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THE "WINDOW PROBLEM" IN STUDIES OF CHILDREN'S ATTAINMENTS:
A METHODOLOGICAL EXPLORATION

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ABSTRACT

Numerous studies of the determinants of children's attainments rely on observations of circumstances and events at age 14 as proxies for information over the entire childhood period. Using 21 years of panel data from the Michigan PSID on 825 children who were 14-16 years old in 1979, we evaluate the effects of using truncated or "window" (e.g., age 14) information in models of the determinants of attainments (e.g., education, nonmarital fertility) of young adults. Correlations between truncated and full-childhood variables are presented, along with 5 tests of the reliability of estimates based on "window" measurements. The tests are designed to evaluate the differential effects of data accuracy, multiple occurrence of events, duration of circumstances, and the timing of events or circumstances during childhood between "window" and full childhood information. We conclude that most of the standard truncated variables serve as weak proxies for multi-year information in such models, and draw the implications of these findings for future data-collection and research.

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I. Introduction

Numerous studies in the 1980s employed recently available longitudinal micro-data on families and individuals to estimate the effects of family circumstances and events early in an individual's life on his/her attainments later in life. The attainments analyzed included schooling, fertility behavior (especially, teen nonmarital births), welfare reciprocity, and labor market success. Hypotheses drawn from economics and sociology concerning the potential effect of various circumstances or events experienced by a child while growing up on the child's potential for later success or failure were tested. The circumstances or events included variables such as parental occupation and education, growing up in a mother-only family, a poor family, or a family receiving welfare, or experiencing a parental divorce or a geographic move.

In an ideal study of this sort, longitudinal information on a rich set of circumstances and events spanning the entire childhood period would be available for testing these hypotheses. However, many of the published studies relying on longitudinal data have not employed such long-duration childhood information. For example, in some prominent longitudinal data sets (e. g., the National Longitudinal Survey of Youths), collection begins with a sample of individuals at age 14; researchers using these data are constrained

from observing events and circumstances in the preadolescent period. In other cases, researchers desire to study outcomes later in life (e.g., attainments among 20-30 year olds). When longitudinal data are limited in the length of time over which they have been collected, older individuals may be chosen at the sacrifice of information on preadolescent circumstances. Because of either data limitations or researcher choice, then, information on these family, school, or neighborhood variables during a brief observation "window", often a single year, is used as a proxy for information spanning the entire childhood period.²

Several questions are pertinent to evaluating the reliability of estimates of the effects of the determinants of children's attainments that rely on variables based on "window" observations. The primary questions pertain to the accuracy of data reported, the multiple occurrence of events, the duration of circumstances, and the timing of events or circumstances during childhood.

-Is a single-year report on a family background or economic status (income) variable as accurate as, say, an average of multiple reports?

-Can a variable based on an observation "window" reliably capture the effect of events that might occur intermittently or with a low frequency throughout the childhood years (e.g., parental separations)?

-Can a "window" observation reliably measure the effects of circumstances that may be present over longer or shorter durations during childhood, and for which duration of occurrence may matter (e.g., living in poverty).

-Can a "window" observation reliably measure the effects of events or circumstances that may be present during particular periods of childhood, and for which the timing of occurrence matters (e.g., geographic moves in, say, early childhood)?³

By definition, variables specified by a "window" observation

sacrifice information relevant for assessing the effect of events and circumstances for which multiple occurrence, timing, and duration is relevant. The question, then, is one of statistical reliability and accuracy in measurement: How reliable (or accurate) are estimates of effects based on variables constructed from "window" information relative to estimates based on variables constructed from more complete longitudinal information?⁴

In this paper, we provide evidence on the reliability and accuracy of variables based on truncated observations of important childhood circumstance and events in empirical estimates of the determinants of children's success. Section II. describes our approach to answering this question, and the criteria that we use in assessing the accuracy of estimates that rely on variables based on window observations. Section III. provides our estimates and assessment; Section IV. concludes.

