WORKING PAPER SERIES

Poverty over Time and Location:

An Examination of Metro-Nonmetro Differences

John M. Ulimwengu

David S. Kraybill

RPRC Working Paper No. 04-05

August 2004

Rural Poverty Research Center

http://www.rprconline.org/

RUPRI Rural Poverty Research Center
214 Middlebush Hall
University of Missouri
Columbia MO 65211-6200
PH 573 882-0316

RUPRI Rural Poverty Research Center
Oregon State University
213 Ballard Hall
Corvallis OR 97331-3601
PH 541 737-1442

Poverty over Time and Location: An Examination of Metro-Nonmetro Differences

John M. Ulimwengu and David S. Kraybill

Introduction

Over time, poor individuals and households differ in the duration and number of poverty spells they experience. Transitory poverty may occur because households are unable to smooth consumption expenditures. Persistent poverty may arise because households do not accumulate sufficient physical or human capital. Both transitory and persistent poverty can be aggravated by poorly functioning insurance and credit systems. The persistently poor may need programs to enhance human and physical capital endowments, while the transitorily poor may need programs that complement their own resources and help them cope with crises.

Over locations, communities differ in industrial structure, density of economic activity, natural resources, public goods, and government policies and programs which may create disparities in living standards between geographical locations (Ravallion and Wodon). In many countries, differences in living standards between regions and communities are too large to be explained by differences in individual or household characteristics alone (Bigman and Fofack). In this paper, using a framework that incorporates both time and space, we analyze the differences between the dynamically poor living in metropolitan and nonmetropolitan areas.

Dynamic profile of poverty by location

We define a dynamically poor individual as someone whose income has been below the poverty line for at least one year, and we identify two categories of dynamic poverty. *Persistent poverty* applies to individuals poor for 10 years or more. *Transitory poverty* applies to individuals poor for 1 to 9 years. As pointed out by Devine, Plunkett, and Wright, there is no obvious or universally agreed-upon standard by which a person could be designated persistently poor. In a particularly influential study, Duncan et al. defined households as persistently poor if they were in poverty for eight or more out of ten years.

Our data is a geo-coded version of the National Longitudinal Survey of Youth (NLSY79), a nationally representative sample of 12,686 individuals aged 14-21 in 1978 (Center for Human Resource Research). This cohort was interviewed annually 1979-94 and biennially from 1994-2000. Income is defined at the household level in NLSY79. It includes earnings, passive income, government transfer payments, food stamps, and income from other sources. The income definition is much broader than in the Current Population Survey (CPS), which is used by the U.S. Census Bureau to calculate the official poverty rate.

Overall, females are the largest group of dynamically poor individuals in both metropolitan and nonmetropolitan areas (table 1). Among the peristently poor, females represent 61.2% in metro areas and 52.5% in nonmetro areas. Among the transitorily poor, females represent 53.0% in metro areas and 42.6% in nometro areas. From 1979 to 2000, the persistently poor spent 13.6 years in poverty on average in metro areas and 14.0 in nonmetro areas. The transitorily poor in metro and nonmetro areas spent 7.5 and 6.0 years, respectively, in poverty on average.

Racial differences in poverty rates are large, a phenomenon noted in many previous studies. Blacks are the largest racial group in the persistent poverty category, representing 41.7% in metro areas and 37.3% in nonmetro areas. In the transitory poverty category, the majority are Caucasians, 60.4% in metro areas and 67.5% in nonmetro areas.

The official poverty line in the U.S. represents the cost of acquiring a minimum basket of goods for families of various sizes. The basket is bigger for large families than for small families. In our income-to-needs ratio, the denominator (needs) is based on this official household size-sensitive poverty line. The official U.S. poverty rate is a static rate, calculated on an annual basis. Though we use a dynamic rate in the econometric analysis below, we first calculated static rates from the NLY79 data to see how they compare to the official U.S. poverty rate. Over our 22 year study period from 1979-2000, the average of the annual rates of poverty computed by the U.S. Census Bureau is 11.0%. Using the NLSY79 data over the same period, we calculated an average annual static poverty rate of 12.9%. Neither the official poverty rate nor the static poverty rate we computed from NLSY79 data incorporates differences in living costs across geographical locations in the United States. However, in our econometric analysis below, we adjust the poverty threshold for geographical differences in housing costs (Citro and Michael).

