COMMUTING AND MIGRATION IN NORTH CAROLINA: DOES SUBURBANIZATION EXPLAIN THE TRENDS?

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ARE REPORT NO. 13
JANUARY 1997

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INTRODUCTION

Dramatic changes in the relative distribution of urban and rural population growth over the past 25 years represent a continuing empirical puzzle for regional scientists, rural sociologists, and other students of rural development. The 1970s witnessed the so-called "nonmetropolitan turnaround," a reversal of the longstanding trend toward depopulation of rural areas. During that decade, U.S. rural population grew faster than the urban population, and more people migrated from urban to rural areas than in the opposite direction (Fuguitt). The 1980s saw a reversion to the historical trend of net out-migration from rural areas, although net migration into some rural counties – particularly retirement destinations and "recreation" counties – continued to take place (Johnson). Recent demographic data suggests that since 1990 net in-migration rates for rural areas have once again risen above those of urban areas (Fuguitt and Beale).

Social scientists attempting to understand these shifting trends have gravitated toward two competing explanations. Proponents of a *regional restructuring* hypothesis assert that sweeping changes in the organization of production have resulted in a weakening of the agglomeration economies that have underlain the historical tendency toward an ever-growing urban share of aggregate economic activity. These changes have been attributed to such diverse sources as shifts in national comparative advantage (especially from manufacturing to service industries), technological changes (particularly information technologies), intensifying international competition, and even the growing dominance of multinational corporations (Frey). Whatever the purported reason, advocates of the regional restructuring hypothesis generally attribute observed trends in rural-urban population dynamics to changes in the spatial distribution of employment opportunities.

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A second school of thought holds that changing locational preferences and ever-greater mobility of workers and firms has facilitated a *deconcentration* of population. Advocates of the deconcentration hypothesis pay particular attention to residential choices made by workers and consumers. They argue that the diminishing cost of distance and rising negative externalities in urban areas (e.g, congestion and crime) have led to a greater role of locational amenities as a determinant of where people live and where employers locate (Wardwell). In other words, proponents of the deconcentration argument tend to view trends in rural-urban population dynamics as a by-product of widespread changes in residential preferences.

While the conceptual literature making the case for one or the other of these two perspectives is rather large, empirical work in this area is very limited and, from our perspective, unsatisfying. Empirical analyses generally have been confined to looking at simple correlations between various types of migration flows and various indicator variables – e.g., employment shares of different industries (Johnson) or locational preferences reported by survey respondents (Fuguitt and Brown). What is lacking are analyses that derive testable hypotheses from these competing explanations and then set about testing them.

In this paper, we attempt to conduct such an analysis. We estimate an empirical model of the determinants of inter-county commuting patterns that sheds light on the strength of these two alternatives – regional restructuring and deconcentration. We argue that these two hypotheses imply markedly different predictions for the relationship between commuting and migration that can be tested in a fairly straightforward way – by determining whether commuting and migration are positively or negatively related after controlling for other economic factors. Our analysis is conducted using data from North Carolina, a state where trends in rural and urban population growth have been fairly similar to those in the rest of the nation. For the most part, our empirical results validate the deconcentration hypothesis. We find clear evidence that migration into rural areas located adjacent to metropolitan counties was to a large degree a product of suburbanization. We do find some evidence linking net migration into more remote rural counties during the 1970s to these counties' positive economic performance; however, we find that by 1990 suburbanization had begun to extend into these more distant rural counties as well.

The paper is organized as follows. In the next section of the paper, we briefly summarize the salient features of work in two distinct lines of inquiry that bear directly on our empirical analysis – regional wage equalization and migration studies from the regional economics literature and urban labor market analysis from the urban economics literature. Insights drawn from this body of work are used to formulating an empirical test of competing explanations of rural-urban population dynamics. Next we present descriptive analyses of trends in migration and commuting in North Carolina to provide an empirical backdrop for our econometric analysis. We then propose and estimate a model of the determinants of commuting for different types of commuting flows and interpret the econometric results. We conclude by offering some summary observations.

BACKGROUND

Observed trends in the spatial distribution of population and employment are fundamentally related to three key choices made by working-age people: (a) where to live; (b) whether or not to work in the wage market; and (c) where to work. In this paper, we abstract from labor force participation decisions, and focus exclusively on workplace and residential choice decisions. We begin by reviewing some of the most important research on migration and commuting found in the regional economics and urban economics literature. These provide the analytical underpinnings for the empirical analyses to be conducted in the following sections of the paper.

Wage Differentials, Migration and Employment

Wage differentials have long been used as a measure of the extent and rate of adjustment in the supply of and demand for labor. Even though wage differentials have declined over time (Dickie and Gerking) some important ones still exist. The degree to which current differentials relate to the characteristics of workers and cost-of-living differentials is not fully agreed upon. It is clear, however, that migration has played an important role in the decline in inter-regional wage variation, even though the process has not been a speedy one (Greenwood and Hunt; Greenwood, et al.)

The scholarly literature in this area has increasingly paid greater attention to the underlying labor supply and demand forces at work. Two studies stand out in this regard. Carlino and Mills posed the question of whether "people follow jobs" or "jobs follow people." This question can be restated in two ways. First, do people migrate to regions with pleasant climates (or fail to migrate away from them in the case of natural increase in population over time)? Second, which is more mobile, labor or capital? Carlino and Mills proposed a system of two equations in which population and employment were determined simultaneously. Although their empirical results are not definitive, they demonstrate the importance of approaching labor market issues as if individuals make the decision about location and workplace simultaneously.

A second important study in this area is the analysis of labor markets across Canada by Vanderkamp. Vanderkamp jointly estimated population, wage, and employment equations in order to explain spatial variation in the adjustment of regional labor supply, labor demand, and wage rates. This work focused on migration as an equilibrating force, primarily because migration was the major mover of population in the specific regions studied. His innovation was to treat migration at the same time he analyzed wages and employment.

A key feature of both of these studies is the implicit assumption that workplace and residency are determined jointly and simultaneously by workers, a marked advance in the complexity and the theoretical sophistication of the analysis of labor market adjustments. At the

same time, however, both studies left aside the question of commuting as a means of modifying local labor supply and as a means of simultaneously resolving the residence and workplace choice questions.

Commuting and the Economics of Urban Labor Markets

An important strand of the urban economics literature emphasizes the development of rent gradients across a single urban center under the assumption that all demand for labor exists in one central workplace (Straszheim, 1987). In these models, land and housing rent gradients are generated as a consequence of workers choosing a residence after having chosen a workplace. Commuting emerges as a natural product of this line of analysis, while migration is generally ignored. Recent theoretical and empirical work in this area extend the analysis to include wage gradients for different worker skill levels as a way of explaining the observation that highly skilled workers tend to commute further than less skilled workers.

Since the early 1980s, several authors have formally modeled intra-urban migration and commuting as alternatives in the process of jointly optimizing the workplace and residency decisions (Siegel; Simpson; van der Veen and Evers). Later, Evers explicitly treated the decision of place of residence and place of work simultaneously in a regional context, thereby extending the analysis of a single intra-urban labor market to the study of regional labor markets. A key feature of Evers' theoretical analysis is the introduction of the concepts of substitution and complementarity between commuting and migration. Commuting and migration are *substitutes* for households that find local wages lower than distant wages and who must either commute or migrate to maximize their income. Alternatively, substitution between migration and commuting would occur if positive local shocks were to lower the propensity of households to out-commute and increase the rate of in-migration. For a given location, substitution would manifest itself empirically as a positive relationship between out-commuting and out-migration (or, equivalently, a negative relationship between out-commuting and in-migration.

