opportunities. State data were collected for 1970 and 1980 on urban and rural population, urban and rural per capita income as well as urban and rural labor force participation rates and unemployment rates. As stated earlier, we wish to determine the effect of regional population shifts, e.g. Sunbelt/Snowbelt, as well as urban/rural shifts. To examine the effect of regional shifts, we used inaction

**Table 1**

Summary Statistics

Means

| Region | % Δ population | % Δ income | Gini 1970 | Gini 1980 |
|---|---|---|---|---|
| Northeast | 6.25 | 105.36 | .377 | .339 |
| Rural | 9.48 | 117.67 | .379 | .333 |
| Urban | 4.69 | 108.15 | .380 | .342 |
| North Central | 4.59 | 117.12 | .384 | .339 |
| Rural | 6.66 | 124.04 | .380 | .339 |
| Urban | 3.83 | 118.48 | .386 | .339 |
| South | | 17.42 | 130.93 | .400 |
| .352 | | | | |
| Rural | 11.71 | 138.49 | .424 | .351 |
| Urban | 20.73 | 124.71 | .400 | .353 |
| West | 32.80 | 138.53 | .385 | .341 |
| Rural | 18.59 | 132.43 | .378 | .343 |
| Urban | 37.48 | 130.14 | .387 | .339 |
| U.S. | | 16.33 | 124.99 | .388 |
| .348 | | | | |
| Rural | 11.89 | 129.70 | .393 | .343 |
| Urban | 18.14 | 121.65 | .389 | .344 |

**Table 2**

Regression Results

| Variable | Parameter Estimate | T for Ho: Parameter=0 | Prob > \| T \| |
|---|---|---|---|
| | **DEPENDENT VARIABLE = LUG80** | | |
| INTERCEP | 0.67674877 | 5.081 | 0.0001 |
| NESPOP | 0.05292025 | 3.269 | 0.0023 |
| NCSPOP | 0.02709641 | 1.636 | 0.1102 |
| SSPOP | 0.05252300 | 3.930 | 0.0004 |
| STPOP | 0.07398933 | 0.317 | 0.7533 |
| TMUU | 0.11668880 | 2.984 | 0.0050 |
| TFUU | -0.13180406 | -2.422 | 0.0205 |
| TMRU | 0.01956612 | 0.773 | 0.4446 |
| TFRU | -0.09578403 | -2.722 | 0.0098 |
| UI | 0.08095147 | 2.173 | 0.0363 |
| RI | -0.06199262 | -1.766 | 0.0856 |
| URBPOP | -0.06589710 | -0.394 | 0.6961 |
| RURPOP | -0.05478468 | -0.550 | 0.5856 |
| | **DEPENDENT VARIABLE = LRG80** | | |
| INTERCEP | 0.93073866 | 3.952 | 0.0003 |
| NESPOP | 0.05520859 | 1.929 | 0.0615 |
| NCSPOP | 0.03643566 | 1.244 | 0.2211 |
| SSPOP | 0.05710289 | 2.417 | 0.0207 |
| STPOP | -0.57712147 | -1.397 | 0.1708 |
| TMUU | 0.06293053 | 0.910 | 0.3686 |
| TFUU | -0.00796153 | -0.083 | 0.9345 |
| TMRU | 0.02064403 | 0.461 | 0.6474 |
| TFRU | -0.10191378 | -1.638 | 0.1099 |
| UI | -0.13658931 | -2.073 | 0.0451 |
| RI | -0.02475531 | -0.399 | 0.6923 |
| URBPOP | 0.39458555 | 1.333 | 0.1906 |
| RURPOP | 0.21609641 | 1.227 | 0.2276 |
| | **DEPENDENT VARIABLE = LST80** | | |
| INTERCEP | 0.83391714 | 6.409 | 0.0001 |
| NESPOP | 0.03764919 | 2.381 | 0.0225 |
| NCSPOP | 0.02308792 | 1.427 | 0.1619 |
| SSPOP | 0.05533539 | 4.239 | 0.0001 |
| STPOP | -0.12115449 | -0.531 | 0.5988 |
| TMUU | 0.08065562 | 2.111 | 0.0416 |
| TFUU | -0.03505163 | -0.659 | 0.5138 |
| TMRU | 0.03688742 | 1.491 | 0.1444 |
| TFRU | 0.08065562 | -4.675 | 0.0001 |
| UI | 0.02400251 | 0.659 | 0.5137 |
| RI | -0.08245787 | -2.405 | 0.0213 |
| URBPOP | 0.03447673 | 0.211 | 0.8342 |
| RURPOP | 0.05447354 | 0.560 | 0.5790 |

terms for three regional dummy variables: STPOP is each state's population in 1980 divided by the state's population in 1970. The variables NESPOP, NCSPOP and SSPOP were calculated by multiplying STPOP by the appropriate 0-1 dummy variable for states in the Northeast, North Central and South regions. For example, if the state is in the Northeast, NESPOP equals STPOP, NCSPOP and SSPOP have a value of zero. If the state is in the North Central region, NCSPOP equals STPOP and NESPOP and SSPOP equal zero. To allow for the effect of urban/rural shifts, we included the ratio of 1980 to 1970 urban population (URBPOP) and a similar ratio for rural population (RURPOP).

