A Multinomial Logit Analysis of Teenage Fertility and High School Completion

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Abstract:
This paper examines economic, institutional and sociological antecedents of high school completion and adolescent fertility using data on women from the 1979 National Longitudinal Survey of Youth A multinomial logit model is estimated in which the dependent variable represents combinations of high school completion and early fertility outcomes Benefits from various government assistance programs and earnings differences attributable to high school completion are included as potential economic determinants Of these variables, welfare generosity appears to have a significant positive effect on adolescent childbearing. Other variables including family planning clinic availability, family background, religiousness, physical maturity, race and ethnicity are also found to be important determinants of teenage parenthood and educational attainment.

Article:

1. INTRODUCTION

THERE ARE MANY decisions that individuals make as teenagers that have important consequences later in life. Two significant decisions that confront teenage women are whether to complete a high school education and whether to become a parent.[1]

The consequences of not completing high school are well known. Education is related to labor market productivity and, hence, to earnings. Individuals who fail to complete high school face diminished employment prospects as adults. These individuals run an increased risk of being impoverished and becoming dependent on government assistance. To the extent that education is associated with nonmarket productivity, high school drop-outs may also be less efficient household providers (Haveman et al., 1991).

Teenage childbearing also appears to be associated with a set of adverse economic, social and health outcomes. The economic consequences of early fertility include reduced adult earnings (Lundberg and Plotnick, 1989) and increased poverty and welfare dependence (Hofferth, 1987). Teenage childbearing is also associated with increased sub sequent fertility, decreased marital stability and marriage prospects (Hofferth, 1987), and reduced health outcomes for both mother and child (Strobino, 1987).

While most analysts acknowledge the consequences of becoming a teenage mother and not completing high school,[2] there is considerable disagreement over the antecedents of these decisions. Various factors including economic circumstances and opportunities, family background, neighborhood quality, emotional and physical maturity, intellectual ability and school quality have been found to be correlated with high school completion and teenage childbearing. Unfortunately, the exact mechanism by which these factors influence teenagers' decisions is not well understood.

This paper empirically examines economic and demographic hypotheses regarding teenagers' joint education and fertility decisions. Specifically, the paper uses data from the 1979 National Longitudinal Survey of Youth (NLSY) to estimate a multinomial logit model of high school completion and teenage fertility. The decisions to

bear a child and to complete high school are each expressed as dichotomous variables; the dependent variable in the multinomial logit model is the cross product of these two variables.

This analysis extends the existing literature in several respects. First, while economic theories of educational attainment (human capital investment) have been extensively tested, few studies have focused on high school completion. Similarly, numerous studies have examined the economic determinants of fertility generally, but only a handful (An et al., 1990; Duncan and Hoffman, 1990; Lundberg and Plotnick, 1990) have concentrated on adolescent childbearing Last, despite a great deal of sociological work in this area, economic studies have not examined the joint determinants of high school completion and teenage fertility.

The paper's results provide limited support for economic models of educational attainment and fertility. Government transfer programs which reduce the cost of teenage fertility are found to have significant positive effects on adolescent childbearing. However, measures of the benefits and opportunity costs of high school completion (the predicted adult lifetime earnings associated with completion and noncompletion) appear not to be significant explanatory variables. The paper does confirm previous sociological results and finds that access to family planning services, family background, religiousness, physical maturity, race and ethnicity have important effects on education and fertility.

The remainder of this paper is organized as follows. Section 2 reviews some of the empirical literature regarding education and fertility. The methods used to construct the analysis variables are detailed in Section 3. A brief descriptive analysis of the variables also appears in Section 3 Section 4 presents and discusses estimates from the multinomial logit model Concluding remarks appear in Section 5

2. THEORETICAL CONSIDERATIONS

Sociologists and economists have had a keen interest in the general issues of fertility and educational attainment. While hypotheses regarding the determinants of these decisions differ greatly between disciplines, explanations of each decision are similar within disciplines.

Economic Hypotheses

Economists use cost—benefit analysis to examine fertility and schooling decisions This analysis relies on a notion of total cost which includes both the direct and indirect costs of each decision. Direct costs refer to the actual expenses associated with a particular alternative. Indirect or opportunity costs refer to the net benefits associated with the next best alternative. With respect to education, the potential increase in lifetime earnings represents the primary benefit of high school completion Public provision of elementary and secondary schooling eliminates direct costs of school attendance for most individuals.[3] Other direct costs might include transportation, clothing and any distaste for school work. The opportunity cost of high school completion is the labor income or leisure foregone while the individual attends school.

A similar framework can be used to analyze fertility decisions. The primary benefit of fertility is assumed to be the satisfaction of becoming a parent. The direct costs of fertility include prenatal health care costs, delivery costs, subsequent child care costs and the physical discomfort associated with pregnancy and delivery. Social stigma attached to adolescent childbearing may represent an additional direct cost. The opportunity costs of teenage childbearing are the additional schooling and labor income that might have been obtained in the absence of fertility. To the extent that education and work experience affect adult wages, fertility may also entail costs in subsequent periods.