Commuting and migration will be *complements* in two situations. A particular household might change its place of residence without changing its place of work if, for example, residential amenities in the new location better suit its preferences. This kind of positive relationship between in-migration and out-commuting would characterize suburbanization or ex-urbanization. Alternatively, complementarity between migration and commuting would occur for persons who are choosing a new workplace and at the same time choose a new residence. For example, a household moving into North Carolina may choose to work in one county but live in another. Here, too, a positive relationship would exist between out-commuting and in-migration.

The concept of substitution or complementarity between migration and commuting represents a useful way to gauge the relative merit of the two competing explanations for trends in rural-urban population dynamics described earlier– regional restructuring and deconcentration. These two hypotheses imply markedly different predictions for the relationship between commuting and migration. The regional restructuring hypothesis posits

sweeping changes in the organization of production that have produced positive local economic shocks for rural areas *vis-a-vis* urban areas. If this is true, then we would expect an attenuation of out-commuting from rural areas to urban areas to have accompanied net migration into rural areas (i.e., that commuting and migration are substitutes for rural-urban commuting flows). Conversely, the deconcentration hypothesis centers on changes in residential preferences and the increasing importance of rural amenities *vis-a-vis* urban amenities. If this is the case, then we would expect a positive (complementary) relationship between migration into rural areas and out-commuting from rural areas to urban areas.

Our strategy for empirically exploring the relative merits of these two competing explanations is therefore to test whether commuting and migration are positively or negatively related after controlling for other economic factors. We pursue this course later in the paper. Prior to conducting this econometric analysis we first describe recent trends in migration and commuting in North Carolina.

TRENDS IN MIGRATION AND COMMUTING IN NORTH CAROLINA

In this section we provide some descriptive information on trends in migration and commuting in North Carolina since 1960. We base our analyses on county-level data collected and tabulated by the U.S. Census Bureau. Data on net migration by age, race and sex in North Carolina for the periods 1960-1970 and 1970-1980 are directly available from the U.S. Census Bureau. Comparable net migration data for the 1980-1990 period (computed using hitherto unpublished Census Bureau data) were made available to us by the North Carolina Department of Administration. In all cases, the net migration figures were computed using estimated age-race-sex specific survival rates adjusted for local (county) mortality rates.

Journey-to-work (commuting) data have been published by the Census Bureau for the years 1960, 1970, 1980 and 1990. These provide information on the county of residence and county of work for all workers, including both commuters – defined as those working in one county and residing in another – and non-commuters. For 1980 and 1990 these journey-to-work data are further disaggregated into twelve one-digit SIC categories, along with industry-specific average wages received by all workers moving between specific county pairs.

Migration

Table 1 summarizes net migration during these three decades by age cohort and race. Beginning first with the aggregate figures, it is clear that the 1960s marked the latest decade in a long historical pattern of out-migration from rural North Carolina, both to urban centers within the state as well as to locations in other states (see Figure 1). In sharp contrast, the 1970-1980 period witnessed significant net in-migration to rural areas – the so-called nonmetropolitan

turnaround of the 1970s – as well as a large influx of persons into the state.[1] Net in-migration into North Carolina increased in the 1980s. However, overall net migration into rural areas, while still positive, was considerably less than in the previous decade. That is, the great bulk of this inflow into North Carolina from outside the state settled in urban growth centers such as the Research Triangle and Charlotte areas.

Table 1 also indicates striking racial differences in migration patterns over the three decades under consideration (see Figure 2). Of particular note is the net out-migration of non-whites from rural areas in all three periods. Hence, the net in-migration into rural North Carolina observed during the 1970s and 1980s was, in the aggregate, confined to whites.

To what degree were observed trends in migration due to relocation related to changing employment opportunities? Some hints as to the answer to this question may be gathered by examining the data for the two age cohorts containing "prime" working age individuals – i.e., the 15-24 and 25-54 cohorts. For metro areas, these two cohorts account for the bulk of net migration in all three periods for both whites and non-whites. For rural areas, this is also true for non-whites. However, over the three decades under consideration the share of older, white individuals in overall rural net migration grew sharply – evidence of the growing number of retirees choosing to settle in rural communities. Indeed, individuals aged 55 and above accounted for slightly more than fifty percent of net in-migration into rural North Carolina during the 1980s.

Of North Carolina's 100 counties, 25 are classified as metro, 43 are rural counties adjacent to metro counties, and 32 are rural and *not* adjacent to metro counties.[2] Net migration data for these three different types of counties are found in Table 2. Not surprisingly, over the past twenty years the absolute level of migration flows has tended in nearly all cases to be greatest in metro counties and smallest in (remote) non-adjacent rural counties – particularly among prime working age cohorts. The data indicate that the large (aggregate) migration of whites *into* rural areas during the 1970s and (to a lesser extent) the 1980s was distributed among adjacent and non-adjacent counties roughly in proportion to their populations. However, further examination of the data reveals that migration into four particular non-adjacent counties accounts for the lion's share of in-migration to this class of counties.[3] Excluding these four counties

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[1]Throughout this paper, we use the 1980 Census Bureau designation of nonmetro and metro counties, and use the terms "nonmetro" and "rural" interchangeably.

[2]As of 1990, of the state's 6.6 million residents 3.76 million (57%) lived in metro counties, 1.91 million (29%) lived in rural adjacent counties, and 0.96 million (15%) lived in rural non-adjacent counties.

[3]The counties in question were Pitt and Watauga (sites of state universities), Dare (a booming tourism and retirement destination), and Wayne (site of the Seymour Johnson Air Force base). For all other rural non-adjacent counties, net migration among whites of prime working age was 7,745 during the 1970-1980 period and 10,410 during the 1980-1990 period.

indicates very small net in-migration into non-adjacent counties during the 1970-1980 period and net out-migration during the 1980-1990 period.

The following insights emerge from the migration data presented above. First, there has been a persistent flow of non-whites from rural to metro areas over the entire 1960-1990 time period. Second, beginning in the 1970s a decades-long pattern of out-migration of whites from rural areas was reversed – evidence of the nonmetropolitan turnaround observed nationwide during that decade. Third, among prime working age cohorts this net migration of whites into rural North Carolina was generally concentrated in counties that are adjacent to metro counties. This raises the issue of how much rural in-migration was attributable to relocation for employment opportunities, and how much was attributable to suburbanization. We will return to this issue when we estimate the determinants of commuting.

Commuting

Table 3 summarizes the journey-to-work data for three types of counties in North Carolina.[4] One is immediately struck by the tremendous growth in commuting over the period considered. Between 1960 and 1990 there was a fivefold increase in the number of workers commuting into metro areas and a fourfold increase in the number of workers commuting into rural areas. In all years, the number of commuters into metro areas was approximately double the number of commuters into rural areas, an indication of the greater employment activity in metro areas.

In addition to this absolute increase in commuting activity, the 1960-1990 period also witnessed an increase in the relative importance of commuters as a share of the entire working population (see Figure 3). Statewide, the proportion of commuters in the workforce grew from just under 10% to over 21%. During this period, the proportion of rural dwellers working in metro counties increased steadily – from 5.3% in 1960 to nearly 15% in 1990. The figures are even more striking for residents of rural counties adjacent to metro counties; the proportion of this group commuting into metro areas rose from 7.3% in 1960 to 20.2% in 1990.

