DOCUMENT RESUME

ED 081 561 RC 007 272

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TITLE	Rapid Industrial Development, Competition, and Relative Economic Status: A Study in Human Ecology. Working Paper RID 73.10.
INSTITUTION	Wisconsin Univ., Madison. Center of Applied Sociology.
SPONS AGENCY	Economic Development Administration (DOC), Washington, D.C.; National Inst. of Mental Health (DHEW), Rockville, Md.
REPORT NO	MH-19689; OER-417-G-72-7(99-7-13248)
PUB DATE	73
NOTE	34p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Age; Demography; *Ecology; *Economic Status; Education; Income; *Industrialization; Rural Development; *Rural Economics; *Socioeconomic Influences; Tables (Data)
IDENTIFIERS	Illinois

ABSTRACT

The document has 3 goals (1) to examine the distribution of economic benefits of industrial development as reflected by the concept of competition in human ecology; (2) to provide an empirical test of the ecological model, and (3) to relate the findings to public policy. Two Illinois study areas were identified. First, as an experimental region, Putnam County and bordering sections of the 3 contiguous counties were selected. Second, a comparable region across the state--Iroquois County--was selected as a control region. Both regions: (1) are about equidistant from Chicago, (2) had similar highway and railway systems in 1966, and (3) were rural agricultural counties similar in demographic composition. In 1966, 1,171 household heads were interviewed in the experimental region, and 411 in the control region. Five years later, after the industrial plant had beenin operation, 1,166 persons in the experimental region were interviewed and 399 in the control region. Findings are presented in 5 tables and are summarized--e.g., Table 1 presents gross and net effects on income of each category of competitive capacity. (FF)

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* Read at the meeting of the American Sociological Association, New York, 1973. The research was supported by the College of Agricultural and Life Sciences of the University of Wisconsin, Madison; The National Institute of Mental Health, PHS Grant MH-19689; and The Office of Economic Research, Economic Development Administration, Grant OER-417-G-72-7 (99-7-13248). Leo F. Schnore, David Featherman, T. Michael Carter and David Blanchard made many helpful comments.

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Rapid Industrial Development, Competition and Relative Economic Status: A Study in Human Ecology

As Smith (1971) has pointed out, the extent to which government should intervene in industrial location and related business decisions is an important question facing the United States as well as several other western countries. Advocates of a laissez faire policy have argued that in the long run the price system will produce an optimal spatial pattern of industrial activity at both the national and regional levels. Experience, however, has demonstrated that several major assumptions of the free market model are not completely substantiated in the real world (Hansen, 1971; Smith, 1971; Lampard, 1968). Consequently, uneven distribution of industrial activity - a saturation in some geographical areas and a negligible amount in others - has generated severe social, economic and environmental problems (cf. Rodwin, 1971) and has led to increasing governmental intervention.

One facet of this intervention which is most apparent is the massive program to promote the flow of capital into areas of lagging economic growth (see, for example, the Appalachian Regional Development Act of 1965, Economic Development Act of 1965 and the Rural Development Act of 1972). That these efforts have been relatively successful is suggested by the fact that the construction of large manufacturing complexes in non-metropolitan areas is currently one of the major trends in industrial location (Stuart, 1971). These new installations range across the industrial spectrum -- from a steel plant in rural Illinois (Summers, et al., 1969) to a brick factory in the coastal plains of South Carolina (McElveen, 1970) to a tissue paper mill in central Mississippi (Crecink, 1970).

In addition to interventionist policies there are recent market forces which encourage the mobility of industry to non-metropolitan areas. Small towns are attractive to industry for a variety of reasons including decreased taxes and lower land and water costs. Similarly, from the local point of view, industrial development represents additional revenue, increased employment and general economic expansion. Most importantly, there is the assumption that bringing industry to small towns and rural areas will stifle outmigration and thereby stabilize the population (Stuart, 1971; Weitz, 1966). Indeed, as Hansen and Munsinger (1972) have pointed out, these assumptions are so wide spread that there is intense competition among small communities to attract industry. As Moore (1965) has noted, American culture equates economic development with progress. Thus, despite some recent evidence (Smith, et al., 1971; Garrison, 1972) and arguments of certain location theorists (e.g. Hansen, 1971) that rapid economic growth may not be the panacea for small town problems that has generally been assumed it is unlikely that the present trend will be curtailed (see, for example, Smith, et al., 1971: 185).