In principle, empirical tests of these two models are easily constructed. Factors which increase the costs of teenage childbearing such as decreased adult earnings for teenage mothers should be associated with lower rates of fertility. Factors which decrease the costs of childbearing such as increased public welfare program benefits should be associated with higher rates of fertility. Similarly, high school completion should be positively correlated with wage premia for high school graduates and negatively correlated with wages for high school drop-outs.

Unfortunately, these theories have found only limited empirical support Consider the studies which have examined the effects of economic variables on teenage fertility. Duncan and Hoffman (1990) analyzed the effects of earned family income at age 26 and the Aid to Families with Dependent Children (AFDC) program on out-of-wedlock teenage births and AFDC participation They found that future income had a strong negative effect on premarital teenage fertility and welfare receipt but that AFDC benefits had little effect on these decisions. Using an alternative econometric specification and a more comprehensive measure of public assistance, An et al. (1990) also found that welfare generosity had little effect on premarital teenage childbearing.

Lundberg and Plotnick (1989, 1990) used NLSY data to estimate (1) the effect of teenage fertility on adult earnings and (2) the effect of adult earnings on fertility and marriage decisions. Lundberg and Plotnick discovered strong negative effects of both fertility on adult earnings and adult earnings on fertility for white teenagers. They also found a significant positive effect of AFDC benefits on fertility among whites. However, their results for blacks suggested that teenage fertility actually increased adult earnings.

Sociological Hypotheses

Sociological models of teenage fertility and high school completion consider the effects of family background, neighborhood characteristics, race and ethnicity. In particular, sociologists have noted that the children of teenage mothers and high school drop-outs are at greater risk of becoming teen parents or not completing high school, respectively, than children from other families. Sociologists have also found variations in patterns of early childbearing and educational attainment by racial and ethnic groups.

Several hypotheses have been offered to explain the apparent intergenerational transmission of family structure and educational attainment. These hypotheses are reviewed by Sandefur and McLanahan (1990) and briefly outlined here. First, family structure and parents' education may have economic effects on children's development. Second, the transmission of outcomes may reflect an explicit or implicit transmission of values. Third, the outcomes may be the result of diminished expectations and resources in the neighborhoods where poor families are likely to live.

Differences in the previously discussed characteristics account for some of the differences in early fertility and educational attainment between racial and ethnic groups. Beyond these factors there may be cultural differences in the acceptance of teen parenthood and attitudes toward education. For example, extended kin networks among blacks provide a source of support for young and single mothers. Moreover, discrimination may reduce the economic rewards associated with education and work experience and thereby reduce the incentives for completing school or delaying fertility.

Despite difficulties in obtaining and measuring important variables (e.g. stress levels, cultural attitudes, individual resiliency), several studies have attempted to test the relative empirical importance of these hypotheses. In an examination of sexual activity and pregnancy among black youths in Chicago, Hogan and Kitagawa (1985) were able to distinguish between and find significant effects from family background, economic circumstances, neighborhood quality and individual aspirations. Sandefur and McLanahan (1990) analyzed teen marriage, teen parenthood and premarital parenthood and found that family structure, parental education, family income and individual aspirations were significant determinants. Recent examinations of the differential effects of family background on high school completion include Haveman et al. (1991), Manski et al. (1990), and Wojtkiewicz (1991).

Sociological studies have also jointly examined fertility and educational attainment. Mott and Marsiglio (1985) reported that 87% of women aged 20-26 had completed high school.[4] The completion rate for childless women was 95%. Completion rates for women who had given birth before leaving school, conceived before but given birth after leaving school, and conceived after leaving school were 64, 53 and 79%, respectively.

There are several possible explanations for the negative association between high school completion and early fertility. The presence of a child may increase the mother's opportunity cost of attending school and, consequently, decrease the likelihood of high school completion. On the other hand, low educational attainment may reduce subsequent earnings and reduce the opportunity cost of fertility. Causality between high school completion and early parenthood could run either or both ways. Alternatively, educational attainment and fertility may be determined by a mutual set of exogenous factors such as family background or culture. Given the difficulty in appropriately modelling and identifying the effects of school completion and fertility on one another, this paper focuses only on the reduced-form determinants of these decisions.[5]

3. DATA AND METHODOLOGY

This study uses a multinomial logit model of fertility and schooling behavior in which the dependent variable takes one of four values: (0) if the woman completed high school and did not give birth; (1) if she did not complete high school and did not give birth; (2) if she completed high school and gave birth, and (3) if she did not complete high school and gave birth. The approach is equivalent to assigning a level of indirect utility to each alternative and assuming that individuals choose the alternative that yields the greatest utility. Indirect utility is assumed to be a function of economic and demographic variables as well as other unobserved characteristics. Coefficient estimates represent the differential effects of the observed characteristics on utility.

The multinomial logit specification has some drawbacks. Most notably, the model relies on a restrictive error distribution. As a result, the model suffers from the well-known "independence of irrelevant alternatives" problem. Coefficient estimates in the model are also somewhat difficult to interpret. Despite these shortcomings, there are advantages to using the multinomial logit approach. Importantly, estimation is easy and inexpensive. The parameterization of the model is also relatively flexible.