II. Methods and Criteria

Our assessment of the reliability of the estimates of effects in attainment models based on snapshot observations of parental situations rests on a series of "tests", all of which employ longitudinal data on a sample of nearly 2000 children. These data are taken from the Michigan Panel Study of Income Dynamics (PSID), and include children who were both aged 0-6 in 1968 and in the sample in 1989. For each child, detailed annual information on family background (age, race, one/two parents present, location, number of siblings), resources (family income, income source, adult labor supply, home ownership), and events (parental separation,

remarriage, change in geographic location) is recorded, and made specific to the age of the child. The attainments of these children in young adulthood is also known.

We employ a variety of comparisons and tests designed to estimate reliability in each of the dimensions noted in the questions above; no single test can answer the question in all dimensions. Our strategy is to present tests based on variety of viewpoints regarding the definition and interpretation of reliability.

First, we present a set of correlations between variables based on a "window" observation and alternative variables constructed from multiple years of longitudinal information. They indicate the extent to which the snapshot variables serve as accurate measures of the diverse and/or changing character of family situations at a point, or over a period, of time.

Second, we conduct a series of tests based on estimates of six single-equation probit models relating family background and family circumstance/event variables to each of two limited dependent variable outcomes--high school graduation and teen out-of-wedlock birth; three models are estimated for each of the two dependent variables.⁵ The three models specify a variety of family circumstances and events⁶ in different ways, enabling tests of the conformance of the estimates based on the "window" variable with estimates based on variables reflecting multiple occurrences of the circumstance or event, and their duration and timing. The circumstance/event variables subject to the tests for window-

reliability are specified as follows:

- number of occurrences (or years) of a circumstance or event for each of three childhood periods⁷ (three variables)
- number of occurrences (or years) of a circumstance of event for the age 6-14 period (one variable)
- occurrence of a circumstance or event at age 14 (the "window" variable)

Using these models, we undertake five tests or comparisons designed to assess the reliability of the single-year, age 14 measurement of these circumstance/event variables:

- Test 1: A likelihood-ratio test of the null hypothesis that adding information from the age 6-14 period to a specification including the age 14 window variable does not significantly improve the fit of the estimated model.
- Test 2: A sign-and-significance comparison in which the estimated coefficients on variables based on information from the age 14 window are compared with the estimated coefficients on the same variables measured over periods of varying length during the childhood period.
- Test 3: A comparison of the magnitude of the effects of simulated changes between those "window" and the multi-year variables which conform in terms of sign and statistical significance .
- Test 4: A test of the conformance between the implicit policy advice of the estimates based on "window" and multi-year variables.
- Test 5: A test of the ability of models using "window" variables to identify successful outcomes, relative to that of models relying on multi-year information.

III. Results

Correlations

Table 1 presents simple correlations between pairs of variables based on: 1) occurrence at age 14, 2) occurrence at any time during age 6-14 period, and 3) number of occurrences during age 6-14 period. The three measures reflect differences in multiple occurrences and duration. The variables are designated as

either circumstance or event variables; the former represent economic or parental circumstances at different points during the childhood period, the latter identify discrete changes occurring at different times. The correlations are estimated for the entire sample of observations.

Several comparisons are relevant. First, of the 13 correlations shown in Table 1, only 3 exceed .75; six are below .40, suggesting that a variable constructed from a one-year observation is generally a weak proxy for variables reflecting multiple, relatively rare, or transitory occurrences over the childhood period, and that such one-year reports are also less accurate than an average of multiple year reports.

Substantial differences in correlation coefficients are observed between the "event" and the "circumstance" variables. The age 14 window variable appears to capture circumstances more readily than events, and that is not surprising. Economic and family circumstances are rather persistent variables; observed family income relative to needs when a child is 14 is not likely to be greatly different than income/needs at other points during childhood.⁸ Conversely, the age 14 variable appears to be a rather poor proxy for events that do not occur regularly during the childhood years; the correlations for the event variables range from .27 to .40.

Moreover, the age 14 window variable tends to be more highly correlated with both event and circumstance variables that are measured in terms of multiple occurrences, rather than as dummy

variables. Again, this is not surprising; the more often during childhood that an event or circumstance occurs, the more likely that an observation at a particular age will capture it. Finally, variables that tend to change slowly or infrequently over time (e.g., family income/needs or living in a metropolitan area) are better proxied by an age 14 observation than those that may change with some frequency (e.g., being in poverty).