The increase in rural-metro commuting flows during the 1980s is also reflected in Bureau of Economic Analysis data on the flow of real earnings resulting from inter-county commuting for the period 1969-1992 (see Figure 4). Net earnings flows from metro to rural counties occurred in all years during this period. However, it is evident from Figure 4 that this trend escalated beginning in the early 1980s.[5] Part of this is no doubt due to the increased volume of rural-urban commuting noted above. Additionally, the average wage premium received by these workers also increased during this period. This can be seen in Table 4, which presents

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[4]These include all counties within North Carolina and those counties in Virginia, South Carolina, and Georgia belonging to commuting zones containing North Carolina counties (as defined by Killian and Tolbert).

[5]Trend regressions using a spline at 1980 confirm that the trends for both outflows of earnings from metro counties and inflows of earnings into rural counties increased significantly after 1980.

data on average real wages received by commuters in metro and rural areas in 1980 and 1990 for 12 industries. Average wages in metro areas exceeded those of rural areas for 9 of 12 industries in 1980 and for all industries in 1990. Metro wage premia – computed as the ratio of metro and rural wages – increased for some industries and decreased for others between 1980 and 1990. On aggregate, however, the average metro premium (weighted by the number of workers in specific industries) grew by over 40%.

In summary, the commuting data indicate that there has been a tremendous growth in commuting activity, in terms of both the absolute number of workers residing and working in different counties and the share of commuters in the total workforce. While this growth in commuting has occurred among all residence-workplace combinations, there was greater growth in rural-metro commuting flows (particularly during the 1980s). Additionally, average wages in metro counties grew faster than in rural counties during the 1980s, a factor which very likely accounted for some share of the increase in the net flow of earnings from metro to rural areas over that decade.

DETERMINANTS OF COMMUTING

The descriptive analysis of migration and commuting in the previous section indicates that substantial movements of workers in North Carolina have taken place over the past three decades. In this section we estimate an empirical model of commuting that maintains the hypothesis of simultaneous workplace and residential choice. We do so by including net migration as an explanatory variable in a commuting equation that controls for other important economic factors affecting commuting flows (relative wages, the relative cost of living, and the cost of travel). This allows us to test whether migration and commuting are substitutes or complements for different types of commuting flows. As discussed earlier, we regard statistical tests of complementarity or substitution between rural in-migration and rural-to-metro commuting as tests of deconcentration versus regional restructuring.

The Empirical Model

We estimated the following model of the determinants of the rate of commuting:

$$\frac{COM_{ij}}{POP_i} = f\left(\underset{+}{\Delta WAGE_{ji}}, \underset{+}{\Delta HOUSE_{ji}}, \underset{-}{DISTANCE_{ij}}, \underset{?}{\frac{NMIG_i}{POP_i}} \right) \quad \textbf{(1)}$$

where:

COM_{ij}/POP_i = number of workers commuting from county i to county j, normalized by the population in county i

$\Delta WAGE_{ji}$ = wage in county j minus wage in county j

$\Delta HOUSE_{ji}$ = housing cost in county j minus housing cost in county i

$DISTANCE_{ij}$ = distance from county i to county j

$NMIG_i / POP_i$ = net migration into county i in the previous period, normalized by the population in county i in the previous period.

The expected signs of the first derivatives are given underneath the individual variables. We expect a positive differential between the prevailing wages in the county of residence and the county of work to exert a positive influence on workers' propensity to commute. We take the cost of housing to be a proxy for the cost of living in a particular place. A positive differential in the cost of housing between two counties is thus expected to result in greater number of workers deciding to live in the lower cost location and commute to the higher cost location. The distance variable measures the cost of commuting, and is expected to pose a disincentive to commuting. The sign of the net migration variable is ambiguous; it will be positive if migration and commuting are complements and negative if they are substitutes.

Data Construction

Our commuting data was taken from the Census Bureau's Journey-to-Work dataset. We confined our analysis to six single-digit SIC classification industries – construction, manufacturing, wholesale and retail trade, services, state and local government, and transportation and communications. These six industries account for roughly 90% of all employment in the state. We additionally restricted our analysis to the years 1980 and 1990 – the only years for which wage data were available in the Journey-to-Work dataset.

Given that there are 100 counties in North Carolina, there are 4,950 total county pairs for each industry-year combination (59,400 total). Of this total, there were 3,730 pairs of counties between which some commuting occurred. In roughly two-third of these county pairs, commuting flows were observed going in both directions; however, in the vast majority of cases the volume of commuting in one direction greatly outweighed commuting in the other direction. We therefore computed net commuting between each pair of counties for which commuting activity was observed, and used the positive value (normalized by total county population) as our dependent variable.[6] The dependent variable is thus the rate of net out-commuting from the county of residence to the county of work.

Each observation in the Journey-to-Work dataset provides the number of workers commuting from one county to another, along with the average wage received by those

[6]For the other 55,670 county pairs, net commuting was zero.

workers.[7] For each county-industry-year combination, we computed the mean of these average wages, weighted by the number of workers receiving each (average) wage. Wage differentials were then computed as the mean real wage in the county of work minus the mean real wage in the county of residence. For county pairs in which zero commuting was observed, the absolute value of the wage differential was used.

For housing costs we used Census data on the median price of a single family house in each county. This median price, deflated by the Department of Commerce GNP deflator, was used to compute the real housing cost differential between the county of work and the county of residence. Again, for county pairs in which zero commuting was observed, the absolute value of the housing cost differential was used.

The distance between each county-pair was computed from LandSat aerial reconnaissance survey data compiled NC State University Department of Parks, Tourism, and Recreation. This survey generated XY coordinants of the geographical centroid of each of North Carolina's 100 counties, as well as the centroids of the largest city in each of the state's 25 metro counties. The distance between any two counties was calculated using the county centroids for rural counties and the city centroids for metro counties.

Finally, the migration variable that we used was based on net migration of working age (15-54 years old) individuals over the ten year period leading up to the year coinciding with the net commuting variable (i.e., 1970-80 for commuting in 1980, 1980-90 for commuting in 1990). This was then normalized by dividing by the population in the initial year to produce a county net migration rate.

Implementation

North Carolina is a large state, spanning over 400 miles from west to east. We expect *a priori* that beyond a certain distance, commuting becomes unfeasible for the vast majority of workers. This is borne out by data on the frequency distribution of distances traveled by North Carolina commuters (Table 5). These indicate that in both 1980 and 1990, nearly all commuting occurred between counties located less than 75 miles apart. In order to avoid spurious results for distant county pairs, we therefore created a dummy variable taking the value of 1 for county pairs located less than 75 miles from one another and 0 otherwise, and multiplied it by the key explanatory variables (wage differential, housing cost differential, and net migration). All regressions included these interactive variables.

Finally, concern over potential endogeneity of migration prompted us to test for simultaneity bias using a Wu-Hausman test. We compared OLS estimates with two-stage least square estimates in which population in the initial year of the migration period (e.g., 1970 for the 1970-

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[7]Also included are the number and average wages of non-commuters – i.e., workers whose county of residence and county of work are the same.

1980 net migration variable) and the natural rate of population growth (observed population growth less net migration) were used as instruments for net migration. The test statistic was significant at the .05 level or better in nearly all circumstances, so we report two-stage least squares estimates throughout.

RESULTS

We report separate commuting regressions for 1980 and 1990 for commuting flows into metro counties from other metro counties, from rural counties adjacent to metro counties, and from rural counties not adjacent to metro counties.[8] In all models, we included dummy variables for industry type (with manufacturing as the omitted variable), as well as a squared distance term to pick up possible non-linearities in the impact of travel costs on commuting.