The welfare ratio is defined as family income deflated by a date- and location-specific poverty threshold (Ravallion and Wodon). From 1979-2000, on average, the persistently poor living in metro areas enjoyed the same welfare ratio (1.2) as those in nonmetro areas (table 1). The nonmetro transitorily poor experienced a higher welfare level (3.3) than their metro counterparts (2.9) during the same period.

Explaining dynamic poverty in metro and nonmetro areas

Assume each individual maximizes utility subject to various constraints ranging from individual characteristics to regional and community attributes, including governmental policy. We use an intertemporal model in which the *i*th household has a vector of assets, A_{it}, at time *t* (Carter and May). These assets include individual and community characteristics. Each period, individual *i* chooses a level of consumption (C_{it}) and investment (I_{it}) to maximize the discounted stream of expected well-being. Formally, we have

$$\underset{\{C_{it}, I_{it}\}}{Max} E\sum_{t=0}^{\infty} \delta^t U(C_{it}), \qquad (1)$$

where U(·) is a utility function and δ is the discount rate. Using Bellman's equation, the dynamic optimization problem takes the following form:

$$V_t(A_{it}) = \max_{\{C_{it}, I_{it}\}} U(C_{it}) + \delta V_{t+1}(A_{it+1}) \qquad (2)$$

subject to

$$\begin{aligned} C_{it} + P_t' I_{it} &= f(A_{it}) \\ A_{it+1} &= A_{it} + I_{it} - \Theta_{it}, \\ A_{it+1} &\geq 0 \end{aligned} \qquad (3)$$

where **f**(·) is a generalized earnings function, $\mathbf{P_t}$ is a vector of market prices at which entitlements are sold and purchased, and **Θ** is a vector of stochastic asset shocks that can be positive or negative. Earnings depend upon individual characteristics and also upon community assets, which influence private factor returns.

Optimal consumption, the solution to the preceding dynamic optimization problem, is assumed to be determined by variables drawn from both individualist and structuralist theories of poverty. The model goes beyond a simple combined individualist-structuralist approach, however. It also assumes that consumption is affected by stochastic shocks, so as to account for the dynamic vulnerability that is characteristic of poverty.

Replacing optimal consumption with a measure of living standard for our empirical analysis, we use a components-of-variance model to analyze the causes of poverty in metro and nonmetro locations (Stevens; Lillard and Willis). To account for time (w_t) and individual heterogeneity (v_i), we use a two-way random effects version of the components-of-variance model. The temporal evolution of living standard (Y_{it}) is given by

$$\begin{aligned} Y_{it} &= X_{it}\beta + u_{it} \\ u_{it} &= \upsilon_i + w_t + \varepsilon_{it} \end{aligned}, \tag{4}$$

where the living standard is defined as the log of the income-to-needs ratio (Blackorby and Donaldson), X_{it} is a vector of individual attributes (age, gender, household size, educational attainment, marital status, and race) and community attributes (county per capita income, county per capita transfer payments, and a regional dummy variable), and u_{it} is a normally distributed error term with the following structure:

$$\text{cov}(u_{it}, u_{js}) = \begin{cases} (\sigma_\upsilon^2 + \sigma_w^2 + \sigma_\varepsilon^2) & \text{if i = j and t = s} \\ \sigma_\upsilon^2 & \text{if i = j, t} \neq \text{s} \\ \sigma_w^2 & \text{if i} \neq \text{j, t = s} \\ 0 & \text{otherwise} \end{cases}.$$

The model is estimated by the restricted maximum likelihood (REML) method, which has the favorable theoretical property that it accommodates data that are missing at random (Rubin; Little). This procedure fits the structure of our data (panel data) with sizeable numbers of missing values.