Tests of Comparability

Test 1--Likelihood Ratio Test

Table 2 presents the tests necessary to determine if estimation results from models that use variables reflecting the occurrence of circumstances and events over the childhood period provide significantly more information compared to models that use variables based on age 14 information. Test results are shown for both the Education and the Teen-out-of-Wedlock Birth outcomes.

For both of the outcomes, the tests indicate that models that include information over the childhood period yield estimates that are significantly different than those from models that include only the age-14 variables. This is the case both for models that add data over the entire 6-14 period, and those which add data for the three time periods separately.⁹

For the education outcome, the null hypothesis that there is no significant improvement from the addition of information over the childhood period to that observed at age 14 is rejected at the .10 (entire age 6-14 period) and .05 (three periods over age 6-14) significance levels. For the out-of-wedlock birth outcome, the

null hypothesis is rejected at the .05 and .01 significance levels, respectively.

Conversely, the likelihood ratio test indicates that estimates obtained from models that add the age 14 variables to the multi-year childhood information are not significantly different from those based only on the age 6-14 variables. These results suggest that information on duration and timing do matter but, that adding information from the age 14 measurement to that measured over ages 6-14 does not.

The final test, comparing the results using variables from the three time periods to those using variables reflecting the entire age 6-14 period, indicates a significant difference (at the 10% level) in the teen out-of-wedlock birth estimates, but not in the high school graduation estimates.

Test 2--Sign and Significance Comparison

In this comparison, the estimated coefficients on the age 14 event/circumstance variable are compared to coefficients on variables measured 1) during early childhood, ages 6-8, 2) during adolescence, ages 9-12, and 3) over the entire age 6-14 period.¹⁰ Hence, there are 15 comparisons for the education models (3 comparisons for each of 5 variables) and 18 for the out-of-wedlock birth models, for a total of 33 comparisons.

We conclude that the "window" and the multi-year variable do not convey the same information regarding "effects":

If, at the .2 level of significance, either the two coefficients have different signs or the coefficients have the same sign but only one of them is statistically significant.¹¹

Table 3 presents the 33 possible comparisons, and indicates those for which conformance is judged to exist. In 11 of the 15 possible comparisons for the high school graduation models, the age-14 variable is judged to yield statistically comparable information to that of the multi-year variables. In the out-of-wedlock birth models, however, conformance among the pairwise comparisons is far weaker. In only 7 of the 18 comparisons is our sign-and-significance test met. Overall, the test is passed in only slightly more than one-half of the possible cases (18 of 33).

Of the 18 cases in which conformance is observed, 6 show conformance because neither of the coefficients has statistical significance at the .2 level or less. In but 12 of the 33 cases do both the age-14 and multi-year variables have statistical significance at the .2 level. Eight of these 12 same-signed and significant comparisons are in the education estimates.

Test 3--Magnitude of Simulated Effect Test

This comparison concerns the implications for policy of the results from the 33 age-14 vs. multi-year pairwise comparisons. For those 12 cases in which the coefficients both have the same sign and are statistically significant at the .2 level, we compare the magnitude of the effect on the dependent variable of equivalent, one standard deviation simulated changes in the age-14 and the multi-year independent variables. The results are presented in Table 4.¹²

If we accept as equivalent simulated effects that are within 2 percentage points of each other, we find that 9 of the 12 same-

signed and significant cases indicate similar quantitative effects. A more demanding criterion of a difference of no more than 1 percentage point indicates comparable quantitative effects in but 6 of the 12 cases.

Test 4--Conformance of Policy Advice Test

Here, we take the coefficient on the multiyear variable as providing the correct implicit advice regarding policy, and ask if the one-year, age-14 variable yields the same advice. We interpret a significance level of less than .2 as providing a weak basis for policy advice.