Principal Variables

The model is estimated using data on women drawn from the 1979-1985 panels of the NLSY. The NLSY is a national sample of individuals who were 14 to 21 years old in 1979. The individuals have been reinterviewed annually. Economic, demographic and other behavioral data are available for each individual in all years. Retention through 1985 was roughly 90%.

The two decision variables are high school completion and teenage fertility. The high school completion variable reports whether the woman finished 12 or more years of education before age 20. No distinction is made between graduation and completion of a General Equivalency Degree (GED) program. Teenage fertility is measured as whether the woman gave birth before age 20.[6]

The independent economic variables are calculated using external data. To account for the costs and benefits of high school completion, repeated cross-section data on women's eduction, age, annual wage and salary income, ethnicity and state of residence are collected from the 1979-1981 releases of the Current Population Survey (CPS).[7] Using the CPS data, log annual wage and salary earnings are regressed on nine variables — work experience (age minus years of schooling minus six), experience squared, a flag for high school completion, interactions of the high school flag and the two experience variables, flags for African and Hispanic ethnicity, and year dummies. Separate regressions are performed for each state and the District of Columbia.[8]

Estimates from these regressions are used to predict separate state- and race-specific earnings/ experience profiles for women who did and did not complete high school. The discounted (4% annually) sums of the separate profiles over a 40- year career are assumed to represent the expected present value of lifetime earnings for graduates and nongraduates and are used as measures of the economic rewards associated with high school completion and noncompletion, respectively.[9]

State welfare benefits are also collected and merged into the analysis sample. Welfare benefits are assumed to reduce the cost of teenage fertility.[10] Monthly state AFDC payments assuming no other income, monthly food stamp (FS) benefits assuming no income but AFDC, and average monthly Medicaid payments are computed for

a family consisting of one adult and one child for the years 1978-1983 (Committee on Agriculture, Nutrition and Forestry, 1985, Committee on Ways and Means, 1981-1984, and unpublished data from the Food and Nutntion Service, the Office of Family Assistance and the Health Care Financing Administration). For each woman, the figures roughly correspond to benefits in effect as of age 19.

Demographic variables incorporated to explain these decisions include race, ethnicity and family background. Dummy variables are used to identify women of African and Hispanic origin. Family structure at age 14 is represented by three dummy variables indicating whether the woman lived with her mother only, lived with her mother and a stepfather, or lived in some other arrangement. The omitted category represents women who resided with both parents at age 14. The number of siblings is also used to describe family structure.[11]

The socioeconomic status of the teenager's family is represented by another set of variables Educational attainment of the teenager's mother is assumed to be positively associated with family socioeconomic status, family schooling expectations, and individual ability. Work experience of the mother is used to represent family economic circumstances, supervision and values. The estimated models include a dummy variable for the mother's (or stepmother's) labor force participation. Other family characteristics recorded in the dataset include indicators for whether household members subscribed to a newspaper, subscribed to a magazine or held a library card and an indicator for whether a foreign language was spoken in the home.

The analysis also includes several personal attributes for each teenager. Religiousness, measured by frequency of attendance at church services, is assumed to be an indicator of individual values. Age at menarche is used as a control for physical maturity. An earlier age at menarch is assumed to increase the length of exposure to fertility.

Lastly, the analysis incorporates measures of relevant institutional differences between states. For instance, the convenience and implicit cost of obtaining contraceptives may be adversely affected by state laws which restrict their sale, distribution or advertisement. These laws may, in turn, contribute to high rates of adolescent childbearing. The analysis uses a compilation of state family planning laws (Bush, 1983) to construct a dummy variable indicating residence in an area with contraceptive restrictions. State expenditures for family planning clinics represent an alternative fertility policy measure. The percentage of Medicaid-eligible women at risk of unintended pregnancy served by organized clinics in 1979 (Orr and Brenner, 1981) is used as an additional control for interstate differences in contraceptive cost and availability. Residual institutional and regional variation is captured by indicators for residence in the South and residence in a metropolitan area.

Descriptive Statistics

Descriptive statistics for the analysis variables are reported in Table 1. After excluding noninterviews and observations with missing information, the analysis sample contains observations for 4741 women. Of these women, 3682 were high school graduates and 1250 were teen parents. Applying 1985 sample weights from the NLSY, the high school completion and early fertility rates are 84 and 20%, respectively. Data from Table 1 suggest that a negative association exists between high school completion and teen parenthood. The high school completion rate for teen mothers is 56%, and the early fertility rate among high school drop-outs is 57%.

Table 1 reports means for all of the explanatory variables and means conditional on the decision variables. The estimates from Table 1 yield the expected result that adult earnings are negatively, albeit weakly, associated with teenage fertility. However, the figures also indicate that adult earnings for high school graduates are negatively associated with school completion. Results from the government assistance cross-tabulations are likewise weak and inconsistent. Monthly AFDC and Medicaid benefits are positively associated and FS benefits are negatively associated with completing high school and not becoming an adolescent parent.