To examine the relative effects of urban/rural income growth on inequality, we use measures of urban and rural income growth. We define RI as the ratio of 1980 to 1970 rural income. The variable UI is defined similarly for urban income.

To proxy the change in employment opportunities during 1970-80 period, data for several labor force participation variables were collected. These data included male (female) labor force participation rates in urban and rural areas and male (female) unemployment rates in urban and rural areas.

The labor force proxies used in the regression analysis were constructed in a manner similar to the population and income variables: the value of the variable in 1980 was divided by the value of the variable in 1970. The labor force participation rate variables and the unemployment rate variables were found to be highly collinear. A stepwise regression method indicated the unemployment rate variables to have higher explanatory values; thus they were retained for the final analysis. The four unemployment rate variables are: male urban (TMUU); female urban (TFUU); male rural (TMRU); and female rural (TFRU).

The effect of this set of variables on inequality in 1980 was examined vis-a-vis the logistic function described in (7). Unfortunately, migration theory does not predict a specific relation between population shifts and changes in demographics. Therefore, we do not hypothesize as to the relation between income inequality and changing demographics. The (transformed) Gini coefficients for the total population in each state (LST80), for the urban population (LUG80) and for the rural population (LRG80) were defined as the dependent variables. The results of the regression analysis are reported in Table 2.

One of the hypotheses tested here is the effect of regional population shifts on inequality. Our results indicate that for all three measures of inequality there is a differential impact for state-population shifts in the Northeast and South. In both cases, states with greater population growth, 1970-1980, had less inequality in 1980.

In terms of the urban/rural shifts, we find no relation between growth in urban or rural regions and inequality. Interaction terms were also defined for URBPOP and RURPOP by regional location. There was some evidence that urban growth in the South had some correlation with lower inequality for urban and total populations. However, for these regressions, the collinearity index as much higher than for those reported here and the validity of the regression coefficients are questionable. We conclude that urban/rural shifts have had less of an impact on inequality than the regional population shifts between the Sunbelt and Snowbelt regions.

Urban income growth has had a reducing effect on urban income inequality but a reverse relation with rural income inequality. States with higher urban income growth, the South and West, apparently also have lower levels of urban and overall inequality. At the same time, the effect on rural inequality of this income growth has been to increase rural inequality. States with high rates of rural income growth also have suffered a increase in rural inequality. Part of this outcome may be due to urban to rural migration where the relatively wealthy move to the rural areas. Examples would include states such as New Hampshire, Vermont, Michigan, and West Virginia.

The labor market parameter estimates imply a discouraged worker effect in the urban and total state regressions. Low income people tend to leave the labor force first. In addition, men leave at a faster rate than women. This situation is especially true as an increasing number of women in the labor force are also heads of households. Our results indicate that growth in unemployment has a differential effect on inequality depending on whether the growth is in female or male unemployment. States with higher unemployment for urban males in 1980 than 1970 had lower inequality for the urban population. For both urban and rural females, the relationship was reversed. The effect on state inequality was strongest for rural female unemployment and urban male unemployment. We concur with the conclusion of Shackett and Slottje (1986) (as well as with other results in the labor literature) that the impact of female and male unemployment on inequality are in opposite directions. Furthermore, there are no apparent differential impacts on rural inequality but the differential effects on urban inequality are quite strong.

## Summary

The purpose of this paper has been to examine the impact of urban/rural migration on the size

distribution of income across states and by urban/rural classification. In addition, we analyzed labor market effects on inequality in the various states and adjusted for regional differences to see what effects the sunbelt migration has had on inequality. To study these questions required the use of a flexible functional form of income distribution to allow us to make meaningful comparisons between attributes. The beta distribution of the second kind was chosen because it is flexible enough to allow disaggregation to the state and urban/rural population's inequality measures.

We found that shifts in the urban/rural population did not appear to effect inequality across states. Rather it appears that migration across regions has had a significant impact on inequality. In addition, we found urban growth in the South to be correlated with lower inequality in urban areas. Higher urban income levels appear to imply lower inequality in urban areas but the opposite relation with rural income distributions. The labor market effects are consistent with previous analysis of the discouraged worker effect: states with high unemployment among males have less inequality with opposite effects for women. Interestingly, the rural areas did not display any relation with the four labor market variables.

We conclude that the sunbelt/snowbelt shift and the changing pattern of income have had the most impact on inequality. Labor force proxies demonstrate a distinctly different impact for females and for males. This result suggests that it is not the urban/rural mix that is important but rather the overall shift in participation rate elasticities that are related to inequality.

## FOOTNOTES

[1]Throughout the paper, we use the four region census classifications.

2For a summary of these trends, see Beale (1977), Berry and Dalmann (1977), Chalmers and Greenwood (1980) and Sternlieb and Hughes (1977).

3Fomby et al. (1984) discuss the problems with this form.

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