To measure the difference in living standards between nonmetro and metro areas, we introduce two measures developed by Ravallion and Wodon, based upon the Oaxaca decomposition (Oaxaca and Ransom). The expected living standard is the predicted (fitted) value from the living-standards equation. The difference in *expected living standard* between metro and nonmetro areas, interpreted as the overall level of "metro-nonmetro dualism," is

$$E[Y_{it} \mid i \in \text{metro}] - E[Y_{it} \mid i \in \text{nonmetro}] = \hat{\beta}'_{metro} X_{t,metro} - \hat{\beta}'_{nonmetro} X_{t,nonmetro} \qquad (5)$$

where $X_{t,metro}$ and $X_{t,nonmetro}$ are metro and nonmetro subsample means.

The *conditional probability of being poor* for individuals *i* living in metro and nonmetro areas is

$$\begin{aligned} \text{Prob}[\text{Y}_{\text{it}} < 0 \mid i \in \text{metro } X_{it} = X] &= \Phi[-(\beta'_{\text{metro}} X)/\sigma_{\text{metro}}] \\ \text{Prob}[\text{Y}_{\text{it}} < 0 \mid i \in \text{nonmetro } X_{it} = X] &= \Phi[-(\beta'_{\text{nonmetro}} X)/\sigma_{\text{nonmetro}}] \end{aligned} \qquad (6)$$

where X is the vector of independent variables from the overall (national, including non-dynamically poor) sample instead of the metro or nonmetro sub-samples in order to capture only spatial differences between these two areas, σ_{metro} and σ_{nonmetro} are standard deviations of errors in the metro and nonmetro regressions, and Φ is the cumulative density of the standard normal distribution.

The difference in expected living standard between metro and nonmetro areas can be broken down by characteristics or groups of characteristics. The living standard variable includes an unobserved component for which we cannot control and which we assume converges to zero asymptotically. The difference in expected living standard is due to systematic differences in individual and geographical characteristics in metro versus nonmetro areas, as well as to differences in the returns to these characteristics in the two areas.

Results

Separate living-standards equations were estimated for metro areas, nonmetro areas, and the nation. The sample is limited to NLSY79 respondents who were dynamically poor, as defined above, during the period 1979-2000. It might be thought at first glance that an analysis focusing only on the poor would be subject to selectivity bias. This would indeed be the case if we used a static definition of poverty. However, in a dynamic poverty analysis, households move in and out of poverty over time and, therefore, selectivity bias is not a problem.

The dependent variable is the log of the income-to-needs ratio of dynamically poor individuals. Population weights were used in the estimation to account for intentional over- and under-sampling in the NLSY79 sample design. Weighting the regression is important so that valid population inferences can be drawn from the sample. The coefficients, reported in table 2, indicate the marginal change in living standards induced by a one unit change in the corresponding independent variable. Because of attrition (that is, individuals dropping out of the sample) that yields unbalanced data, the sum of observations in the metro and nonmetro equations is not equal to that in the national equation. However, the REML estimation procedure incorporates all the available information in the data and reduces or even eliminates bias (Rubin).

We first discuss results for the national equation. The type of poverty experienced by the poor has a large and statistically significant impact on the standard of living. Ceteris paribus, the living standard of the persistently poor is 37.4% lower than that of the transitorily poor (the default). This finding supports the view that distinguishing between the "very poor" and the "less poor" is important in the design of anti-poverty strategies. Reducing the poverty of the persistently poor may require remedies that are either larger in magnitude or possibly different than those required to address the poverty of the transitorily poor.