Results among the demographic variables are more dramatic. For example, the women who did not complete high school are disproportionately black and Hispanic; the women who became teen mothers are also disproportionately black. Women who did not complete high school are more likely to come from nonintact

families, larger families, families who spoke a foreign language and families who provided fewer reading materials. Teenagers' educational attainment also appears to be positively associated with religiousness, mothers' schooling and mothers' labor force participation and negatively associated with residence in the South. The teen mothers in the sample come disproportionately from nonintact families, families with more siblings, families with less educated mothers and families with less access to reading materials. The results also suggest that residence in the South and an earlier age at menarche are positively associated with adolescent fertility.

4. RESULTS

Estimation results from the multmomial logit model appear in Table 2. The columns in Table 2 list estimates of the effects of the independent variables on the joint decisions to not complete high school and not become a teen parent (category 1), become a teen parent and complete high school (category 2), and become a teen parent and not complete high school (category 3) relative to the decision to complete high school and not become a teen parent.

Table 1. Variable means

Variable	All women	Did not finish high school	Became a teen parent	Dependent variable for multinomial logit (0)	(1)	(2)	(3)
Observations	4741	1059	1250	3050	441	632	618
Weighted observations	4763	741	954	3470	317	530	424
PDV earnings†/no high school	6.47	6.49	6.42	6 47	6.55	6.41	6 44
	(1.23)	(1.06)	(1.13)	(1.29)	(1.04)	(1.19)	(1.07)
PDV earnings†/high school	11.34	11.43	11.35	11.33	11.47	11.31	11.40
	(1 60)	(1.40)	(1.39)	(1.69)	(1.45)	(1.42)	(1.36)
Monthly AFDC benefits	2.80	2.63	2.62	2.86	2 67	2.64	2 60
(2 persons)‡	(1.14)	(0.99)	(1.04)	(1.20)	(1.20)	(1 08)	(1 08)
Monthly FS benefits	1.07	1.10	1.10	1.06	1.08	1 10	1 11
(2 persons)‡	(0.27)	(0.23)	(0.24)	(0.29)	(0.23)	(0 24)	(0.23)
Monthly medical benefits	1.16	1.15	1.13	1.17	1.17	1 13	1.13
(2 persons)‡	(0.33)	(0 28)	(0.27)	(0.35)	(0.29)	(0.27)	(0 27)
African origin	0 13	0.21	0.26	0.10	0 16	0.28	0.24
	(0.34)	(0.34)	(0.38)	(0.32)	(0 31)	(0.41)	(0 36)
Hispanic origin	0 06	0 12	0 08	0.04	0.12	0.06	0 11
	(0 23)	(0.27)	(0.24)	(0.22)	(0.28)	(0.21)	(0 26)
Mother only	0.12	0.19	0.16	0.10	0.19	0.14	0 19
	(0.32)	(0 33)	(0.32)	(0 32)	(0.33)	(0 32)	(0.33)
Mother and stepfather	0 07	0 12	0.10	0 05	0 11	0.09	0.12
	(0.25)	(0 27)	(0.27)	(0 24)	(0 27)	(0 27)	(0.27)
Other family structure	0 06	0 14	0.10	0.04	0 13	0.07	0.15
	(0 23)	(0.29)	(0.26)	(0.21)	(0 28)	(0.23)	(0 29)
Number of siblings	3.45	4.39	4.17	3.19	4.14	3.84	4 57
	(2.20)	(2.34)	(2.27)	(2.10)	(2.23)	(2.09)	(2 40)
Foreign language spoken at home	0.11	0.16	0.12	0.10	0.20	0.12	0.13
	(0.32)	(0.31)	(0.29)	(0.33)	(0.34)	(0.29)	(0.28)
Mother's years of education	11.62	9 66	10.26	12.15	9.94	10.91	9.45
	(2.63)	(2.32)	(2 26)	(2.60)	(2.23)	(1 97)	(2 37)
Mother in labor force	0.53	0.48	0.52	0 53	0.53	0.58	0 44
	(0.50)	(0.42)	(0.44)	(0 53)	(0.42)	(0 45)	(0.41)
Magazines	0.66	0.39	0.45	0.74	0 43	0 53	0.35
	(0.47)	(0.41)	(0 44)	(0.47)	(0 42)	(0.46)	(0.40)
Newspapers	0.83	0.65	0 70	0.88	0 70	0.77	0.61
	(0.37)	(0.40)	(0 40)	(0.34)	(0.39)	(0.39)	(0 40)
Library card	0.78	0.62	0.67	0 82	0.66	0.73	0.59
	(0.42)	(0.41)	(0.41)	(0 41)	(0 40)	(0.41)	(0.41)
Attends religious services infrequently	0 36	0.37	0.38	0.35	0.36	0.39	0.37
	(0.48)	(0.40)	(0.43)	(0 51)	(0.41)	(0 45)	(0 40)
Attends religious services often	0.48	0.37	0.41	0 51	0 39	0 45	0.36
	(0.50)	(0.40)	(0.43)	(0.53)	(0.41)	(0.46)	(0 40)
Lived in urban area at age 14	0.78	0.78	0 76	0.78	0.83	0.77	0 74
	(0.42)	(0 35)	(0.38)	(0.44)	(0.32)	(0.38)	(0 36)
Lived in South at age 14	0 33	0.42	0 43	0.29	0.38	0 41	0 46
	(0.47)	(0.41)	(0.43)	(0.49)	(0 41)	(0 45)	(0.41)
State restricts contraceptives	0.38	0 37	0.36	0.39	0 40	0.37	0.35
	(0.49)	(0 40)	(0.42)	(0.52)	(0.42)	(0.44)	(0.39)
Medicaid-eligible women served by	0.33	0.34	0.35	0.32	0.33	0.34	0.35
family planning centers	(0.18)	(0 16)	(0.16)	(0.19)	(0 16)	(0.17)	(0 15)
Age at menarche	12.84	12.68	12 62	12.89	12.88	12.70	12.53
	(1.50)	(1.33)	(1.31)	(1.59)	(1.36)	(1.32)	(1 30)