The full regression results are contained in Table 6. The explanatory power of the regression for commuting from rural nonadjacent counties to metro counties is relatively lower than in the other two regressions, presumably due to the much smaller proportion observations of non-zero commuting for this type of commuting flow. In most cases, coefficients on the wage differential, housing cost differential, and net migration variables were statistically insignificant and/or small in magnitude. On the other hand, these same variables were generally significant when interacted with the distance dummy. Predictably, this suggests that none of these three variables appears to exercise any significant impact on commuting between counties located more than 75 miles apart; instead, distance appears to be the dominant determinant of commuting (or lack thereof) between distant counties.

Table 7 presents commuting elasticities for commuting flows into metro counties from counties located within a 75 mile radius (evaluated at the means for such county pairs). Regardless of the type of county of origin, commuting into metro areas is strongly influenced by the cost of travel, as evidenced by large elasticities with respect to distance. Elasticities with respect to wage and housing cost differentials are in all cases positive (as expected), and in nearly all cases significant. In both 1980 and 1990 metro-metro commuting was considerably more responsive to wage differentials than rural-metro commuting. At the same time, differences in housing costs exercised a relatively greater impact on commuting from rural adjacent counties to metro counties than for other types of commuting flows.

We now consider the estimated elasticities of commuting with respect to net migration. After controlling for the effects of distance and differences in wages and housing costs, we find

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[8]We also estimated commuting equations for three types of flows into rural counties: commuting between all rural counties, commuting from non-adjacent to adjacent counties, and commuting from metro to adjacent counties. In general, our empirical model performed poorly for these regressions: their explanatory power was low, and many of the coefficients on the wage and housing cost differential variables were of the wrong sign. Because of this, we refrain from making inferences from these regressions based on the estimated coefficients of net migration variable.

a significant, positive relationship between in-migration and commuting into metro counties from nearby (adjacent) rural counties. This complementarity exists for both years, but appears to have been considerably stronger in 1980.[9] This strongly suggests that migration into nearby rural counties was to a large degree a product of suburbanization related to the residential preferences of workers with jobs in urban locations.

The results for commuting flows from more remote, rural non-adjacent counties into metro counties are mixed. For 1980 we find a negative association between commuting and migration after controlling for the effects of distance and differences in wages and housing costs. Net migration rates were positive for non-adjacent counties during the 1970s; the negative relationship between outcommuting and net migration thus implies that positive economic performance in this set of rural counties translated into in-migration (or retention of potential out-migrants). For 1990 we find a statistically significant, but very small positive relationship between commuting and migration. Coupled with the results for rural adjacent to metro flows, we take this as evidence that the area over which commuters into metro areas chose to reside widened during the 1980s so that by 1990 suburbanization had begun to extend into these more distant rural counties.

Finally, we find no significant relationship between commuting and migration for commuting flows between pairs of metro counties. Many of North Carolina's most important urban counties are clustered together into large urban labor markets (e.g., the three counties comprising the Research Triangle and the three counties containing Greensboro, Winston-Salem, and High Point). This increases the likelihood that urban dwellers changing jobs might do so without changing residence.

Taken as a whole, our results offer strong support for the deconcentration hypothesis described at the beginning of this paper. Trends in rural-urban population dynamics in North Carolina over the past 25 years appear to have been mainly attributable to changes residential preferences, rather than to the sweeping changes in the spatial distribution of employment posited by the regional restructuring hypothesis. Our econometric results provide clear evidence that for both 1980 and 1990, suburbanization was a significant determinant of commuting into metro counties from nearby rural counties. We do find some evidence linking net migration into more remote rural counties during the 1970s to these counties' positive economic performance (in line with regional restructuring). However, we further found evidence that by 1990 suburbanization had begun to extend into these more distant rural counties as well.

CONCLUSION

In this paper, we have presented empirical analyses of migration and commuting in rural and urban areas of North Carolina over the past 30 years. In doing so, we have attempted to

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[9]Pooling the data for 1980 and 1990 and re-estimating the regressions to test for period effects, we found that the migration elasticity was indeed significantly greater in 1980 than 1990.

synthesize the insights emerging from two distinct lines of inquiry – regional wage equalization and migration studies from the regional economics literature and urban labor market analysis from the urban economics literature. These lead us to conclude that empirical analysis of spatial labor market adjustment must proceed under the assumption of simultaneity in the choice of workplace and residence on the part of economic agents. As such, our empirical approach to estimating the determinants of commuting explicitly accounted for the impact of net migration.

Modeling commuting in this way also supports a test of two competing explanations of the dramatic changes in rural-urban population dynamics over the past 25 years. Taken as a whole, our empirical analysis offers clear support for the deconcentration perspective described at the beginning of this paper. Our empirical analysis has strongly suggests that, at least in North Carolina, net migration into rural areas has been fundamentally due to changes in the residential preferences as opposed to changes in the spatial distribution of employment opportunities.

REFERENCES

Carlino, Gerald and Edward Mills. 1992 "Determinants of County Growth," *Journal of Regional Science* 27: 39-54.

Dickie, Mark and Shelby Gerking. 1989. "Interregional Wage Differentials in the United States: A Survey", in Jouke Van Dijk, et al. (eds.), *Migration and Labor Market Adjustment*, Dordrecht, The Netherlands: Kluwer Academic Publishers, pp. 111-145.

Evers, Gerard. 1989. "Simultaneous Models for Migration and Commuting: Macro and Micro Economic Approaches," in Jouke van Dijk, et al. (eds.), *Migration and Labour Market Adjustment*, Dordrecht, The Netherlands: Kluwer Academic Publishers, pp. 177-197.

Frey, William. 1987. "Migration and Depopulation of the Metropolis: Regional Restructuring or Rural Renaissance?" *American Sociological Review* 52: 240-257.

Fuguitt, Glenn. 1985. "The Nonmetropolitan Population Turnaround." *Annual Review of Sociology* 11: 259-280.

Fuguitt, Glenn and Calvin Beale. 1996. "Recent Trends in Nonmetropolitan Migration: Toward a New Turnaround?" *Growth and Change* 27: 156-174.

Fuguitt, Glenn and David Brown. 1990. "Residential Preferences and Population Redistribution: 1972-1988." *Demography* 27: 589-600.

Greenwood, Michael and Gary Hunt. 1984. "Migration and Interregional Employment Redistribution in the United States," *American Economic Review* 74: 957-969.

Greenwood, Michael, Gary Hunt, Dan Rickman and George Treyz. 1991. "Migration, Regional Equilibrium, and the Estimation of Compensating Differentials," *American Economic Review* 81: 1382-1390.

Johnson, Kenneth. 1993. "Demographic Change in Nonmetropolitan America, 1980 to 1990." *Rural Sociology* 58: 347-365.

Killian, Molly and Charles Tolbert. 1991. "A Commuting-based Definition of Metropolitan Local Labor Markets in the United States," in J. Singelmann and F. Desaran (eds.), *Inequalities in Labor Market Areas*, Boulder CO: Westview Press.

Renkow, Mitch. 1996. "Income Non-convergence and Rural-Urban Earnings Differentials: Evidence from North Carolina." *Southern Economic Journal* 63: 1117-1128.

Siegel, Jay. 1975. "Intrametropolitan Migration: A Simultaneous Model of Employment and Residential Location of White and Black Households." *Journal of Urban Economics* 2: 29-47.

Simpson, Wayne. 1980. "A Simultaneous Model of Workplace and Residential Location Incorporating Job Search." *Journal of Urban Economics* 8: 330-349.