Consistent with many other studies, we find a statistically significant relationship between gender and standard of living of the poor. On average, the living standard of poor males is 11.6% higher than that of poor females. This difference could be a result of gender differences in time spent outside the labor force or it could be due to gender discrimination though, given our set of independent variables, we are unable to discern the precise source of the difference. Racial differences in living standards are also sizeable among the dynamically poor. Compared to poor Caucasians, poor individuals in Black, Hispanic, and Indian ethnic groups have significantly lower living standards: -8.2%, -6.3% and -30.3%, respectively. Age is also a statistically significant factor in the standard of living of the poor. Each additional year of age is associated with a 1.5% decrease in living standard. Household size is not statistically significant.

Marriage is associated strongly with higher living standards of the poor. Ceteris paribus, the living standard of poor married individuals is 30.6% higher than that of poor unmarried individuals. Given the structure of our components-of-variance model, this result (as every other result in our model) accounts for variation across both individuals at each point in time and across time for each individual.

Completing college has a positive and statistically significant impact on living standards of the poor. Compared to persons whose highest degree is high school (the default), poor individuals who hold a college or university degree have incomes that are 3.3 % higher on average. This difference, while important, is relatively small, suggesting that higher education alone does relatively little to raise the incomes of persons who are already poor. The coefficient on the college variable is significant only when it is lagged by one year. The contemporaneous value was not significant, perhaps because of delays between college graduation and employment.

Employment boosts the living standard of poor individuals, as expected. However, it raises the living standard by only 11.0%, ceteris paribus, over the period 1979-2000. This relatively small effect may be due to reduction in governmental transfer payments when poor individuals become employed, or it may be because employment is part-time or low-paying. Sector of employment also makes a difference. Poor individuals employed in manufacturing have a living standard that is 12.2% higher, on average, than that of persons employed in the public sector (the default).

Local economic conditions are important in the standard of living equation. On average, an increase of $1,000 in county per capita income increases the living standard of the poor by 2.5%. The magnitude of governmental transfer payments in the local economy is associated with lower standards of living of the poor. For every $1,000 increase in county per capita transfer payments, the standard of living of poor households is 4.6% lower on average.

We now compare results for metro and nonmetro regressions. The living standard of poor Blacks and Indians is significantly lower than that of poor Caucasians in nonmetro areas but not in metro areas. College education has a significant and positive effect on living standards of the poor in the metro equation but not in the nonmetro equation. Employment in agriculture, compared to the public sector (the default), is associated with a lower living standard for the poor in the metro equation but not in the nonmetro equation. In the nonmetro equation, manufacturing employment raises living standards of the poor by 16.5% compared to that of persons employed in the public sector; no such effect is observed in the metro equation.

The expected living standard, calculated using equation (5), was systematically higher in nonmetro compared to metro areas over the period 1979-2000 (table 3). Either the level of individual and geographical characteristics or the return to these characteristics was higher in nonmetro areas compared to metro areas. Using a two-tailed t-test, we found the difference in expected living standards between these two areas to be statistically significant at the level of five percent or less, except for the 1994-2000 period. Computed using equation (6), the probability of being poor conditional on all factors except geographical location being the same, was higher in metro areas than in nonmetro areas, except for the period 1979-1983. From 1979 to 2000, the average conditional probability of being poor was 27.4% in nonmetro areas and 28.4% in metro areas. During 1994-2000, owing perhaps to national economic expansion, the probability of being poor declined in both nonmetro and metro areas relative to earlier years.

Conclusion

Our key indicators, expected living standard of the poor and the probability of remaining poor, are based on a living-standards model that adjusts for local and individual characteristics. These two indicators reveal whether there are locational differences in living standards and poverty after controlling for differences in the values of characteristics and the returns to characteristics. While we find evidence of metro-nonmetro differences in the incidence of poverty based on descriptive statistics and in the determinants of poverty based on regression analysis, the differences are relatively small in absolute terms and are tilted largely in favor of nonmetro areas.