Note: Statistics use 1985 NLSY weights rescaled to match sample size Figures in parentheses represent standard deviations.

* Categories represent (0) — no teenage birth/completed high school (omitted in estimated models), (1) — no teenage birth/did not complete high school, (2) — teenage birth/completed high school, and (4) — teenage birth/did not complete high school.

† Variable divided by 10,000.

‡ Variable divided by 100.

Table 2. Multinomial logit coefficient estimates — full sample

Independent variables	No teenage birth/ no high school Estimate	(SE)	Teenage birth/high school Estimate	(SE)	Teenage birth/ no high school Estimate	(SE)
Intercept	0 379	(0.702)	1 463†	(0.668)	3.248*	(0.681)
Earnings — no high school	0 120	(0.074)	0 024	(0.056)	0.028	(0.063)
Earnings — high school	−0 014	(0.050)	−0 020	(0.043)	−0 003	(0.046)
Government benefits	−0 073	(0.087)	−0.052	(0 078)	0.110	(0.079)
African origin	0 023	(0.146)	0 952*	(0.119)	0 483*	(0.130)
Hispanic origin	−0 269	(0 232)	−0 230	(0.210)	0 384‡	(0 224)
Mother only	0.531*	(0 138)	−0.018	(0 122)	0 427*	(0 124)
Mother and stepmother	0.697*	(0 204)	0.431†	(0 171)	0 853*	(0.171)
Other family	1.165*	(0 183)	0.242	(0.172)	1.147*	(0 167)
Siblings	0 065*	(0 021)	0.045†	(0.019)	0 082*	(0 019)
Foreign language	0 325	(0 216)	0.148	(0 182)	−0.543*	(0 213)
Mother's education	−0 266*	(0 023)	−0 159*	(0 021)	−0.297*	(0.021)
Mother in labour force	0.185	(0 115)	0 239†	(0 095)	−0 080	(0 101)
Magazines	−0 564*	(0 121)	−0 409*	(0 100)	−0 692*	(0.111)
Newspapers	−0 293†	(0.127)	−0.186	(0 113)	−0 493*	(0.109)
Library card	−0 273†	(0.123)	−0 046	(0.109)	−0 305*	(0 108)
Religion infrequently	−0.458*	(0.154)	−0.009	(0.144)	−0 534*	(0.139)
Religion often	−0.840*	(0 155)	−0.368*	(0 141)	−1 087*	(0 137)
Urban area	0.511*	(0 157)	0.048	(0.117)	0 003	(0 127)
South	0 520†	(0.225)	0 499*	(0.173)	0.975*	(0.203)
Contraception laws	0 270‡	(0 149)	0.182	(0.122)	0.048	(0.134)
Clinic availability	−0 724	(0.462)	−0.850†	(0 395)	−1 472*	(0.432)
Age at menarche	0 016	(0.034)	−0 082*	(0 030)	−0.125*	(0 031)
Log likelihood			−3562 71			
Observations			4741			

Note Omitted category is "no teenage birth/completed high school." Estimation uses 1985 NLSY weights rescaled to sample size. Earnings divided by 10,000; government benefits divided by 100.
* Significant at 1% level † Significant at 5% level. ‡ Significant at 10% level SE = standard error.

The model specified in Table 2 includes adult earnings measures for graduates and nongraduates and a single government assistance measure which represents the total benefits from the AFDC, FS and Medicaid programs.

Examining the economic variables, none of the coefficients in Table 2 is significant at conventional levels. The opportunity costs of high school completion are estimated to have a marginally significant (t statistic = 1.61) positive effect on the joint no teen birth/no high school outcome; government assistance is estimated to have a weak positive effect on the joint teen birth/no high school decision. Although these effects conform to theory, the lack of statistical significance suggests that there is little support for the economic hypotheses.

The coefficient estimates for the demographic and institutional variables are consistent with expectations and generally more significant. With respect to race and ethnicity, African origin is estimated to have a positive significant effect on both of the states associated with early fertility. Hispanic women appear to be more likely to leave school and become teen mothers.