Using this standard, 18 of the 33 coefficients based on multi-year variables indicate that policy intervention would effect the outcome with .8 confidence or more. Only 12 of the 33 age-14 coefficients have the same sign as the multi-year variables and meet the .8 confidence test. Stated alternatively, in one-third (6 of 18) of the cases in which policy action would seem warranted, the window observation fails to provide this advice.

Test 5--Identification of Successful Outcomes Test

An important criterion in appraising an estimated limited dependent variable model is its ability to accurately identify the occurrences of an event that are observed in the data. The models that we have estimated using variables constructed from age 6-14 information yield substantially more accurate identifications than do the models using the age-14 variables. For the high school graduation model, those not-graduating are correctly identified only 10 percent of the time in the models using the age 14

variable; models relying on information over the age 6-14 period correctly identify nearly 21 percent of the dropouts. In the teen out-of-wedlock birth model, the comparable percentages are 7 and 25, respectively.

IV. Conclusion

This exploration has yielded rather discouraging results regarding the accuracy of single-year window observations (relative to averages of multi-year observations) and the reliability of empirical estimates based on such window variables. We conclude that, in general, single-year "window" variables serve as weak proxies for multi-year information recorded over the life of the child.¹³

Clearly, then, important information is lost when circumstances or events observed in but a single year are used to represent the complex and changing environment in either a different developmental period, or over a longer period of time. Those estimates in the published literature based on one-year window observations should be interpreted very carefully. They may inaccurately reflect the effect of circumstances and events in but the single year of observation; they often provide biased and misleading estimates of the effects of a child's environment over a longer, or for a different, period of time.

These results also highlight a basic issue of data collection in the social sciences. Our results suggest a high priority for the collection of longitudinal information on individuals and families extending over the entire period of childhood. Such

efforts are extremely costly, however, and require long periods of observation before data is ripe for analysis. An alternative might be the compilation of retrospective information on parental situations at various points during childhood from respondents who are children. While the costs of the latter strategy are smaller, the ability to accurately capture correctly-timed information on important aspects of parental circumstances and events through this strategy is weaker. In any case, the importance of the process which determines whether children succeed or fail in later life--and of the role that family resources, stressful events, and general environment play in this process--suggests that careful attention be paid to developing data that will permit reliable estimates of the effect of important environmental, family, and individual variables on attainments.

Table 1

Representative Correlations;
Age 14 Variables and Variables Reflecting Age 6-15 Observations
N=825

EVENTS

Parental Separations:

	Ever Separated ages 6-15	Total Separations ages 6-15
Separated at age 14	.32	.40

Parental Remarriages:

	Ever Remarried ages 6-15	Total Remarriages ages 6-15
Remarried at age 14	.27	.25

Geographic Moves:

	Ever Moved ages 6-15	Total Moves ages 6-15
Moved at age 14	.27	.28

cont'd

CIRCUMSTANCES

In Poverty:

	Ever Poor ages 6-15	Years Poor ages 6-15
Poor at age 14	.51	.74

Income-to-Needs Ratio:

	Average Income/Needs ages 6-15
Income/needs at age 14	.88

Live in Urban Area:

	Ever Live in SMSA ages 6-15	Years Lived in SMSA ages 6-15
Live in SMSA age 14	.83	.96

Mother Worked:

	Mother Ever Worked ages 6-15	Years Mother Worked ages 6-15
Mother worked when child age 14	.48	.71

Table 2

**Likelihood Ratio Tests of Hypothesis that Variables Based on
Multi-year Information Add No Relevant Information to that
Based on Age 14 Window Information**

High School Graduation

	Likelihood Ratio	Degrees of Freedom
A. Model Based on Age 14 Window Variables	-389.66	24
B. Model Based on Ages 6-14 Variables	-386.62	24
C. Model Based on Three Age-period Variables	-382.27	34
D. Model Based on Age 14 Window Variables and Ages 6-14 Variables	-383.15	31
E. Model Based on Age 14 Window Variables and Three Age-period Variables	-376.96	39
	Significance Level	
Test 1--A. vs. D.	< .10	
Test 2--B. vs. D.	< .50	
Test 3--A. vs. E.	< .05	
Test 4--B. vs. E.	< .25	
Test 5--B. vs. C.	< .50	