These cautionary remarks aside, however, previous research has demonstrated that new industry is associated with an increase in the aggregate income of residents of small communities (Bertrand and Osborne, 1960; Stevens and Wallace, 1964; Sizer and Clifford, 1966; Jordan, 1967; Garrison, 1972; Beck, 1972). Exactly how this increase is distributed throughout the population, however, has not been determined. Lack of attention to this distributional question is surprising since, as Merton pointed out (1949), phenomena which are functional for a social

system at large may be dysfunctional for some segments of the system. In the case of industrial development of small towns, Taylor and Jones (1964), although they present no data, have suggested that since the weakest economic competitors in the area may be negatively effected, new socio-economic problems will emerge concerning these groups. The present research pursues this line of reasoning with three goals in mind: (1) to examine the question of the distribution of economic benefits of industrial development as reflected in the concept of competition in human ecology, (2) to provide an empirical test of the ecological model, and (3) to relate the findings to public policy.

COMPETITION

Human ecologists have long recognized the importance of competition in generating, maintaining and restoring the functional balance of populations (Durkheim, 1933; Park, 1936; Hawley, 1950; Schnore, 1958). One of the major tenets of ecological theory posits that a community strives toward is a state of functional equilibrium. When this "balance of nature" is disturbed competition is intensified until a new ecological balance develops. One outcome of this increase in competition is a realignment of functional roles within the population during which new patterns of dominance are established. New patterns may mean that some population segments are shifted in regard to their position in the functional hierarchy of the community (see Schnore, 1958). In ecological terms, in the scrambling for position which occurs when a new dominant (e.g. industry) enters the system some groups in the population will benefit while others will be forced to assume subordinate roles.

While this line of reasoning is central to both "classical",(e.g. Park, 1936) and "contemporary" (e.g. Hawley, 1950) ecological theory the actual impact of an ecological disturbance upon the functional organization of a community has not been empirically assessed. More specifically, the following question has been implicitly posed but not answered: In the realignment of an ecological system are the weakest competitors relegated to even lower positions in the system?

The capacity to be economically competitive can be operationalized along numerous dimensions but four variables previous research has shown to be determinants of economic status in the United States are (1) age, (2) sex, (3) education, and (4) labor force status. A fifth variable- race - could also be interpreted as an index of competitive capability but due to the racially homogeneous nature of the study communities, this factor cannot be included in the analysis.

Age. Palmore and Whittington (1971) have presented data which support the argument (see Palmore, 1969) that the economic status of the elderly declines with industrialization. In the case of industrial development of non-metropolitan areas such status deterioration has particular importance. Demographers have long recognized the surplus of elderly individuals in small towns and villages in the United States (Brunner and Kolb, 1933; Cowgill, 1965; Fuguitt, 1968; Taeuber, 1970). With the industrial development of these areas it is reasonable to assume that the economic status of the elderly will be eroded. Unlike the younger residents of the community, older people cannot compete in the labor market and are unable to take advantage of the new occupational opportunities generated by industrial development (Taylor and Jones, 1964). Thus, as weak competitors, the elderly, already

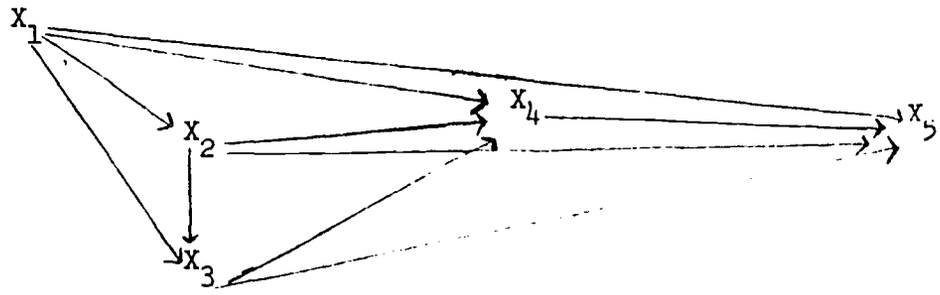
near the bottom of the economic hierarchy (Riley and Forner, 1968; Streib and Schneider, 1971), may be relegated to even lower positions.

Sex, like age, can be taken as an index of the capacity to be economically competitive. There is a sharp economic disparity between the sexes in the United States (Knudsen, 1969; The President's Commission on the Status of Women, 1965). Most importantly, a substantial economic gap exists between male and female heads of households (Stein, 1970). This gap may well be widened when a large industry locates in a small community because females are often unable to take advantage of the increased employment opportunities generated by the plant. As Cavender and Schmitt (1971) have pointed out, community leaders are most eager to attract large manufacturing plants. Since such industries have predominantly male payrolls, females receive virtually no "first round" benefits. Their inability to compete in a changing labor market may well be a precursor to even lower economic status.

Education reflects two important dimensions of the capacity to be competitive in a changing economic structure. First, education is directly associated with marketable skills. Second, education increases an individual's adaptability to changes in the labor demand of a community. Not only are educated persons more likely to be aware of shifts in labor demands, but they are also more attractive as candidates for the "on the job" training programs incoming industries develop to train a local labor force.