Family structure also has the anticipated effects on the outcome variables. Living in a nonintact family appears to have strong negative effects on high school completion and delaying childbirth. Interestingly, growing up in a mother/stepfather family is estimated to have a stronger effect on fertility and school completion than growing up in a mother-only family. The results suggest that for children the emotional and psychological costs of a parent's remarriage may outweigh the socioeconomic benefits. Additional siblings are estimated to decrease educational attainment and increase the likelihood of early fertility.

Among the other family background variables, increased access to reading materials and increased parental education are estimated to encourage high school completion and to deter teen parenthood. Mother's labor force participation is estimated to have a significant positive effect on the joint outcome of becoming a teenage mother and completing high school but little effect on the other two joint outcomes. Residing in household in which a foreign language is spoken appears to have a negative effect on the joint teen birth/no high school outcome.

Residence in the South, residence in an urban area and residence in a state which restricts contraceptives are each estimated to have negative effects on educational attainment. Educational attainment appears to increase with religiousness and the availability of family planning services. Residence in the South significantly increases the likelihood of an adolescent birth. As expected, increased religiousness, a later age at menarche and increased availability of family planning services are estimated to decrease the chances of teen parenthood.

The coefficients in Table 2 describe the effects of independent variables on each of the decisions relative to the joint no teen birth/completed high school outcome. Because these relative effects are difficult to interpret, the paper provides an alternative description of the estimation results. Table 3 lists estimates of the marginal effects of the independent variables on the probabilities associated with outcomes (1) through (3).[12] These estiamtes have interpretations similar to those of standard regression coefficients.

The estimated marginal effects are generally consistent with the results from Table 2, although there are some small differences. For example, government assistance is now estimated to have a marginally significant positive effect on the joint teen birth/no high school outcome. Growing up in a household in which a foreign language is spoken now appears to have a significant positive effect on the joint no teen birth/no high school outcome.

To more closely examine the effects of the economic variables, the multinomial logit model has been re-estimated using different combinations of variables. Estimates of the marginal effects of the economic variables from three alternative models are presented in Table 4.[13]

Table 3 Multinomial logit marginal effect estimates — full sample

Independent variables	No teenage birth/ no high school Marginal effect	(SE)	Teenage birth/high school Marginal effect	(SE)	Teenage birth/ no high school Marginal effect	(SE)
Earnings — no high school	0.007	(0.005)	0.001	(0 005)	0.0003	(0.004)
Earnings — high school	−0.001	(0.003)	−0.002	(0 004)	0.0002	(0.003)
Government benefits	−0 005	(0 005)	−0 006	(0.007)	0 009‡	(0 005)
African origin	−0.013	(0 008)	0 084*	(0 010)	0 021†	(0.008)
Hispanic origin	−0 018	(0.013)	−0 025	(0.020)	0.033†	(0.015)
Mother only	0.027*	(0 008)	−0.012	(0 011)	0.024*	(0.008)
Mother and stepmother	0 028†	(0 011)	0.023	(0 016)	0 046*	(0 011)
Other family	0 053*	(0 010)	−0 003	(0 015)	0 064*	(0.011)
Siblings	0.003†	(0.001)	0 003	(0 002)	0 004*	(0 001)
Foreign language	0.024‡	(0 012)	0.018	(0.017)	−0.044*	(0 014)
Mother's education	−0.011*	(0 001)	−0 009*	(0 002)	−0.016*	(0.001)
Mother in labour force	0 010	(0.007)	0 022†	(0 009)	−0.011	(0.007)
Magazines	−0 022*	(0 007)	−0 025*	(0 009)	−0 037*	(0.007)
Newspapers	−0.010	(0 007)	−0 008	(0 010)	−0 029*	(0 007)
Library card	−0.012‡	(0 007)	0 002	(0.010)	−0 018†	(0 007)
Religion infrequently	−0 021†	(0 009)	0 011	(0 013)	−0 032*	(0 009)
Religion often	−0 034*	(0 009)	−0.013	(0 013)	−0 062*	(0.009)
Urban area	0 029*	(0 009)	−0.0001	(0.011)	−0 006	(0.008)
South	0 015	(0 013)	0 030‡	(0.016)	0.056*	(0 014)
Contraception laws	0.014	(0 008)	0 014	(0 011)	−0.002	(0 009)
Clinic availability	−0.019	(0 026)	−0 055	(0.036)	−0.083*	(0 028)
Age at menarche	0 003	(0.002)	−0.006†	(0 003)	−0 008*	(0 002)

Note· Estimation uses 1985 NLSY weights rescaled to sample size. Earnings divided by 10,000; government benefits divided by 100. *Significant at 1% level. †Significant at 5% level. ‡Significant at 10% level. SE = standard error.