Straszheim, Mahlon. 1987. "The Theory of Urban Residential Location," in Edwin Mills (ed.) *Handbook of Regional and Urban Economics*, Volume II, Amsterdam: Elsevier Science Publishers, pp. 718-757

Vanderkamp, John. 1989. "The Role of Regional Adjustment," in Jouke van Dijk, et al (eds), *Migration and Labour Market Adjustment,* Dordrecht, The Netherlands: Kluwer Academic Publishers, pp. 146-176.

van der Veen, Anne and Gerard Evers. 1983. "A Simultaneous Model for Regional Labor Supply, Incorporating Labor Force Participation, Commuting and Migration." *Socio-Economic Planning Sciences* 17: 239-250.

Wardwell, John. 1980. "Toward a Theory of Urban-Rural Migration in the Developed World," in David Brown and John Wardwell (eds.), *New Directions in Urban-Rural Migration.* New York: Academic Press, pp. 71-118.

Table 1. Net migration in North Carolina by race and age cohort, 1960-1990

County Type	Cohort	White	Non-white	Total
		---------- 1960-1970 ----------		
Metro	0-4	-382	-484	-866
Metro	5-14	11,774	-3,364	8,410
Metro	15-24	83,272	10,958	94,230
Metro	25-54	33,714	-13,220	20,494
Metro	55-64	7,372	-76	7,296
Metro	65&up	8,489	233	8,722
Metro	**Total**	**144,239**	**-5,953**	**138,286**
Rural	0-4	216	-2,953	-2,737
Rural	5-14	-3,618	-28,050	-31,668
Rural	15-24	-28,249	-77,025	-105,274
Rural	25-54	-19,710	-63,117	-82,827
Rural	55-64	592	2,401	2,993
Rural	65&up	3,566	-2,910	656
Rural	**Total**	**-47,203**	**-171,654**	**-218,857**
		---------- 1970-1980 ----------		
Metro	0-4	453	2,345	2,798
Metro	5-14	3,671	12,310	15,981
Metro	15-24	74,495	36,645	111,140
Metro	25-54	16,814	9,339	26,153
Metro	55-64	5,547	1,232	6,779
Metro	65&up	6,846	1,713	8,559
Metro	**Total**	**107,826**	**63,584**	**171,410**
Rural	0-4	3,917	1,805	5,722
Rural	5-14	25,902	4,741	30,643
Rural	15-24	33,713	-21,732	11,981
Rural	25-54	57,952	-11,440	46,512
Rural	55-64	22,363	3,126	25,489
Rural	65&up	17,184	2,967	20,151
Rural	**Total**	**161,031**	**-20,533**	**140,498**

Table 1. (continued)

County Type	Cohort	White	Non-white	Total
		---------- 1980-1990 ----------		
Metro	0-4	26,717	6,554	33,271
Metro	5-14	33,902	12,177	46,079
Metro	15-24	100,671	36,896	137,567
Metro	25-54	106,717	9,866	116,583
Metro	55-64	7,807	2,947	10,754
Metro	65&up	7,488	2,076	9,564
Metro	**Total**	**283,302**	**70,516**	**353,818**
Rural	0-4	2,227	-11,430	-9,203
Rural	5-14	12,687	2,171	14,858
Rural	15-24	14,501	-15,577	-1,076
Rural	25-54	16,604	-22,308	-5,704
Rural	55-64	25,603	3,418	29,021
Rural	65&up	20,552	2,277	22,829
Rural	**Total**	**92,174**	**-41,449**	**50,725**

Source: U.S. Census Bureau (1960-70 and 1970-80) and NC Dept. of Administration (1980-1990).

Table 2. Net migration for different types of counties in North Carolina, 1960-1990[a]

County Type	Persons Aged 15-54		All Persons	
	White	Non-white	White	Non-white
		1960-1970		
Metro	116,986	-2,262	144,239	-5,953
Rural, adjacent to metro	-39,788	-82,520	-31,234	-101,707
Rural, not adjacent to metro	-8,171	-57,622	-15,969	69,947
		1970-1980		
Metro	91,309	45,984	107,826	63,584
Rural, adjacent to metro	67,086	-21,552	122,728	-14,398
Rural, not adjacent to metro	24,579	-11,620	38,303	-6,135
		1980-1990		
Metro	205,891	47,068	283,302	70,516
Rural, adjacent to metro	26,343	-23,674	76,641	-27,169
Rural, not adjacent to metro	6,259	-14,517	18,682	-14,713

a. Positive numbers indicate net in-migration; negative numbers indicate net out-migration.

Source: U.S. Census Bureau (1960-70 and 1970-80) and NC Dept. of Administration (1980-1990).

Table 3. Magnitude of commuting flows in North Carolina, 1960-1990[a]

County of Residence	County of Work	1960	1970	1980	1990
		---------- Number of Commuters ----------			
Metro	Metro	61,147	113,232	209,716	317,213
Rural, adjacent to metro	Metro	33,633	60,461	100,881	160,400
Rural, not adjacent to metro	Metro	1,340	3,697	5,771	9,024
	TOTAL	**96,120**	**177,390**	**316,368**	**486,637**
Metro	Rural, adjacent to metro	12,143	18,594	37,524	54,122
Rural, adjacent to metro	Rural, adjacent to metro	14,785	23,702	45,902	55,120
Rural, not adjacent to metro	Rural, adjacent to metro	8,642	13,975	25,979	32,920
	TOTAL	**35,570**	**56,271**	**109,405**	**142,162**
Metro	Rural, not adjacent to metro	434	742	2,974	4,248
Rural, adjacent to metro	Rural, not adjacent to metro	7,923	12,860	22,549	29,484
Rural, not adjacent to metro	Rural, not adjacent to metro	9,400	17,895	29,749	41,226
	TOTAL	**17,757**	**31,497**	**55,272**	**74,958**
		---------- Number of Non-Commuters ----------			
	Metro	780,515	959,304	1,294,328	1,607,193
	Rural, adjacent to metro	419,152	430,673	566,742	635,168
	Rural, not adjacent to metro	211,153	217,737	296,403	340,314

a. Includes all counties within North Carolina and those counties in Virginia, South Carolina, and Georgia belonging to commuting zones containing North Carolina counties (as defined by Killian and Tolbert).

Source: U.S. Bureau of Census data

Table 4. Average wages in metro and rural counties of North Carolina, 1980 and 1990

Industry classification	1980 Average Wage			1990 Average Wage		
	Metro Areas	Rural Areas	Metro Premium	Metro Areas	Rural Areas	Metro Premium
Manufacturing	17,093	14,999	14.0	22,275	17,959	24.0
Wholesale/retail trade	15,550	13,238	17.5	21,108	19,059	10.8
Services	15,753	10,826	45.5	19,515	14,999	30.1
State & local government	16,214	14,731	10.1	20,322	18,557	9.5
Transportation & communication	23,172	20,048	15.6	26,543	23,411	13.4
Construction	16,367	15,848	3.3	18,690	16,285	14.8
F.I.R.E.	17,690	15,568	13.6	25,107	23,065	8.9
Self-employment	14,106	15,493	-9.0	17,578	14,333	22.6
Federal Civilian Government	21,414	20,136	6.3	11,916	11,102	7.3
Farming	8,698	9,166	-5.1	21,125	17,901	18.0
Agricultural services, Forestry, Fishing, & Mining	12,717	14,712	-13.6	18,068	16,419	10.0
WEIGHTED AVERAGE	**17,128**	**14,759**	**16.1**	**20,849**	**16,935**	**23.1**

a. All figures in constant 1988 dollars, deflated by the U.S. Department of Commerce GNP Deflator.

