SOME ASPECTS OF INCOME DISTRIBUTION

The Effects of the Rural Income Maintenance Experiment on the School Performance of Children

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A comprehensive evaluation of any welfare reform proposal must consider both long-run and short-run costs and benefits. One short-run benefit of a negative income tax program *(NIT)* is likely to be improvements in the school performances of the children of participants. These improvements may occur for several reasons: health may improve as a result of increased consumption of nutritious food and health care; learning aids such as books and magazines may become more readily available; and parents may spend more time with their children, participating with them in learning-related activities. Therefore, a long-term benefit of an *NIT* may well be the higher earnings that these children will eventually receive as a result of such improvements.

This paper summarizes the findings of an analysis of the effects of the Rural Income Maintenance Experiment on four measures of school performance—attendance, comportment grades, academic grades and standardized achievement test scores.

I. The Model

The analysis of the relationship between participation in a negative income tax program and school performance is based on a theoretical model which assumes that learning is composed of two distinct but interrelated components: learning that occurs as a result of environmental exposure rather than as a consequence of any behavioral choice and learning that is directly attributable to the child's choice of activities. Changes in the home and/or school environments may affect both components of learning. If the general intellectual quality of the environment improves, the child's nonchoice learning will increase. Also, changes in the environment will affect the child's allocation of time among activities that differ in terms of their learning components.

Notationally, the determinants of learning can be expressed as follows:

$$L_t = f(\bar{L}_{t-1}, g, A_t, E_t)$$

where

L_t = learning in period t

$\bar{L}_{t-1}$ = the knowledge stock in period t

g = genetic endowment

A_t = activities selections in period t, and

E_t = environmental conditions in period t.

The introduction of a negative income tax program may affect learning directly and indirectly through its effects on the child's environment and on the child's activity selections. The relationships between the program parameters and the variables in the learning function are discussed briefly below.[1]

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[1]Maynard presents a more rigorous exposition of this theoretical model.

The parameters of a negative income tax program include the guaranteed annual income, G, and the income tax rate, t. If total earnings and other income falls below the critical level determined by G and t, the family receives an income subsidy which is a function of the program parameters and total earned and other unearned income. Since payments are made to the parents, the program's impact on school performance depends indirectly on the induced modifications in the parents' behavior.

For families whose incomes fall below the break-even level, the primary effects of the program are expected to be 1) an increase in total family income and 2) a reduction in parents' labor force activity. These effects can be broken down into a price effect of the tax, an income effect of the (compensated) tax, and an income effect of the guarantee.

The price effect of the tax on income lowers the effective wage rate, thereby inducing a reduction in both labor force activity and in income. The income effect of the tax tends to offset the price effect by inducing an increase in these factors. The usual assumption is that the net effect of the imposition of or increase in the tax will be a simultaneous decrease in labor force hours and in income.

These two effects are competing in terms of their effects on school performance. It is assumed that parental time and income expenditures that complement education objectives are normal goods and superior to expenditures that compete with education objectives. Thus, parents will spend the additional nonlabor-market time 1) interacting generally with their children, 2) in ways that improve the child's learning efficiency, 3) in ways that increase the desirability of learning activities, and 4) substituting for the child's work-type activities. The first of these effects will lead to greater amounts of nonchoice learning, while each of the last three effects will alter the child's time allocation between activities of greater and lesser learning intensities.

The tax-induced reduction in income is assumed to have a negative influence on the environment, with the result that less of the child's time will be devoted to learning-intensive activities and less nonchoice learning will occur. It is uncertain whether the favorable price effect of the tax will dominate this negative income effect.

However, for families initially below break-even, it is assumed that the tax-induced decrease in income is more than offset by the guaranteed annual income of an *NIT* program. To the extent that parents allocate this income to the consumption of goods that increase the quality of the environment and that encourage the consumption of learning-intensive activities, school performance will improve. For example, parents may purchase goods such as increased nonlabor-market time, better quality housing, more nutritious foods, health care, and books. These goods may improve the child's learning efficiency, and they may permit and encourage the consumption of greater amounts of learning-intensive activities. Also, constraints on school attendance and continuation may be alleviated.

In summary, imposition of a negative income tax is expected to lead to improved school performance through its effects on the parents' time and income allocations. Their time reallocations may result in an increase in 1) knowledge diffusion from the parent or other environmental aspects to the child, 2) the release of time constraints on the child, or 3) increases in the relative desirability of learning intensive activities. The Rural Income Maintenance Experiment collected data to investigate whether or not such positive influences on performance are observed when a negative income tax program is implemented.