We began this work with the standard view that nonmetro poverty is worse than metro poverty, a conclusion based on short-term, static definitions of poverty (Jolliffe). Our analysis does not support the "nonmetro is worse off" view. The critical difference between our findings and those of others, such as Jolliffe, may lie in our use of a dynamic (longer term) definition of poverty that defines income more broadly than the income measure used in the Current Population Survey, on which official poverty rates are based, and in the adjustment for cost of living differences between metro and nonmetro areas. Our results suggest that distinguishing between persistently poor and transitorily poor is of importance in the design of anti-poverty strategies. A failure to acknowledge that difference may lead to poverty strategies that miss targeted poor populations.

Table 1. Poverty Statistics for Metro and Nonmetro Areas, 1979-2000

	Metro		Nonmetro		
Variable	Persistent	Transitory	Persistent	Transitory	Nonpoor
Gender (%)	100.0	100.0	100.0	100.0	100.0
Male	38.8	47.0	47.5	57.4	54.9
Female	61.2	53.0	52.5	42.6	45.1
Avg. time in poverty (yrs)	13.6	7.5	14.0	6.0	0.0
Race (%)	100.0	100.0	100.0	100.0	100.0
Asians	0.0	0.3	0.0	1.7	0.0
Blacks	41.7	15.4	37.3	8.4	2.9
Caucasians	34.4	60.4	30.7	67.5	79.5
Hispanics	11.8	7.5	1.7	2.3	2.4
Indians	4.8	4.1	13.0	5.4	3.2
Other	7.3	12.3	17.3	14.7	12.0
Avg. welfare ratio	1.2	2.9	1.2	3.3	4.6

Note: An individual is dynamically poor if he/she experienced at least one year in poverty. *Persistent poverty* applies to individuals poor for 10 years or more. *Transitory poverty* applies to individuals poor for 1 to 9 years.

Table 2. Econometric Results for Living-Standards-of the-Poor Model

	Nation			Metro			Nonmetro		
Independent variables	Estimate		t-value	Estimate		t-value	Estimate		t-value
Intercept	0.5532	***	5.1	0.6668	***	5.3	0.5323	***	3.3
Poverty type									
Transitory (default)									
Persistently	-0.3743	***	-24.0	-0.3889	***	-20.4	-0.4099	***	-14.4
Gender (0=female, 1=male)	0.1163	***	8.0	0.1218	***	6.8	0.0983	***	3.7
Race									
Caucasian (default)									
Black	-0.0821	**	-2.5	-0.0626		-1.6	-0.1122	*	-1.7
Hispanic	-0.0625	*	-1.9	-0.0742	*	-1.9	-0.1273	**	-2.1
Asian	0.0370		0.2	-0.1278		-0.6	-0.1263		-0.5
Indian	-0.3029	***	-5.6	-0.3525		-4.9	-0.2941	***	-2.9
Other	-0.3069	***	-6.8	-0.3045		-4.2	-0.2109	**	-2.5
Age (years)	-0.0151	***	-5.1	-0.0158	***	-4.4	-0.0109	**	-2.3
Household size	-0.0061		-0.8	-0.0171		-1.7	-0.0099		-0.6
Household size squared	0.0002		0.3	0.0015		1.5	0.0005		0.3
Married (0=no, 1=yes)	0.3062	***	23.7	0.3305	***	18.6	0.2717	***	10.4

Educational Attainment									
High school (default)									
Elementary	-0.0197		-1.4	-0.0144		-0.8	-0.0384		-1.3
College (lagged)	0.0334	*	1.9	0.0430	*	1.8	0.0343		0.9
Employed (0=no, 1=yes)	0.1104	***	8.2	0.1620	***	9.0	0.0923	***	3.4
Sector of employment									
Public sector (default)									
Agriculture	-0.0348		-0.7	-0.1492	*	-1.8	-0.0354		-0.4
Manufacturing	0.1220	***	3.1	0.0677		1.2	0.1648	**	2.1
Services	0.0550		1.5	0.0155		0.3	0.0883		1.2
Other	0.0401		1.1	0.0066		0.1	0.0828		1.2
County per capita income ($1,000)	0.0253	***	10.8	0.0173	***	5.6	0.0288	***	6.2
Per capita transfer payment ($1,000)	-0.0456	**	-2.0	-0.0243		-0.9	-0.0579		-1.3
Region									
Northeast (default)									
Northcentral	-0.0319		-1.5	0.0265	**	1.0	-0.0870	**	-2.1
South	-0.0081		-0.4	0.0495		2.1	-0.0482		-1.2
West	-0.0337		-1.5	-0.0398		-1.5	-0.0236		-0.6
Number of observations	31,968			17,520			7,003		
Log likelihood	-39,104			-21,485			-8,486		