Source: U.S. Census Bureau data

Table 5. Distance traveled by North Carolina commuters, 1980 and 1990

Distance	1980		1990	
	No. of Commuters	% of Commuters	No. of Commuters	% of Commuters
0 - 10	740	0.3	987	0.3
10 - 20	52,532	23.0	6,339	20.0
20 - 30	120,816	53.0	178,896	56.3
30 - 40	32,962	14.5	49,372	15.6
40 - 50	9,636	4.2	13,779	4.3
50 - 60	3,209	1.4	4,509	1.4
60 - 70	1,121	0.5	2,156	0.7
70 - 80	863	0.4	798	0.3
80 - 90	931	0.4	870	0.3
90 - 100	791	0.4	759	0.2
> 100	4,444	1.9	2,059	0.6

Source: U.S. Census Bureau

Table 6. Complete regression results for commuting flows into metro counties[a]

Variable	Metro to Metro		Rural Adjacent to Metro		Rural Nonadjacent to Metro	
	1980	1990	1980	1990	1980	1990
$\Delta WAGE_{ji}$	-7.69E-08	-8.62E-08 *	-9.41E-09	-2.20E-08	-4.27E-10	2.44E-09 **
	(1.36)	(1.68)	(0.92)	(1.27)	(0.55)	(2.04)
$\Delta WAGE_{ji} \times D75^b$	5.00E-07 ***	6.47E-07 ***	1.21E-07 ***	1.94E-07 ***	1.44E-08 ***	4.62E-09
	(6.17)	(8.30)	(4.99)	(6.40)	(5.89)	(1.06)
$\Delta HOUSE_{ji}$	-9.22E-10	1.35E-09	-9.12E-10	-9.51E-09 *	-1.12E-10	-1.67E-10
	(0.06)	(0.11)	(0.19)	(1.83)	(0.42)	(0.49)
$\Delta HOUSE_{ji}$	8.62E-08 ***	6.42E-08 ***	6.04E-08 ***	6.73E-08 ***	1.57E-09 *	3.56E-09 ***
	(3.62)	(3.30)	(7.75)	(8.24)	(1.76)	(3.46)
Distance	-1.36E-04 ***	-1.52E-04 ***	-3.05E-05 ***	-4.60E-05 ***	-1.77E-07	-3.58E-07
	(11.35)	(12.66)	(10.68)	(12.77)	(1.01)	(1.27)
Distance × D75	-2.07E-04 ***	-2.23E-04 ***	-3.16E-05 ***	-3.92E-05 ***	4.54E-06 ***	1.20E-05 ***
	(6.39)	(6.89)	(3.06)	(3.14)	(5.03)	(8.48)
$Distance^2$	4.15E-07 ***	4.56E-07 ***	7.91E-08 ***	1.19E-07 ***	2.91E-10	6.35E-10
	(10.38)	(11.40)	(9.76)	(11.73)	(0.67)	(0.91)
$Distance^2 \times D75$	1.89E-06 ***	1.94E-06 ***	-9.98E-08	-2.30E-07	-6.58E-08 ***	-1.91E-07 ***
	(4.15)	(4.26)	(0.74)	(1.38)	(5.31)	(9.59)
Net migration	2.68E-03	7.46E-03 **	1.06E-03	1.66E-03	9.43E-06	1.22E-04
	(1.35)	(2.24)	(1.06)	(1.41)	(0.22)	(1.63)
Net migration × D75	4.18E-03	-8.70E-04	1.04E-02 ***	1.93E-02 ***	-7.30E-04 ***	-1.27E-03 ***
	(0.47)	(0.10)	(3.24)	(5.17)	(3.30)	(3.13)

Table 6. (continued)

Variable	Metro to Metro		Rural Adjacent to Metro		Rural Nonadjacent to Metro	
	1980	1990	1980	1990	1980	1990
Construction dummy	-2.47E-03 ***	-1.78E-03 ***	-5.85E-04 ***	-5.72E-04 ***	-3.45E-06	2.30E-05 *
	(6.68)	(4.76)	(5.55)	(4.16)	(0.46)	(1.87)
Government dummy	-2.31E-03 ***	-1.75E-03 ***	-5.20E-04 ***	-5.95E-04 ***	-1.83E-05 **	-6.04E-06
	(6.16)	(4.58)	(4.85)	(4.21)	(2.39)	(0.47)
Services dummy	-2.13E-03 ***	-1.19E-03 ***	-5.87E-04 ***	-4.83E-04 ***	-1.62E-05 **	-8.67E-08
	(5.75)	(3.19)	(5.54)	(3.52)	(2.17)	(0.01)
Transp. & Comm. dummy	-2.15E-03 ***	-1.59E-03 ***	-6.73E-04 ***	-6.62E-04 ***	-2.19E-05 ***	-5.23E-06
	(5.84)	(4.28)	(6.33)	(4.81)	(2.91)	(0.43)
Whsle & Ret. Trade dummy	-1.69E-03 ***	-9.58E-04 **	-5.25E-04 ***	-4.00E-04 ***	-8.17E-06	1.29E-05
	(4.50)	(2.54)	(4.92)	(2.89)	(1.08)	(1.04)
Intercept	0.0117 ***	0.0124 ***	0.0031 ***	0.0046 ***	4.21E-05 **	3.85E-05
	(13.08)	(13.94)	(12.17)	(14.39)	(2.39)	(1.36)
R^2	.218	.268	.173	.211	.097	.099
N	1,800	1,800	3,825	3,878	2,552	2,552
Wu-Hausman test statistic	2.85 ***	11.88 ***	38.14 ***	0.66	3.94 ***	11.77 ***

a. These are two-stage least squares estimates, using natural population growth and lagged population as instruments for the net migration rate. The dependent variable is the rate of net outcommuting from county i to county j. Figures in parentheses are t-values. ***, ** , and * denote signficance at the .01, .05, and .10 levels, respectively.

b. D75 is a dummy variable taking the value of 1 for county pairs located less than 75 miles apart and 0 otherwise.

Table 7. Commuting elasticities for commuting flows into metro counties[a]

	Metro to Metro		Rural Adjacent to Metro		Rural Nonadjacent to Metro	
Variable	**1980**	**1990**	**1980**	**1990**	**1980**	**1990**
ΔWage	0.519 ***	0.601 ***	0.284 ***	0.336 ***	0.394 ***	0.160 NS
ΔHousing cost	0.300 ***	0.271 ***	0.653 ***	0.588 ***	0.157 NS	0.347 ***
Distance	-2.937 ***	-2.997 ***	-2.874 ***	-2.895 ***	-1.700 ***	-3.829 ***
Net migration	0.199 NS	0.110 NS	0.395 ***	0.107 ***	-0.290 ***	0.005 ***

a. These are commuting elasticities for county pairs located less than 75 miles of one another, evaluated at sample means. NS denotes not significantly different than zero at the .10 level, while *, **, and *** denote significance at the .10,.05, and .01 levels, respectively.