Table 4. Alternative specifications of multinomial logit model

Independent variables	No teenage birth/ no high school Marginal effect	(SE)	Teenage birth/high school Marginal effect	(SE)	Teenage birth/ no high school Marginal effect	(SE)
Specification A						
Earnings — no high school	0.006	(0.004)	0.001	(0.005)	−0.0004	(0 004)
Earnings — high school	−0.0004	(0.003)	−0.002	(0.004)	0.001	(0.003)
AFDC benefits	−0.021†	(0.010)	−0.013	(0.013)	0.017*	(0.009)
Food stamp benefits	−0.044	(0.037)	−0.046	(0.053)	0.069†	(0.034)
Medical benefits	0.021†	(0 011)	−0.012	(0 017)	0.027†	(0 012)
Log likelihood			−3556.71			
Specification B						
Earnings differential	−0.001	(0 003)	−0.002	(0.004)	0.0001	(0.003)
Government benefits	−0.003	(0 005)	−0 006	(0.007)	0.009*	(0.005)
Log likelihood			−3564.62			
Specification C						
Earnings differential	−0.0001	(0.003)	−0.002	(0.004)	0.0005	(0 003)
AFDC benefits	−0.018*	(0.010)	−0.013	(0.013)	0.017†	(0.009)
Food stamp benefits	−0.036	(0.037)	−0 047	(0 053)	0.069†	(0 034)
Medical benefits	0.024†	(0.011)	−0 013	(0.017)	0.027†	(0.012)
Log likelihood			−3558.66			

Note: Earnings divided by 10,000; government benefits divided by 100 Coefficients for the intercept, African origin, Hispanic origin, mother only, mother and stepmother, other family, siblings, foreign languages, mother's education, mother in labor force, magazines, newspapers, library card, religion infrequently, religion often, urban area, south, contraception laws, clinic availability and age at menarche estimated but not reported.
*Significant at 1% level †Significant at 5% level. ‡Significant at 10% level. SE = Standard error.

The first specification (A) in Table 4 breaks total government assistance down into its three components — AFDC, FS and Medicaid. In Specification A, all three forms of government assistance are estimated to have significant positive effects on the probability of the joint teen birth/no high school outcome. Medicaid benefits are also estimated to have a significant positive effect on the joint no teen birth/no high school outcome AFDC benefits appear to have a significant negative effect on the joint no teen birth/no high school outcome. To judge the appropriateness of allowing separate effects for each of these benefits, note that Specification A nests the model from Table 2 as a special case. The likelihood ratio test for this restriction is distributed x^2 with six degrees of freedom. The computed test statistic (12.0) is significant at the 10% level. Thus, separate coefficients for AFDC, FS and Medicaid appear to be appropriate.

The second specification in Table 4 imposes a restriction on the model from Tables 2 and 3, replacing the separate adult earnings variables for graduates and nongraduates with the difference between those two measures. The earnings difference represents the earnings premium associated with school completion. More technically, the restriction allows a test of the hypothesis that the separate earnings coefficients from Table 2 are equal but oppositely signed. The likelihood ratio test does not reject the restriction. This result is not surprising given the insignificance of the earnings coefficients in both specifications.

Specification C imposes the earnings difference restriction on Specification A. The restriction of equal but oppositely signed earnings coefficients again cannot be rejected. Results for the separate government assistance variables are virtually unchanged from Specification A.

As a check of the robustness of the estimates, the specifications in Tables 2, 3 and 4 have been re- estimated using alternative definitions of the dependent variable. The decision variables were redefined using different age cut-offs (e.g. births prior to age 18, high school completion by age 22). Estimates from these specifications (not reported here) indicate that the paper's results are not particularly sensitive to changes in the dependent variable.

Earlier studies have found significant differences in the determinants of educational attainment and teen fertility by race and ethnicity Given the reported and unreported results for the black and Hispanic dummy variables, a test of the equality of coefficients across racial and ethnic groups is in order. The likelihood ratio from the three-way Chow test (based on Specification C) is distributed as X^2 with 132 degrees of freedom The computed statistic is 201.5 and is significant at the 1% level ($X^2$1.32.001 = 177.6). Thus, there are significant differences in the determinants of early fertility between black, Hispanic and other women.

Table 5 reports economic coefficient estimates from the multinomial logit model separately by race and ethnicity. While the results for the separate groups do not contradict the significant estimates for all women, they nevertheless suggest that the economic effects are not robust across racial and ethnic groups. All of the estimated effects of the economic variables are statistically insignificant for Hispanic women. The insignificant results likely reflect the small sample size and the high rates of marital early fertility for Hispanics. For women of African origin, government assistance is estimated to have significant negative effects on the Joint teen birth/completed high school outcome. This result is clearly counter to expectations. The economic variables have no statistically significant effect on the other decisions for black women. The results for non-Hispanic, non-black women are consistent with the results from Table 4.