Labor force status is a straightforward index of the capacity to be economically competitive. Individuals who do not participate in the labor force cannot take advantage of the occupational opportunities generated by industrial development.

Obviously, these four indicators of economic competitiveness are interrelated. When considering their impact on changes in economic status, therefore, it is useful to view our argument in the context of a simple multivariate model and thus make assumptions concerning the interrelations and causal linkages between the variables explicit. This model may be depicted as follows:



where X_1 = Age

X_2 = Sex

X_3 = Education

X_4 = Labor Force Status

X_5 = Economic Status

Of the series of variables under consideration, age has clear temporal priority. Sex is at least partially determined by age since the probability of being female increases as a cohort ages. Education is influenced by age and sex and all three variables effect labor force status. Finally, the dependent variable - economic status - can be portrayed as a partial function of all four indices of competitive capacity.

In the present analysis we estimate certain parameters of the model for two rural areas at two points in time - 1965 and 1970. During this

time period, one of the areas experienced substantial industrial development. This situation permits a test of the competition hypothesis discussed earlier. If weak competitors are relegated to lower positions in the economic hierarchy, two findings can be anticipated. First, a greater proportion of the variation in economic status will be attributable to the combined effect of the indices of competitive capacity after industrial development has occurred. Second, differences in economic status between strong and weak competitors will be accentuated in the system experiencing industrial development.

METHODOLOGY

Background: In April, 1965 Jones-Laughlin Steel Corporation (J&L) announced plans for the development of a major production complex near the village of Hennepin (1960 population 391) in Putnam County, Illinois (1960 population 4,570). In 1960, agricultural workers constituted 27.2 percent of the labor force (N=1,663).

Construction of the plant began in the spring of 1966 and operation at "Hennepin Works" began in December, 1967. This facility is a heavily capitalized, ultramodern cold rolling mill with a labor force of about 1,021 men and 29 women. The annual payroll of the plant is approximately seven million dollars.

Data: Two study areas were identified. First, as an "experimental" region, we utilized Putnam County and bordering sections of the three continguous counties. Segments of surrounding counties were included on the basis of previous findings (e.g. Wadsworth and Conrad, 1966) that a considerable amount of "leakage" occurs when a large industry locates in a small community.

Second, we selected a comparable region across the state - Iroquois County - as a "control" region. Both regions (1) are about equidistant from Chicago, (2) had similar highway and railway systems in 1966, (3) were rural agricultural regions settled around a county seat, and (4) were similar in demographic composition. Extensive discussion of the selection of the control region as well as detailed comparisons of the regions on social, demographic and economic variables can be found in Summers and associates (1969). The primary objective in selecting the control region was to approximate as closely as possible the two group before and after experimental design in a field situation.

In June, 1966 when construction of the Hennepin Works was still in the earth moving stage, we interviewed 1,171 heads of households in the experimental region and 411 heads in the control region. The samples were selected on a probability basis by means of a multi-stage cluster format (see O'Meara, 1966). Five years later, in the summer of 1971, after the plant had been in operation for over three years, we selected and interviewed a new sample of household heads in both study regions. The number of respondents in 1971 was 1,166 in the experimental region and 399 in the control region.

Variables: Following the conceptual argument presented earlier, age, sex, education and labor force status are employed as operational indicators of the capacity to be economically competitive. In an attempt to identify both strong and weak competitors, these factors are treated as classificatory variables. Age is broken down into four categories - (1) less than 35 years, (2) 35 to 49, (3) 50 to 64, and (4) 65 and over. Sex is a natural dichotomy. Education is divided into

three categories - (1) less than high school, (2) high school, and (3) more than high school. Similarly, labor force status is broken down into three groupings - (1) white collar, (2) blue collar, and (3) not employed.[1] While the aged, females, persons with less than high school education and those out of the labor force are presumed to be the weak competitors, the first step in the data analysis will be to examine the gross effect of each category.

The dependent variable, economic status, is operationalized as total annual dollar income. While one might argue that total economic assets could also be used, we employ income for two reasons. First, change in income is widely recognized as one of the major consequences of industrial development. Second, total assets confuses economic resources and the benefits which flow from them. Income is a much clearer index of immediate changes in economic status.

Statistical Procedures: Multiple Classification Analysis (MCA) is employed to estimate and compare the effects of competitive capacity upon income. Blau and Duncan (1967: 128) have discussed the utility of MCA when the problem being considered includes one quantitative dependent variable and two or more classificatory variables. As Morgan ( ) has pointed out, MCA is especially useful in allowing one to employ the logic of causal analysis in situations where certain requirements of path analysis, e.g. linearity, are not met.[2]

FINDINGS

The first task is to ascertain the extent to which the data support our depiction of competition. Table 1 presents gross and net effects on income of each category of competitive capacity.