*, **, *** significant at 0.10, 0.05, and 0.01 levels

Table 3. Expected Living Standards of the Poor and Conditional Probability of Remaining Poor, 1979-2000

Period	Expected living standards [a] (income-to-needs ratio)			Conditional probability of remaining poor		
	Nonmetro	Metro	Difference	Nonmetro	Metro	Difference
1979-1983	1.52	1.42	0.10**	0.30	0.29	0.01
1984-1988	1.62	1.41	0.21***	0.27	0.29	-0.02***
1989-1993	1.58	1.37	0.21***	0.27	0.30	-0.02***
1994-2000	1.67	1.51	0.16	0.24	0.25	-0.01

*, **, *** significant at 0.10, 0.05, and 0.01 levels

[a] To facilitate interpretation, we present the simple ratio here rather than the log of the ratio, as defined in equation (5).

References

Bigman, D., and H. Fofack. "Geographical Targeting for Poverty Alleviation: An Introduction to the Special Issue." *The World Bank Economic Review* 14(2000): 129-45.

Blackorby, C., and D. Donaldson. "Welfare Ratios and Distributionally Sensitive Cost-Benefit Analysis." *Journal of Public Economics* 34(1987): 265-90.

Carter, M.R., and J. May. "One Kind of Freedom: Poverty Dynamics in Post-apartheid South Africa." *World Development* 29(2001): 1987-2006.

Center for Human Resource Research (CHRR). NLSY79 User's Guide: A Guide to the 1979–2000 National Longitudinal Survey of Youth Data. The Ohio State University, 2001.

Citro, C. F., and R.T. Michael. *Measuring Poverty: A New Approach*. Washington DC: National Academy Press, 1995.

Devine, J.A., M. Plunkett, and J.M. Wright. "The Chronicity of Poverty: Evidence from the PSID, 1968-1987." *Social Forces* 70(1992): 787-812.

Duncan, G.J., R.D. Cole, M.E. Corcoran, M.S. Hill, S.D. Hoffman, and J.M. Morgan. *Years of Poverty, Years of Plenty*. Survey Research Center, Institute for Social Research, University of Michigan, 1984.

Jolliffe, D. *Comparisons of Metropolitan-Nonmetropolitan Poverty During the 1990s.* Washington DC: U.S. Department of Agriculture, RDRR 96, Economic Research Service, June 2003.

Lillard, L., and R. Willis. “Dynamic Aspects of Earnings Mobility.” *Econometrica* 46(1978): 985-1012.

Little, R.J.A. ”Modeling the Drop-Out Mechanism in Repeated-Measures Studies." *Journal of the American Statistical Association* 90(1995): 1112-21.

Oaxaca, R.,and M. Ransom. “On Discrimination and the Decomposition of Wage Differentials.” *International Economic Review* 14(1994): 693-709.

Ravallion, M., and Q.Wodon. “Poor Areas, Or Only Poor People?” *Journal of Regional Science* 39(1999): 689-711.

Rubin, D.B. "Inference and Missing Data." *Biometrika* 63(1976): 581-92.

Stevens, A. H. “Climbing out of Poverty, Falling Back in: Measuring the Persistence of Poverty over Multiple Spells.” *The Journal of Human Resources* 34(1999): 557-88.