II. The Sample and Data

The sample of children used for the analysis is a subset of the children whose families participated in the experiment. It includes all children 1) who were in grades 2 through 12 at the time of the most recent observations on any school performance measure, 2) who did not change their household of residence during the

experiment, and 3) whose family background data are relatively complete. Further, the analysis of any particular dimension of school performance includes only children for whom pre- and postenrollment performance data are available. Altogether, 847 children were included in some portion of the analysis.

The sample children are not representative of the student population in their respective regions —Duplin County, North Carolina and Pocohantas and Calhoun Counties, Iowa. Furthermore, they are not representative of the nation's population of school children but of an intellectually impoverished population. For example, low family income, low parental education levels and large family sizes typify both this sample and students who have a relatively high risk of school failure. Table 1 shows selected characteristics of the Iowa and North Carolina experiment samples, the Iowa and North Carolina regions, and the nation. The differences between the analysis samples and the larger populations affect the generalizability, but not the validity, of the results.

The data base used in the analysis includes extensive information on the school performance of children and the resource supply characteristics of their schools and (for North Carolina grade school children) classrooms. In combination with information concerning each child's home environment, these data have permitted a detailed investigation of the determinants of school performance and the calculation of relatively precise estimates of the effect of the negative income tax program on each of four measures of performance—absenteeism, comportment grades, academic grades, and standardized achievement test scores.

TABLE 1—CHARACTERISTICS OF THE RURAL INCOME MAINTENANCE EXPERIMENT'S SAMPLE, THE SITES AND THE UNITED STATES

Characteristic	North Carolina		Iowa		United States
	Experiment Sample	Duplin County[a]	Experiment Sample	Pocahantas County[a]	
Total Family Income ($)	3,645.00	6,085.00	3,997.00	9,591.00	9,433.0[c]
% Families with Income Below Poverty Level	62.10	39.90	36.80	9.70	9.7[c]
Education of Head (years)	7.60	8.88	10.90	11.50	12.3[c]
% Female Heads	12.70	18.90	13.20	6.80	10.8[b]
% Farmers	29.90	28.10	49.80	83.30	5.2[b]
Family Size	6.50	4.90	6.10	5.10	3.6[b]
Rooms/Person	0.90	0.94	0.92	0.78	*N.A.*
% Black	67.90	43.70	0.00	0.00	11.2[b]

Note: *N.A.* = not available.
[a]*Source:* the screening interviews for the Rural Income Maintenance Experiment.
[b]*Source: Statistical Abstract of the United States*, U.S. Bureau of the Census, 1970.
[c]*Source: Statistical Abstract of the United States*, U.S. Bureau of the Census, 1971.

III. The Results

The general form of the model used to estimate the effects of the negative income tax program on school performance is:

$$L_t = \alpha + \beta_1 L_{t-1} + \sum_{i=2}^{k} \beta_i \, 1nE_i + \sum_{j=k+1}^{n} \beta_j E_j + \beta_{n+1} T + \mu$$

TABLE 2—ESTIMATED DIFFERENTIALS IN SCHOOL PERFORMANCE ADJUSTED MEANS FOR EXPERIMENTAL AND CONTROL GROUPS[a]

Measure of School Performance	North Carolina				Iowa			
	Experimentals	Controls	Differential $(E - C)$	Percent Differential $100x(E - C)/\|C\|$	Experimentals	Controls	Differential $(E - C)$	Percent Differential $100x(E - C)/\|C\|$
Days Absent from School —Grades 2 through 8 (annual)	9.13	13.13	−4.00**	−30.46**	7.54	9.39	−1.85	−19.70
Days Absent from School —Grades 9 through 12 (annual)	7.85	7.61	0.24	3.15	6.80	8.19	−1.39	−16.97
Comportment Grade Point Average[b]	233.42	218.81	14.61**	6.68**	229.37	230.30	−0.93	−0.40
Academic Grade Point Average—Grades 2 through 8	225.92	212.79	13.13*	6.17*	249.90	261.95	−12.05	−4.60
Academic Grade Point Average—Grades 9 through 12	203.45	195.84	8.41	4.29	244.25	255.97	−11.72	−4.58
Deviation from Expected Grade Equivalent Score on Standardized Achievement Test[b]	−14.36	−17.71	3.35**	18.92**	−1.22	1.38	−2.60	−188.41
Percentile Score on Standardized Achievement Test[b]	25.83	25.43	0.40	1.57	44.73	52.47	−7.74	−14.75

*Statistically significant at the ten percent level.