Teen Out-of-Wedlock Birth

	Likelihood Ratio	Degrees of Freedom
A. Model Based on Age 14 Window Variables	-136.48	14
B. Model Based on Ages 6-14 Variables	-132.51	14
C. Model Based on Three Age-period Variables	-123.17	26
D. Model Based on Age 14 Window Variables and Ages 6-14 Variables	-128.96	21
E. Model Based on Age 14 Window Variables and Three Age-period Variables	-119.55	31
	Significance Level	
Test 1--A. vs. D.	< .05	
Test 2--B. vs. D.	< .50	
Test 3--A. vs. E.	< .01	
Test 4--B. vs. E.	< .25	
Test 5--B. vs. C.	< .10	

Table 3
Comparability of Age 14 and Multi-year Coefficients

<u>Education</u>		<u>Out-of-Wedlock Birth</u>
Years in Poverty	Average Ratio of Income to Needs	
-Ages 6-8	NC	NC
-Ages 12-14	NC	-
-Ages 6-14	-	-
Years Living in SMSA	Years Living in SMSA	
-Ages 6-8	-	+
-Ages 12-14	NC	NC
-Ages 6-14	-	+
Number of Parental Separations	Number of Parental Separations	
-Ages 6-8	0	NC
-Ages 12-14	0	NC
-Ages 6-14	0	NC
Years Mother Worked	Years Receiving Welfare	
-Ages 6-8	NC	NC
-Ages 12-14	+	0
-Ages 6-14	+	0
Number of Geographic Moves	Number of Geographic Moves	
-Ages 6-8	-	NC
-Ages 12-14	-	NC
-Ages 6-14	-	0
	Years Living with One Parent	
-Ages 6-8		NC
-Ages 12-14		NC
-Ages 6-14		NC

NC = Not Comparable

- = Coefficients both negative and significance < .2

+ = Coefficients both positive and significance < .2

0 = Neither coefficient significance < .2

Table 4

**Simulated Effects of Changes in Circumstance/Event
Variables Passing Sign/Significance Test**

Education

(Base Percentage = 77.0)

	Age 14 Observation	Multiyear Observation
Years in Poverty, Ages 6-14	-2.09	-4.10
Years Living in SMSA, Ages 6-8	-2.66	-8.09
Years Living in SMSA, Ages 6-14	-2.66	-2.44
Years Mother Worked, Ages 12-14	+3.47	+2.40
Years Mother Worked, Ages 6-14	+3.47	+2.61
Number of Geographic Moves, Ages 6-8	-3.88	-3.52
Number of Geographic Moves, Ages 12-14	-3.88	-2.26
Number of Geographic Moves, Ages 6-14	-3.88	-5.10

Out-of-Wedlock Birth

(Base Percentage = 13.7)

Average Ratio of Income to Needs, Ages 12-14	-1.50	-1.46
Average Ratio of Income to Needs, Ages 6-14	-1.50	-1.49
Years Living in SMSA, Ages 6-8	+2.80	+7.15
Years Living in SMSA, Ages 6-14	+2.80	+2.76

Appendix A

Recent Studies of the Determinants of Children's Attainments Relying on a Limited Window of Observation of Childhood Circumstances and Events

The following are a selection of studies which analyze the influence of family events and circumstances on children's achievements, in which the measurement of the events and circumstances is for a truncated period (often one year) sometime during the child's adolescent years. The studies are limited to those that have been published since 1980.

1. Brooks-Gunn, Jeanne, Greg J. Duncan, Pam Kato, and Naomi Sealand. 1991. "Do Neighborhoods Influence Child and Adolescent Behavior." draft mimeo.

The PSID sample focuses on 1800 black and white women who were observed between ages 14 and 18. Hence, the neighborhood variables, the welfare ratio, and whether or not the family was headed by the mother were all observed when the women were aged 14. The outcomes were dropping out of school and teen out of wedlock birth.

2. Crane, Jonathan. 1991. "The Epidemic Theory of Ghettos and Neighborhood Effects on Dropping Out and Teenage Childbearing." American Journal of Sociology, 96(5), March, 1226-59.