(Table 1 about here)

The findings reported in Table 1 support the argument that the aged, females, persons with less than a high school education and those not in the labor force are weak economic competitors. First, the gross effects of each of these categories indicate an expected mean income substantially below that of the grand mean in both regions for both years. At the same time. the strong competitive categories - non-aged, males, greater than high school education and white collar - require an adjustment which places them above the grand mean.

More importantly, however, the net effects of these categories generally support the conclusions drawn from examination of the gross effects. The one exception revolves around the finding that when the impact of the other variables is removed, the youngest age category displays a somewhat weaker competitive capacity than the aged group. This finding that the youngest as well as the oldest adults are weak economic competitors is not particularly surprising. Individuals recently entering the labor market may well be expected to have weak competitive positions. In sharp contrast to their aged neighbors, however, they have the potential, indeed, the liklihood of moving into strong competitive categories. The emergence of this curvilinear relationship between age and income highlights the importance of using a statistical model which does not assume linearity.

Further examination of the coefficients presented in Table 1 reveals the impact of age is reduced when the other independent variables are taken into account. A more detailed portrayal of this decrease in the apparent effect of age is evident in Tables 2 and 3.

(Tables 2 and 3 about here)

Table 2 presents transformed unstandardized regression coefficients for all variables on income for the experimental region in 1965 and 1970. Table 3 presents comparable data for the control region. Thus, the coefficients reported in these tables afford four discrete estimations of the model.

For purposes of discussion of these estimations, let us focus first on the 1965 portion of Table 2. The coefficients under Model A are the gross effects of age and are identical to those reported in Table 1. Since the basic model posits sex as second in the causal chain, this variable was added to the multiple regression analysis and generated a reduction in the observed effect of age (Model B). Following the causal flow of the model, education was incorporated into the regression analysis and once again, except for a slight increase in the category 50 to 64, the effects of the age categories were reduced (Model C). Finally, labor force status categories were added to the analysis (Model D).

Clearly, as each additional variable is added to the model, the effects of age categories are further reduced. But since the model is fully recursive, one should also find that the effects attributable to sex categories in Model B are reduced in Model C by the addition of education categories and still further reduced by the addition of labor force status (Model D). The data support this expectation. Similarly, one should find the effects of education categories in Model C reduced by the addition of labor force status (Model D). Again, the results are consistent with the logic of the causal model. While

the pattern is not perfectly reproduced in each of the four estimations (Tables 2 and 3), the deviations are few in number and minor in magnitude. Thus, the overall thrust of the data is one of consistency and support for the logic of the causal model.

Since the net effects of age categories in Model D are substantially less than their gross effects, it is important to determine whether or not the total effect of age is mediated by the endogenous variables in the model.[3] This determination can be made by comparing the amount of variation in income explained by Model D to the explanatory power of Model E (age removed entirely). This is done by computing the F ratio for the increment in explained variance (R^2) due to the addition of age categories to that explained by sex, education and labor force status. The results of the computations are shown in Table 4. In three of the four estimations, the increment in explained variation of income due to age is statistically significant. Thus, it appears reasonable to conclude that age does have a direct effect on income net of the effects of sex, education, and labor force status even though the total effect of age is substantially mediated by the endogenous variables.

(Table 4 about here)

Having established that the effect of age is largely mediated by sex, education and labor force status, it is important to consider the relative importance of each of these variables in the mediation process. While there is nothing in the logic of the model itself which generates expectations about their relative importance, we believe it is useful to estimate the percent of total effect of age that is due to each of the endogenous variables. This estimation is accomplished by examining the successive increments in multiple-partial correlation coefficients

(Blalock, 1972, pp. 458-459). The resulting decomposition of the total effect of age is given in Table 5. Considering all four estimations it appears that between 10 and 20 percent of the total effect of age on income is direct. In three of the four decompositions, it is clear that labor force status is the most important mediating variable. That is to say, a considerable proportion of the total (or "gross") effect of age on income should be seen as operating through labor force status rather than being due to age per se. This result is generated by the fact that age has a stronger effect on labor force status than it does on sex or education.

(Table 5 about here)

Although statistically less precise, one can observe this mediation process by noting the relative magnitude of decrease in age category coefficients as one moves from Model A to Model D in Tables 2 and 3. The differences between Model A and B indicate the mediating effect of sex categories. Similarly, the differences between Models B and C show the mediating power of education. Finally, the differences between Models C and D reveal the mediation of labor force status. Clearly, the latter difference is greater than the first two in all four estimations of the model.