**Statistically significant at the five percent level.

[a]Control variables included in the regressions are pre-enrollment measures of (1) the dependent variable, (2) personal characteristics such as ethnicity, sex, *grade level,* health status, and sibling position, (3) family background characteristics such as *parental education,* farm status, and *family size* and (4) home environment factors such as *parents' time allocation, income, assets,* and *nutrition;* and during program school environment characteristics such as school/class enrollment, performance on standardized tests, *ethnic composition,* and teachers' characteristics. The logarithms of variables in italics were included in the analysis.

[b]Comportment grades and standardized achievement test scores are avilable only for children in grades 2 through 8.

where

L_t and L_{t-1} = the post- and pre-experiment performance measures, respectively

E = environmental conditions prior to enrollment in the experiment and school environmental conditions during the period of time between the pre- and postenrollment measures of performance

T = a treatment status variable, and

μ = a random error term

All but the absenteeism equations were estimated using ordinary least squares. Since a high degree of intrafamily correlation among the error terms in the absenteeism equations was observed, those equations were estimated using an error-components model that includes a family-specific error term.

The main findings with respect to the program response are summarized in Table 2, which presents adjusted mean estimates of school performance for children from experimental families and for children from control families.[2] The largest and most significant responses were found for the sample of 2nd through 8th grade students from North Carolina families. These children exhibited statistically significant responses for all four measures of school performance. Positive experimental responses in terms of relative differences in the adjusted mean values of outcome measures include a 30.5 percent reduction in absenteeism, a 6.7 percent increase in comportment grade point average, a 6.2 percent increase in academic grade point average, and an 18.9 percent improvement in the deviation between achievement test scores and expected grade equivalent scores. The percentile scores on standardized achievement tests also rose for 2nd through 8th graders in the North Carolina experimental group relative to children in the control group, but the adjusted mean differential is relatively small and statistically insignificant.

The older sample of children from North Carolina families did not exhibit any significant experimental responses. The adjusted mean value for academic grades was 4.3 percent higher for children from experimental families, but this finding is not statistically significant. The differential for 9th through 12 graders in terms of number of days absent per year is very small and not statistically different from zero.

While the above estimates of experimental responses for children from North Carolina families support the general hypothesis that a negative income tax program will result in improved school performances, the findings for the Iowa samples provide little or no support for this hypothesis. None of the adjusted mean differences in school performance between the experimental and control groups in Iowa is statistically significant. Children from experimental families did reduce their absenteeism, but there was essentially no difference in comportment grades between experimentals and controls. However, the most puzzling result is that both academic grade point averages and achievement test performances tended to be lower, other things being equal, for children whose families were enrolled in experimental negative income tax program. At least part of this anomalous finding can be explained by the presence of differences in sample characteristics[3] and the poorer quality of the Iowa school environment data.[4]

[2]The responses are presented in terms of adjusted means so that the results can be interpreted as applicable to experimental and control groups that have identical compositions, equivalent to the mean values of the control variables.

[3]In general, students in the Iowa sample compared with those in the North Carolina sample were better performers prior to their enrollment in the experiment. While, within each sample, the relationship between the pre- and postexperiment measures of performance seems to be linear, it may be that nonlinearities do exist if the entire range of performances is considered (for example, if data from the two regions are pooled).

[4]Student-specific data on classroom and teacher characteristics are available for the North Carolina sample, but only school-specific demographic data such as per pupil expenditures and enrollment are available for the Iowa sample.

In general, the program responses tend to be larger and more significant for children in the lower grade levels whose behaviors are easier to modify. Also, for children in all grade levels, the program responses are larger for those performance measures, such as absenteeism and comportment grades, that more closely embody current behavior and are less dependent on the effects of past behavior through the stock of knowledge. Investigations of whether or not the program response varied depending on the expected level of benefit or preprogram characteristics of the individual or his/her environment revealed only one consistent finding: as the expected payment level increased, absenteeism decreased still further. Some significant relationships between preprogram factors and the treatment response were identified for selected outcome measures and samples. However, these findings do not appear to be generalizable.

IV. Conclusion

The results of this study suggest that the introduction of a national *NIT* program may lead to overall improvements in school performance and increases in the levels of educational attainment. Participation in the experimental group favorably influenced the performance of the 2nd through 8th graders in the North Carolina sample. These children demonstrated significant improvements in attendance, comportment grades, academic grades and standardized achievement test scores. The most noteworthy of these effects is the 30 percent reduction in their absences. However, neither the high school-age children in North Carolina nor the children in Iowa demonstrated any significant change in their performance as a result of participation in the program.

The findings are not without anomalies which, given the potential magnitude involved, clearly establish the need for further research in this area. For example, some puzzling differences in both the magnitude and direction of responses across sites have not been adequately explained. Before more conclusive policy inferences can be drawn, additional research is required both on the general determinants of school performance and, more specifically, on the causal effects of a negative income tax.

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