Has a sample of 113,997 16-19 year olds and observes family income, head's occupational status, household structure, and family size at the age of the child when teen childbearing and dropping out of high school were observed. The data are cross section data.

3. Datcher, Linda. 1982. "Effects of Community and Family Background on Achievement." Review of Economics and Statistics, 64, 32-41.

Has a sample of males aged 13-22 in 1968, and used family data as of 1968. Family income, family size, parental expectations, receipt of transfer income, Zipcode variables, and some psychosocial variables are all subject to the window problem. These variables were measured for males who were ages 13-22 in 1968, and then these males were observed in 1978.

4. Corcoran, M., and R. Gordon, D. Laren, and G. Solon. 1987. "Intergenerational Transmission of Education, Income and Earnings." Unpublished manuscript. University of Michigan, Ann Arbor.

The same sort of data set as Datcher, but the individuals on

the PSID were aged 10-17 in 1968. Again, family background and neighborhood variables were observed for the observations at these ages.

5. Mayer, Susan. 1991. "The Effect of Schools' Racial and Socioeconomic Mix on High School Students' Chances of Dropping Out." Unpublished paper. Northwestern University.

Her data are for 26,321 students in the 10th grade, and hence about 15 years old. Parental characteristics included father's occupation, whether they owned their home, had 2 or more cars and a dishwasher, and whether or not the family was headed by the mother.

6. Mare, Robert. 1980. "Social Background and School Continuation Decisions." Journal of the American Statistical Association. 75(370), 295-305.

Control variables were family income, father's occupational status, and living on a farm, all when the youth was 16.

(On page 296 he has some interesting language regarding the limitations of these age 16 variables and their problems.)

7. McLanahan, Sara. 1985. "Family Structure and the Reproduction of Poverty." American Journal of Sociology. 90(4), 873-901.

The data is from the PSID, 1978 wave, and consists of respondents who were 17-27 in 1978. A wide variety of family variables were measured for the individual as of his/her age 17, including parents' marital status, years since marital disruption, region of residence, city size, family welfare ratio, mother's employment status, and family welfare receipt.

8. Astone, Nan Marie, and Sara McLanahan. 1991. "Family Structure and High School Completion: The Role of Parental Practices." American Sociological Review. 56, 309-320.

They use a sample of 58,000 students in the High School and Beyond Study who were sophomores in 1980. The parental psychosocial variables, family structure, change in family structure, father's occupation, family income, household possessions, region, urban-rural location were all observed for the sophomore year, or when the children were about 16 years old.

9. Case, Anne, and Lawrence Katz. 1991. "The Company You Keep: The Effects of Family and Neighborhood on Disadvantaged Youths." Unpublished paper. Harvard University.

The use data on the 1989 NBER Boston Youth Survey, containing information on 1200 youths aged 17-24 in high

poverty areas in innercity Boston. Some of the family background variables were measured at age 14 (father or mother present, parents not married) but others were measured at time of survey so that the youths would be 17-24. These include living arrangements, in public housing, family income of others in the household.

10. Hauser, Robert, and William Sewell. 1986. "Family Effects in Simple Models of Education, Occupational Status, and Earnings: Findings from the Wisconsin and Kalamazoo Studies." Journal of Labor Economics. 4(3), S83-S115.

Uses the Wisconsin High School data, a random sample of about 10,000 high school seniors in 1957. The data on family income was for the year of the survey, as was information on students' aspirations, number of siblings, father's occupation, and marital status--hence, measured when the children were about 18 years old. The same must be true of all of the previous studies using the Wisconsin data.

11. Sewell, William, Robert Hauser, and Wendy Wolf. 1980. "Sex, Schooling and Occupational Status." American Journal of Sociology. 86(3), 551-583.

See comments on 10. This paper also contains numerous references to other studies done with the Wisconsin data.

12. Manski, Charles, Gary Sandefur, Sara McLanahan, and Daniel Powers. 1990. "Alternative Estimates of the Effect of Family Structure During Adolescence on High School Graduation." Journal of the American Statistical Association. 87(417), 25-37.