5. CONCLUSIONS

The paper outlines economic and sociological theories of educational attainment and teenage parenthood and tests these theories using a multinomial logit model. Similar to previous research, the paper finds mixed evidence for the economic hypotheses. Benefits from government transfer programs reduce the cost of childbearing and appear to have a positive effect on adolescent fertility. State family planning expenditures reduce the cost of contraception and appear to have a negative effect on teenage parenthood. Other economic variables such as the costs and benefits of high school

Table 5 Multinomial logit results by race and ethnicity

Independent variables	No teenage birth/ no high school Marginal effect	(SE)	Teenage birth/high school Marginal effect	(SE)	Teenage birth/ no high school Marginal effect	(SE)
Hispanic origin						
Earnings differential	−0 024	(0.019)	0 008	(0 019)	0 006	(0.023)
AFDC benefits	−0 007	(0 059)	−0 053	(0 055)	−0 058	(0 057)
Food stamp benefits	0 018	(0 203)	−0 120	(0 202)	−0 213	(0 205)
Medical benefits	0 069	(0 047)	0 039	(0 058)	0 039	(0 057)
African origin						
Earnings differential	0.004	(0.007)	−0.014	(0 011)	−0.001	(0.009)
AFDC benefits	−0 009	(0 023)	−0 089†	(0 036)	0 009	(0.028)
Food stamp benefits	−0 030	(0 094)	−0 270‡	(0 153)	−0 039	(0 117)
Medical benefits	0 023	(0 030)	−0 095‡	(0.054)	0 033	(0 042)
Other origin						
Earnings differential	−0 004	(0.004)	0 002	(0 006)	0 00004	(0 004)
AFDC benefits	−0 023‡	(0 012)	0.002	(0 017)	0 016‡	(0.009)
Food stamp benefits	−0 054	(0 047)	0 007	(0 069)	0 069‡	(0 044)
Medical benefits	0 024	(0 015)	0 001	(0 022)	0 021	(0.015)

Note Estimation uses 1985 NLSY weights rescaled to sample size Earnings divided by 10,000, government benefits divided by 100 Coefficients for the intercept, mother only, mother and stepmother, other family, siblings, foreign languages, mother's education, mother in labor force, magazines, newspapers, library card, religion infrequent, religion often, urban area, south, contraception laws, clinic availability and age at menarche estimated but not reported
*Significant at 1% level †Significant at 5% level. ‡Significant at 10% level. SE = Standard error.

completion appear to have little effect on teenagers' schooling and fertility decisions.

Evidence supporting sociological hypotheses of educational attainment and early fertility is stronger. The estimation results indicate that family background is an important determinant of early fertility and educational attainment. Specifically, nonintact family arrangements, more siblings, less parental education and less household access to reading materials appear to increase the chances of teen parenthood and decrease the

chances of high school completion. These results support theories which emphasize the roles of family stress, family economic circumstances and the implicit transmission of values. Two personal attributes, religiousness and physical maturity, also appear to be strong determinants of fertility and educational attainment.

Finally, the results suggest that there are important effects of race and ethnicity which are separate from the effects of other background variables. While the analysis cannot account for every possible background difference between black, Hispanic and white/other women, the evidence nonetheless supports cultural explanations of early fertility and high school completion.

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NOTES
1 These decisions are relevant to both women and men. However, because the consequences of teenage childbearing appear to fall hardest on women, this study focuses on their fertility and education decisions.
2 The adult outcomes associated with high school completion and teenage fertility are not universally accepted as consequences. Geronimus and Korenman (1991) present evidence that unobserved differences in family background may explain the outcomes generally associated with teenage fertility. Ribar (1992) questions the identifying assumptions used in previous analyses of causal relationships
3. This discussion abstracts from consideration by teenagers of the community's cost of providing education It also ignores decisions between attending public and private schools
4. This completion rate includes women who graduated from high school and who completed a General Equivalence Degree (GED) program. Mott and Marsiglio (1985) also reported separate graduation and GED rates.
5 Previous attempts to examine the causal relationships between fertility timing and educational attainment include Moore and Waite (1977), Moore *et al.* (1978), Rindfuss *et al.* (1980), Marini (1984), Olsen and Farkas (1989), Upchurch and McCarthy (1990) and Geronimus and Korenman (1991) Ribar (1992) provides a detailed evaluation of these studies.
6. The choice of 20 years of age is somewhat arbitrary. There is no reason to suppose that becoming a parent at 19 years, 364 days has a differential effect over becoming a parent at 20 years, 1 day One point is selected for convenience and set at 20 years for comparability with previous research
7 Earnings information is only available up to age 30 in the NLSY. The CPS earnings information is used because it includes observations on older women.
8. The 51 regressions are run on samples which range from 909 individuals in the smallest state to 8818 individuals in the largest state The average sample size for each state is 1871 individuals. Although there are statistically significant differences in the earnings of high school graduates and nongraduates in each state, the overall fit of the regressions is poor. The R^2 statistics in the states with the worst and best fits are 0.05 and 0 30, respectively The average R^2 is 0.12
9 These variables are similar to the opportunity cost measures used by Lundberg and Plotnick (1989).
10 More precisely, AFDC benefits may reduce the cost of nonmarital fertility
11 Background measures at other ages would be useful (see Wojtkiewicz, 1991) Unfortunately, many variables in the NLSY are only recorded as of age 14
12.The reported marginal effects of the kth independent variable on the probability of the Jth alternative *(aPpx,)* are obtained by computing estimates of the marginal effects for each individual in the sample and taking means of those effects. Greene (1990) details methods for calculating the marginal effects and the associated standard errors
13 Coefficient estimates for the noneconomic variables did not change appreciably in the respecifications and, therefore, do not appear in Table 4

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