Figure 1. Net migration into metro and rural counties of NC, 1960-1990

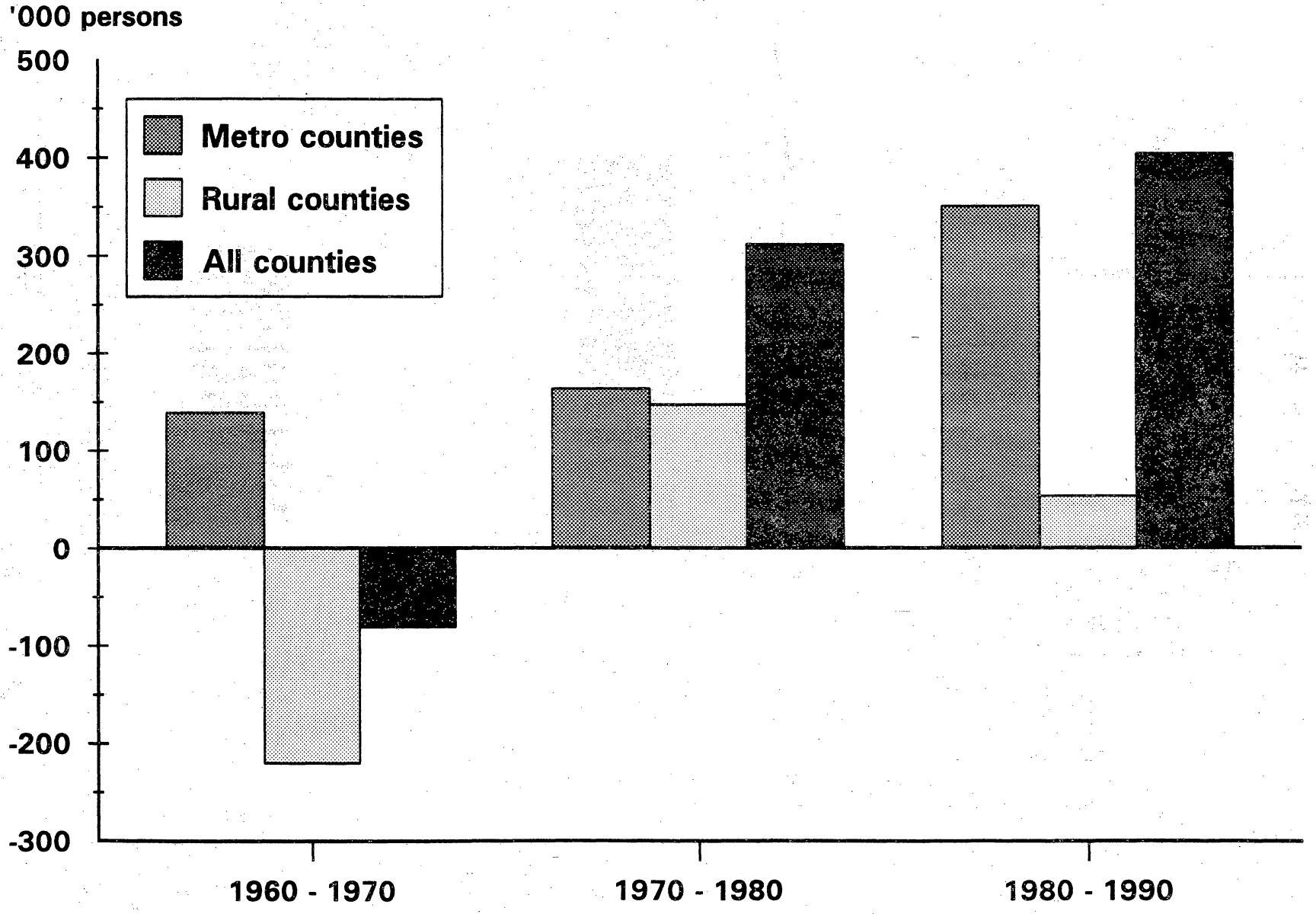


Figure 2. Net migration by race in North Carolina, 1960 - 1990

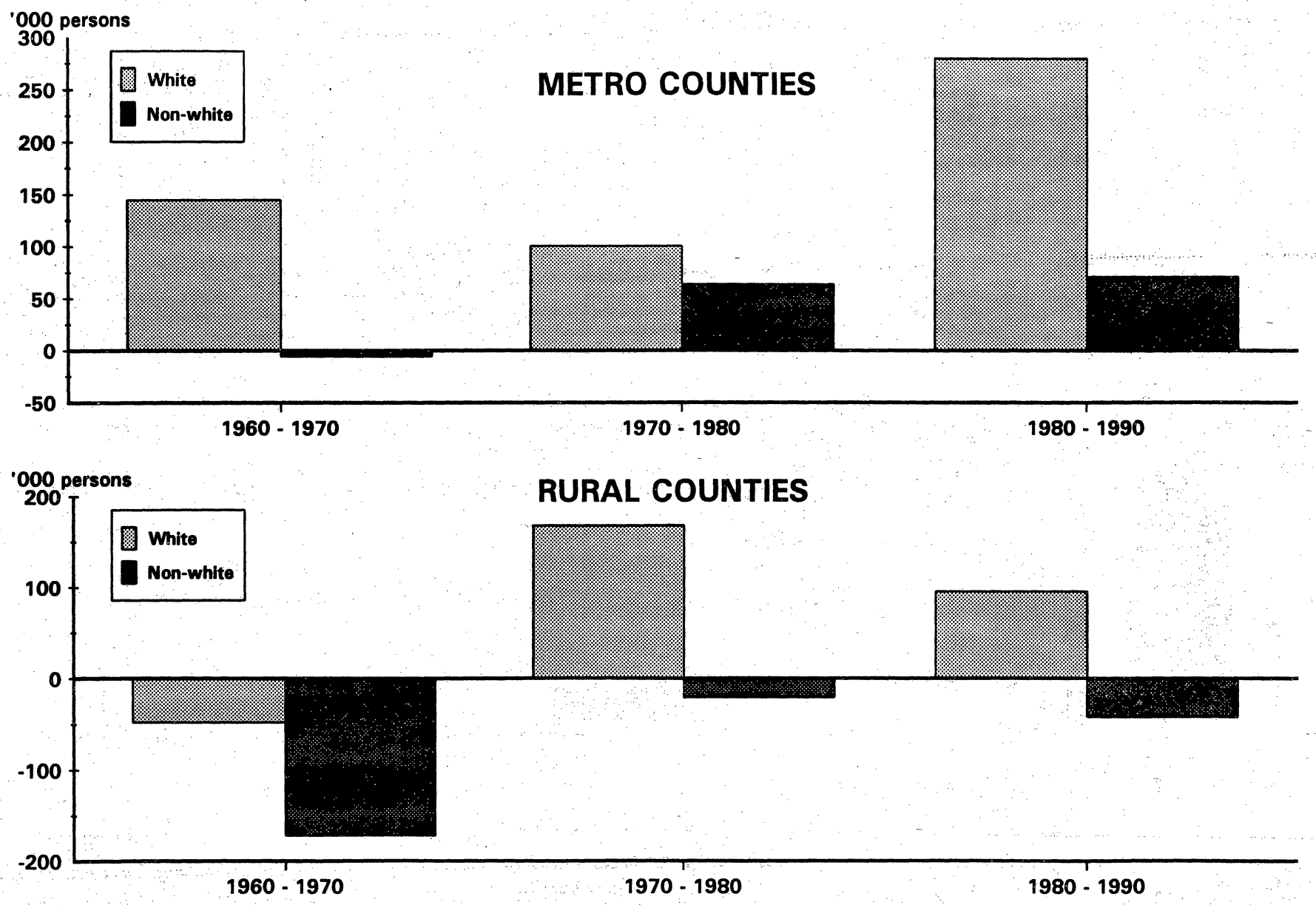