This study uses the NLSY, and uses individuals aged 14-17 in 1979. Variables include family structure at age 14 and region of residence at age 14. The authors are clear that they are trying to measure the effects of these background characteristics when the children were adolescents. Still there is but one year of observation designed to capture the entire period.

13. Duncan, Greg, and Saul Hoffman. 1990. "Welfare Benefits, Economic Opportunities, and Out-of-Wedlock Births Among Black Teenage Girls." Demography, 27(4), 519-535.

PSID data used on 874 black women beginning at age 14. Family background statistics measured at age 14 include region, city size, family welfare reciprocity, family income, single parent family, and number of persons in the household.

14. Duncan, Greg, and Saul Hoffman. 1990. "Teenage Welfare Receipt

and Subsequent Dependence Among Black Adolescent Mothers." Family Planning Perspectives. 22(1), 16-20, 35.

A wide variety of family background variables, including family income, region, city size, and welfare reciprocity were measured when the girl was age 14.

15. Hogan, Dennis, and Evelyn Kitagawa. 1985. "The Impact of Social Status, Family Structure, and Neighborhood on the Fertility of Black Adolescents." American Journal of Sociology. 90(4), 825-55.

Data on about 1000 black girls in Chicago aged 13-19 in 1979. Many independent variables, including parental occupational status, parental labor force and employment status, family income, and housing characteristics, were measured as of the time of the survey, hence the girls were aged 13-19.

16. McLanahan, Sara, and Larry Bumpass. 1988. "Intergenerational Consequences of Marital Disruption." American Journal of Sociology. 94, 130-152.

Uses the National Survey of Family Growth of 1982 with interviews of about 8000 women 15-44. Family structure and region were measured when the girl was age 14, but a number of other variables were based on recall of events and circumstances earlier in the girls' childhood, allowing the authors to address timing issues to some extent.

17. Antel, John. 1988. "Mother's Welfare Dependency Effects on Daughters' Early Fertility and Fertility Out of Wedlock." Unpublished paper. University of Houston.

Sample was girls 18 years or less in 1979, and the data from the NLSY was collected in 1978. A variety of family variables, including welfare receipt, state welfare benefit levels, geographic move in 1978, local unemployment rate, and urban-rural, were used in the analysis.

18. Lundberg, Shelley, and Robert Plotnick. 1990. "Effects of State Welfare, Abortion, and Family Planning Policies on Premarital Childbearing Among White Adolescents." Family Planning Perspectives. 22(6), 246-51, 275.

This study uses the NLSY, and while the main emphasis is on the effects of state policies, a variety of family background variables are used as controls, including living with single parent, number of siblings, mother's work, region, and religiosity, and all of these are measured at age 14.

19. Ribar, David. 1991. "A Multinomial Logit Analysis of Teenage Fertility and High School Completion." Unpublished paper, Pennsylvania State University.

Used the NLSY to analyze this outcome, and hence had family background and events variables measured at age 14. These include family structure, number of siblings, mother's working, father's working, region, urban-rural, religiosity, and magazines, newspapers, and library card.

20. Krein, Sheila. 1986. "Growing up in a Single Parent Family: The Effect on Education and Earnings of Young Men." Family Relations, 35, 161-168.

Uses the NLS, but makes efforts to record certain family structure events over the lifetime. However, family income is measured in high school years and region is of date of interview, hence at age 14 at the earliest.

21. Greenberg, D. and D. Wolf. 1982. "The Economic Consequences of Experiencing Parental Marital Disruption." Children and Youth Services Review. 4, 141-62.

Family structure and other background variables measured at ages 15-17.

22. Duncan, Greg, Martha Hill, and Saul Hoffman. 1988. "Welfare Dependence Within and Across Generations." Science. 239(January), 467-471.

Using data from the PSID on 1085 daughters aged 13-15, in which the economic status of the parents and their welfare reciprocity was observed at the time the girls were 13-15.