Since the sex category coefficients in Model B indicate their total effect on income, one may observe their mediation by examining the changes in these coefficients as education and labor force status are added (Models C and D). Clearly, very little of the total effect of sex is mediated by education. Moreover, only a small amount of their total effect is mediated by labor force status. Thus, one may conclude that the total effect of sex on income is largely a direct effect.

Similarly, one may observe the extent to which the total effect of education is mediated by labor force status by comparing the education category coefficients in Model C with those in Model D. Doing so, it becomes apparent that the total effect of education is only partially mediated by labor force status since the reduction in coefficients is small. It is worthy of note also that the total effect of education is the weakest of the four independent variables.

Overall, these results generate confidence that age, sex, education and labor force status are meaningful indicators of the competitive capacity of individuals. Moreover, the results are supportive of the causal model for economic benefits which flow from the measured indicators of competitive capacity. We turn now to the consideration of the central issue of our analysis: Does the discrepancy in economic benefits (income) between strong and weak competitors increase over time and is the inequality accentuated under conditions of industrial development?

To examine changes in the differences in income between strong and weak competitors one must identify the categories of age, sex, education and labor force status to be regarded as strong and weak competitors. Following our previous discussion and the above findings, we shall consider weak competitors to be persons 65 years of age or older, females, persons with less than high school education and persons not employed. Conversely, strong competitors are persons 35-49 years of age, males, individuals with post high school education, and white collar workers. Data for the comparisons to be made are drawn from Tables 2 and 3. The net effects of the strong and weak categorical variables are compared and differences recorded in Table 6.

(Table 6 about here)

From the data in Table 6 it appears that where income differences between strong and weak competitors are changing at all over time, they are becoming greater. This is most apparent in the comparison of white collar employees and persons not in the labor force. Not only was the difference in income due to the net effect of labor force status greater in both regions in 1965 than for the other variables, by 1970 the gap had widened in both regions more for this variable than any other.

A similar, though less substantial change is observed when one compares males and females. When the effects of age, education and labor force status are taken into account, the income discrepancy between the sexes in both regions is greater in 1970 than it was in 1965. This finding supports Knudsen's (1969) argument of a general decline in the status of females in the United States.

Differences in income due to the net effects of education were substantial in both regions in 1965. There is no indication of an increasing discrepancy in the experimental region. However, there is an increased discrepancy in the control region. Reference to the net effect coefficients in Table 1 helps one to understand the source of these differences. In the experimental region, the deviations in income around the grand mean for strong and weak competitors (with respect to education) are basically unchanged. On the other hand, the strong and weak competitors in the control region are both further from the grand mean in 1970 than they were in 1965. Thus, the positive effect of post-high school education on income has increased at the same time the negative effect of having less than a high school education increased. Since these are net effects, one cannot look to age, sex or labor force status for an explanation of the increased discrepancy. Rather,

one suspects the explanation lies in local wage rate and salary policies.

As is evident in Table 6, discrepancy in income due to the net effect of strong and weak age competitors is unchanged over time in the experimental region. However, in the control region, the discrepancy between strong and weak competitors is virtually eliminated over time. This finding was anticipated. Again reference to the net effect coefficients in Table 1 enhances one's understanding of the descriptive character of the change although it does not provide an explanation. What appears most strikingly is the fact that the under 35 age category is experiencing an increased negative deviation from the grand mean of income. At the same time, the 65 and older age category is moving closer to the grand mean. Consequently, in the control region in 1970 the older group is slightly above the mean and near to the strong competitors (35-49 age category). At the same time, the under 35 age group appears as the weaker competitor. It is worthy of note that the same pattern is occurring in the experimental region, although the aged group still has negative deviation. The observance of this pattern of change in both regions suggests the possibility that the hierarchy of economic dominance in rural areas is changing with respect to age, such that persons under age 35 are becoming the weakest competitors. But one must also recall that we are dealing here with net effects. It would be a non sequitar to conclude from these findings that older persons have more income than younger persons if the effects of sex, education and labor force status are ignored.

DISCUSSION

The implications of these data are that the income differences between strong and weak competitors tend to increase over time. This

is so after allowing for the exception of age categories where it appears possible that a realignment in the hierarchy of economic dominance is occurring. Also, the data show no evidence that the increase in discrepancies is accentuated by industrial development.

Thus, the competition and realignments of a dynamic system which are postulated by ecological theory are supported by this analysis. More specifically, the weakest competitors do tend to be relegated to even lower positions in the system. However, the expectation that industrial development constitutes a significant stimulus to the competitiveness within the system and results in an accentuation of the dynamic processes is not supported. This apparent anomaly can be understood in either of two ways. First, it may be that the magnitude of industrial development which occurred in the experimental region was insufficient to produce a measurable acceleration of the competitive process. However, given the fact that the plant nearly doubled the size of the labor force in Putnam County, one can hardly consider the industrial development to be insignificant. Rather a second explanation is more plausible. The impact of the industrial development may be diffused over such a large geographic area that its effects on the immediate environs is negligible. This has considerable plausibility when we note that approximately 80 percent of the plant work force resides outside Putnam County and the radius of the commuter field is nearly 50 miles.