Figure 3. Commuters as a proportion of the work force in North Carolina

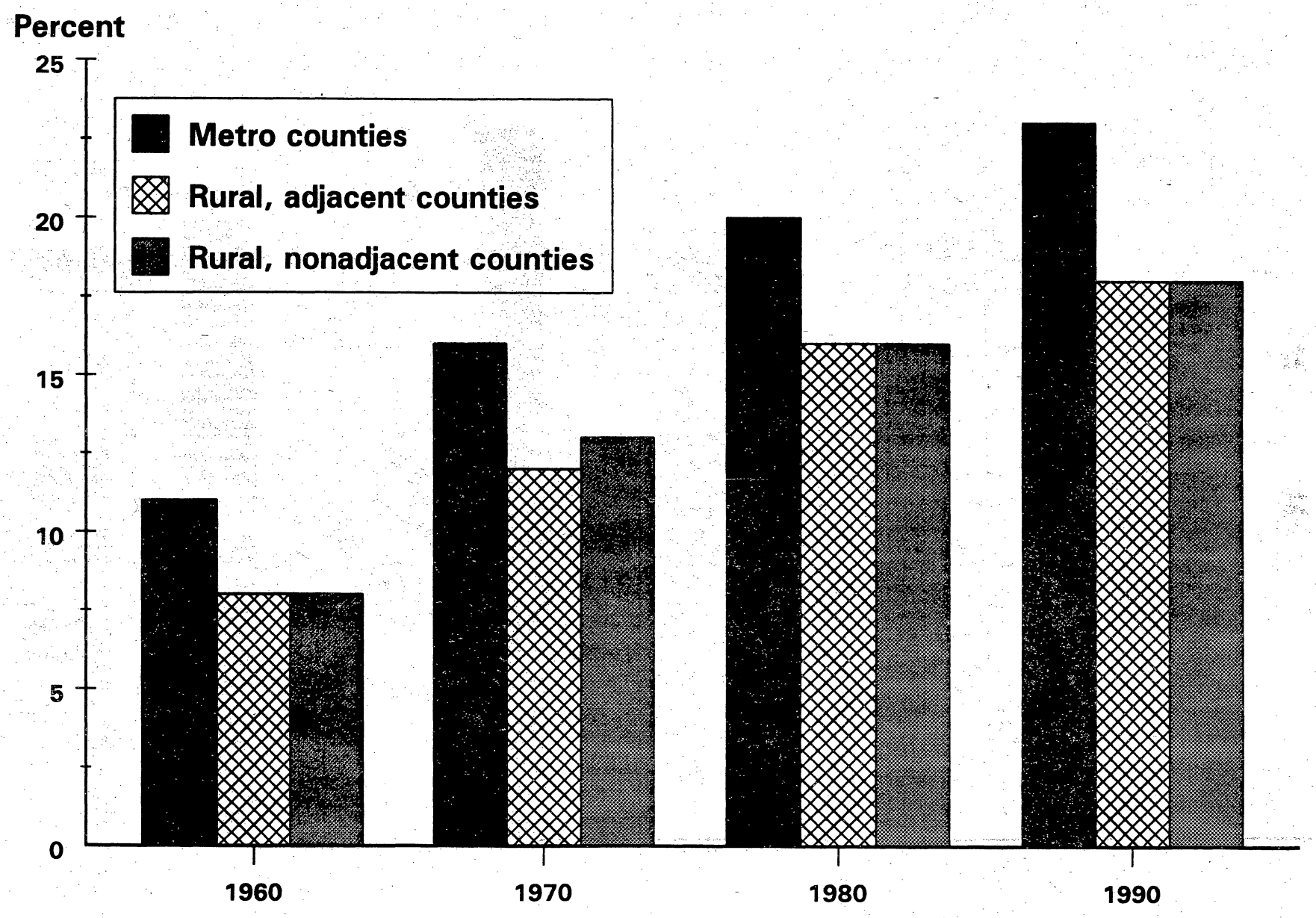
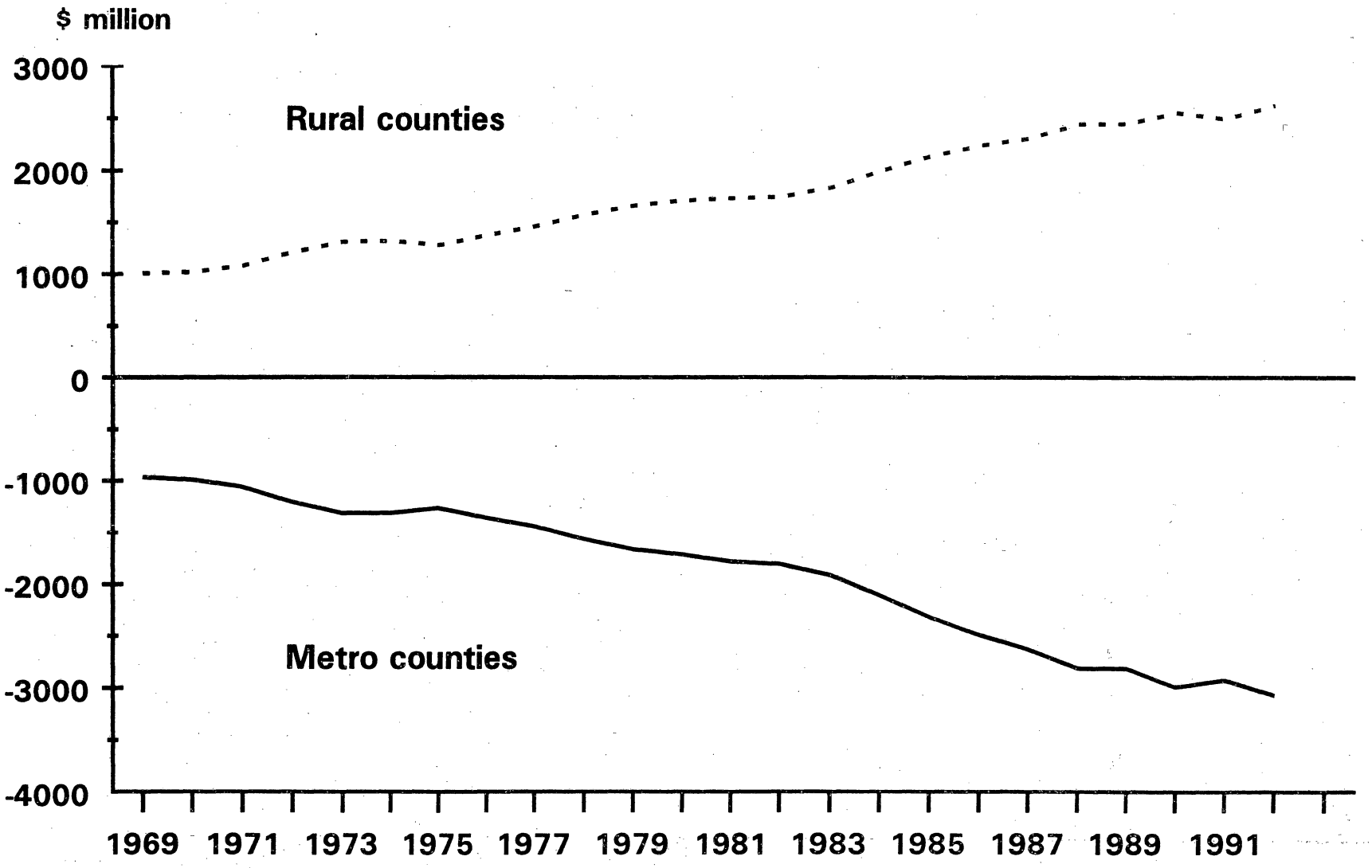


Figure 4. Real earnings flows in metro and rural North Carolina, 1969-1992



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