The policy implications of these two conclusions are rather important. It follows that interventionist efforts of government to increase the mobility of capital into rural areas can proceed without

accelerating the process of increasing income inequality. However, it follows with equal clarity that mobility of capital does not serve as a technique for arresting or reversing the more gradual increments in income inequality in such areas. Where the policy goal is that of reducing income inequality in rural areas focused techniques are called for rather than, or in addition to, gross efforts to stimulate economic activity.

The analysis of competitive capacity and economic benefits also has sharp implications for the focus of techniques to achieve greater income equality. First, it is clear that age, per se, is not a major determinant of income inequality. The gross effect of age on income is largely due to its positive overlap with sex, education and labor force status. This is not to suggest that public policy designed to aid directly older persons has been misplaced historically. Indeed it may be the case that the currently observed minor net effect of age is due to past policy programs which specifically benefitted the aged. Rather, the point is that future efforts should be directed toward weak competitive characteristics other than old age.

Similarly, it is apparent that having less than a high school education does not contribute substantially to income inequality in the rural areas studied. While education appears to be more important than age per se, its total causal effects are minimal. Of course, one should be cautious in generalizing this finding to urban areas because wage and salary policies as well as investment opportunities in urban areas may be more directly linked to educational attainment than in rural areas.

The two most potent causal factors in income inequality are sex and labor force status. While both serve to mediate substantial portions of the total effect of age, they also have a significant direct effect on income. Hence, these are the two variables which should be the focus of policy programs seeking to reduce income inequality.

Since the effects of sex are net of the influence of age, education and labor force status, it follows that income differences are generated to a considerable extent purely on the basis of sex. The most plausible explanation for this fact is discriminatory wage and salary policies. Thus, efforts to reduce the influence of sex on income inequality should be directed toward the elimination of such discriminatory practices. From a public cost standpoint, this is fortunate since very little public money need be expended. Rather, stricter enforcement of equal rights laws is in order as a first step to ensure that equal pay is received for equal work. Similarly, sex differentials in pension and retirement benefits need to be eliminated.

Reducing the net effect of labor force status on income inequality undoubtedly will be more costly to the public and more difficult to achieve. While there is some considerable inequality in income between white collar and blue collar workers, the great discrepancy is between the employed and those not in the labor force. Recall that this factor mediates much of the total effect of age as well as a portion of the total effects of sex and education. Recall also that we are observing a rural population and it is, therefore, possible that the influence of labor force status on income in urban areas will be different.

Reducing the influence of labor force status will be difficult for at least two reasons. First, there persists the value position

that one's right to consume (income) is legitimated by one's work. Thus, there is much public resistence to programs which would achieve income equality by increasing payments to persons not in the labor force even though there are numerous reasons persons are unemployed, ranging from lack of marketable skill to ill health to retirement. The public may be more willing to relinquish the legitimation principle for some of these reasons than for others. Thus, the first difficulty may be partially overcome by programs designed to aid specific groups of persons not in the labor force.

Yet such a piecemeal programmatic approach is a difficulty in itself. The range of efforts required are as numerous as the sources of income among persons not in the labor force; welfare payments, unemployment compensation, pension payments (both private and public), insurance surviver benefits, and others. A monumental input of effort would be necessary to achieve adjustments in all programs such that inequality of income is eliminated. Coordination and enforcement of such a multifaceted programmatic effort would be enormous. Moreover, many compensation programs are regressive in nature. Thus, public cost may be minimized in the long run by a unified programmatic effort such as the negative income tax or the guaranteed annual income.

The above comments are not intended as an argument for specific public policy programs nor as an attempt to dictate public policy. They are intended as a statement of policy implications which flow from our analysis of age, sex, education and labor force status as dimensions of competitive capacity and their effects on economic

economic benefits (income). The establishment of public policy goals and programs to achieve such goals is a political decision which is not ours alone to determine.

Notes

1. Occupations were coded initially according to the 3-digit U.S. Bureau of Census (1960) index of occupations. Occupations with coded values from 000 through 395 including alphabetic codes of N, R, Z, Y, and S were categorized as "white collar." Occupations with coded values from 401 through 973 including alphabetic codes of Q, T, W, P, U, V, and X were categorized as "blue collar." All persons not reporting a full-time occupation were categorized as "not employed."

2. Persons unfamilar with this technique, which we believe to be extremely valuable in social science research, may wish to examine Hill (1959), Suits (1957), Morgan, et al., (1962), Harvey, (1960) Melichar (1966). In addition, sociologists will find O. Dudley Duncan's discussion of the technique in Blau and Duncan (1967, pp. 128-140) especially helpful.

3. Since age is the only exogenous variable in the model, its "total" effects and "gross" effects are synonymous. This is not true for the endogenous variables in the model. The gross effects of an endogenous variable are indicated that variable's relation to the dependent variable without regard for other variables in the model. The total effect of an endogenous variable is its relation to the dependent variable taking into account the effects of all causally prior variables in the model.

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Table 1. Gross and Net Effects of Age, Sex, Education and Labor Force Status on Income[1/] by Region and Year

Categorical Variables	Experimental Region						Control Region					
	1965			1970			1965			1970		
	Gross Effects	Net Effects	N	Gross Effects	Net Effects	N	Gross Effects	Net Effects	N	Gross Effects	Net Effects	N
AGE												
Less than 35	.0693	-.02547	222	.05861	-.07418	260	.05671	-.04352	96	.08617	-.09232	71
35-49	.13739	.05733	306	.20395	.08509	252	.16937	.09496	124	.14779	.01932	94
50-64	.03390	.02225	360	.02929	.03401	265	.01363	.01299	104	-.00746	.01599	114
65 or older	-.29006	-.08290	240	-.29406	-.04415	253	-.32028	-.10285	67	-.1955	.02915	98
SEX												
Male	.08242	.05764	920	.08937	.05631	822	.07039	.03511	329	.09951	.06188	294
Female	-.27611	-.16649	208	-.35319	-.22253	208	-.28241	-.14085	82	-.35246	-.21919	83
EDUCATION												
Post high school	.17655	.10240	343	.16375	.08019	320	.10691	.06484	66	.23434	.14459	65
High School	.06544	.02029	220	.09002	.04084	247	.13895	.08405	137	.08898	.08429	139
Less than high school	-.10847	-.05219	565	-.14957	-.07100	463	-.12544	-.07594	208	-.15954	-.12205	173
LABOR FORCE												
White collar	.19187	.11364	291	.21155	.13008	308	.12265	.05921	121	.23068	.12160	94
Blue collar	.05636	.03164	554	.07042	.05441	469	.07730	.03625	200	.05084	.04809	193
Not employed	-.30762	-.17879	283	-.38808	-.25922	253	-.33668	-.16016	90	-.34995	-.23013	90
TOTAL N			1128			1030			411			377
GRAND MEAN	3.7232			3.7881			3.7363			3.7708		

1/ Dollars of income were transformed by taking their common log equivalents. Thus, the expected (or "adjusted") mean income for any category of independent variable may be obtained by adding the corresponding coefficient to the Grand Mean for that year and region and reading the number value of the resulting logarithms from a table of common logarithms.

Table 2. Transformed Unstandardized Regression Coefficients[1/] for Log of Income Regressed on Age, Sex, Education and Labor Force Status in the Experimental Region, 1965 and 1970

Categorical Independent Variables	1965 Model A	1965 Model B	1965 Model C	1965 Model D	1965 Model E	1965 N	1970 Model A	1970 Model B	1970 Model C	1970 Model D	1970 Model E	1970 N
AGE												
Less than 35	.06923	.04994	.01387	-.02547		222	.05861	.00670	-.02752	-.07418		260
35-49	.13739	.11637	.10169	.05733		306	.20395	.17126	.13995	.08509		252
50-64	.03390	.03293	.04708	.02225		360	.02929	.05032	.07043	.03401		265
65 or older	-.29006	-.24395	-.21310	-.08290		240	-.29406	-.23018	-.18488	-.04415		253
SEX												
Male		.04664	.04533	.03764	.03725	822		.07267	.07174	.05631	.05405	822
Female		-.20629	-.20051	-.16649	-.16475	208		-.28719	-.28349	-.22253	-.21359	208
EDUCATION												
Post high school			.14483	.10240	.09604	343			.11684	.08019	.07899	320
High school			.02375	.02029	.02657	220			.04176	.04084	.04182	247
Less than high school			-.07081	-.05219	-.05353	565			-.09119	-.07100	-.07104	463
LABOR FORCE												
White collar				.11364	.13297	291				.13008	.14012	308
Blue collar				.03164	.04937	554				.05441	.06360	469
Not employed				-.17879	-.23338	283				-.25922	-.28848	253
TOTAL N						1128						1030
GRAND MEAN	3.7232						3.7881					
R^2	.2213	.3029	.3589	.4056	.3909		.2409	.3804	.4275	.5204	.4931	

1/ Transformation follows the procedure described by Melichar (1966).

Table 3. Transformed Unstandardized Regression Coefficients[1/] for Log of Income Regressed on Age, Sex, Education, and Labor Force Status in the Control Region, 1965 and 1970

Categorical Independent Variable	1965 Model A	1965 Model B	1965 Model C	1965 Model D	1965 Model E	1965 N	1970 Model A	1970 Model B	1970 Model C	1970 Model D	1970 Model E	1970 N
AGE												
Less than 35	.05671	.02532	-.02014	-.04352		96	.08617	.03718	-.04637	-.09232		71
35-49	.16937	.13377	.13163	.09496		124	.14779	.11480	.06569	.01932		94
50-64	.01363	.03462	.03039	.01299		104	-.00746	-.00074	.04498	.01599		114
65 or older	-.32028	-.25998	-.20171	-.10285		87	-.19551	-.13619	-.08174	.02975		98
SEX												
Male		.04247	.04180	.03511	.03895	329		.08872	.08571	.06188	.06132	294
Female		-.17040	-.16770	-.14085	-.15627	82		-.31427	-.30358	-.21919	-.21721	83
EDUCATION												
Post high school			.07125	.06484	.07066	66			.18554	.14459	.13568	65
High school			.09211	.08405	.07775	137			.07675	.08429	.06747	139
Less than high school			-.08328	-.07594	-.07363	208			-.13138	-.12205	-.10519	173
LABOR FORCE												
White collar				.05921	.08412	121				.12160	.12265	94
Blue collar				.03625	.05312	200				.04809	.03960	193
Not employed				-.16016	-.23114	90				-.23013	-.21303	90
TOTAL N						411						377
GRAND MEAN	3.7363						3.7708					
R^2	.2790	.3304	.3833	.4148	.3810		.1089	.2789	.3602	.4181	.4077	

1/ Transformation follows the procedure described by Melichar (1966).

Table 4. Increment in R^2 due to Age in the Regression Model for Income.

	R^2	K	N	F[1/]	$P_r(R^2_{y \cdot A} = R^2_{y \cdot A3})$
Control Region					
1965					
Model E	.3810	5	411		
Model D	.4148	8	411	7.5333	< .001
1970					
Model E	.4077	5	377		
Model D	.4181	8	377	2.1875	> .05
Experimental Region					
1965					
Model E	.3909	5	1128		
Model D	.4056	8	1128	9.8000	< .001
1970					
Model E	.4931	5	1030		
Model D	.5204	8	1030	18.2000	< .001

1/ $F = \dfrac{(R^2_{Y \cdot A,B} - R^2_{Y \cdot A})/b}{(1 - R^2_{Y \cdot A,B}) / (n-a-b-1)}$ from Cohen (1968, p. 435)

where df = b and (n-a-b-1).

$$F = \frac{(.4181 - .4077) / 3}{(1 - .4181) / 377-5-3-1)}$$

$$F = \frac{.0104/3}{(.5819)/368} = \frac{.0035}{.0016} = 2.1875$$

$$F = \frac{(.4148 - .3810)/3}{(1 - .4148) / (411-5-3-1)}$$

$$F = \frac{.0338/3}{.5852/402} = \frac{.0113}{.0015} = 7.5333$$

Table 4 (continued)

$$F = \frac{(.5204 - .4931)/3}{(1 - .5204) / (1030-5-3-1)}$$

$$F = \frac{.0273/3}{.4796/1021} = \frac{.0091}{.0005} = 18.2000$$

$$F = \frac{(.4056 - .3909)/3}{(1 - .4056)/(1128-5-3-1)}$$

$$F = \frac{.0147/3}{.5944/1119} = \frac{.0049}{.0005} = 9.8000$$

Table 5. Decomposition of the Total Effect of Age on Income

	Control Region				Experimental Region			
Effect	1965	% of Total	1970	% of Total	1965	% of Total	1970	% of Total
Total	.2790		.1089		.2213		.2409	
Thru sex	.0935	33.51	.0422	38.75	.0479	21.64	.0497	20.63
Thru educ.	.0078	2.80	.0259	23.78	.0540	24.40	.0534	22.17
Thru LF	.1231	44.12	.0232	21.30	.0953	43.06	.0839	34.83
Direct	.0546	19.57	.0176	16.16	.0241	10.89	.0539	22.37

Table 6. Differences in net effects of strong and weak competitors on Log of Income in the Experimental and Control Regions, 1965 and 1970

Competitive Capacity	Experimental Region 1965	Experimental Region 1970	Control Region 1965	Control Region 1970
Age	.14	.13	.19	
Sex	.19	.28	.18	.28
Education	.15	.15	.14	.26
Labor force status	.29	.39	.22	.35