Appendix B

Alternative Probit Estimates of the Effects of Family Background, Circumstances and Events on High School Graduation and Teen Out-of-Wedlock Birth: Varying Periods of Circumstances/ Events Observation

High School Graduation

Variable	Coefficient	T-Statistic
One	-0.64E-1	-0.16

Non-Time Varying Variables

Nonwhite = 1	0.23	1.27
Female = 1	-0.32	-1.98
Nonwhite x Female	0.28	1.31
Catholic	0.85	3.51
Jewish	5.14	0.02
Protestant	0.57	2.75
Head Foreign Born	-0.34	-1.25
Father High School Graduate	0.33	2.17
Father Some College	0.35	2.26
Father College Graduate	0.62	2.81
Mother High School Graduate	0.29	2.00
Mother Some College	0.57	1.98
Mother College Graduate	1.18	2.35
One Parent in 1968	0.90E-1	0.51
No Parents in 1968	0.28	0.92
Number of Siblings	0.28	0.71
Preschool Child Care Time	0.16	0.14

Time-Varying Variables

Years in Poverty, Ages 6-8	-0.75E-1	-1.10
Years in Poverty, Ages 9-11	-0.25E-1	-0.33
Years in Poverty, Ages 12-14	-0.45E-1	-0.66
Years in Poverty, Ages 6-14	[-0.52E-1]	[-2.12]
In Poverty at Age 14	[[-0.19]]	[[-1.33]]
Years in SMSA, Ages 6-8	-0.22	-2.21
Years in SMSA, Ages 9-11	0.26	1.71
Years in SMSA, Ages 12-14	-0.12	-0.98
Years in SMSA, Ages 6-14	[-0.23]	[-1.54]
In SMSA at Age 14	[[-0.21]]	[[-1.73]]

Number of Parental		
Separations, Ages 6-8	-0.20	-1.14
Number of Parental		
Separations, Ages 9-11	0.76E-1	0.40
Number of Parental		
Separations, Ages 12-14	0.51	0.24
Number of Parental		
Separations, Ages 6-14	[-0.33E-1]	[-0.29]
Parents Separated at Age 14	[[0.19]]	[[0.58]]
Years Mother		
Worked, Ages 6-8	-0.23E-3	-0.00
Years Mother		
Worked, Ages 9-11	0.15E-1	0.23
Years Mother		
Worked, Ages 12-14	0.73E-1	1.31
Years Mother		
Worked, Ages 6-14	[0.31]	[1.74]
Mother Worked at Age 14	[[0.28]]	[[2.42]]
Number of Location		
Moves, Ages 6-8	-0.17	-2.35
Number of Location		
Moves, Ages 9-11	-0.34E-1	-0.44
Number of Location		
Moves, Ages 12-14	-0.12	-1.53
Number of Location		
Moves, Ages 6-14	[-0.11]	[-3.41]
Moved Location at Age 14	[[0.41]]	[[2.87]]

Log-Likelihood = -382.27

N = 825

Note: The coefficients and T-Statistics shown for the Non-Time Varying Variables are from the Probit with time-varying variables measured in period-specific form.

[....] = Coefficients and T-Statistics from Probit with time-varying variables measured over years 6-14, in place of period-specific variables.

[[....]] = Coefficients and T-Statistics from Probit with variable measured at age 14, in place of period-specific variables.

Teen Out-of-Wedlock Birth

Variable	Coefficient	T-Statistic
One	-0.83	-1.10
<u>Non-Time Varying Variables</u>		
Nonwhite = 1	0.29	1.20
Any Religion = 1	-0.24	-0.64
Number of Siblings	-0.19	-0.29
Mother's Age at First Birth	-0.37E-2	-0.17
Mother a High School Graduate = 1	-0.71	-3.13
Mother had Out-of-Wedlock Birth	0.35	1.28
Bad Neighborhood in 1976	-0.49	-0.71
<u>Time-Varying Variables</u>		
Average Income-to-Needs Ratio, Ages 6-8	-0.20	-0.90
Average Income-to-Needs Ratio, Ages 9-11	0.15	0.59
Average Income-to-Needs Ratio, Ages 12-14	-0.333	-1.56
Average Income-to-Needs Ratio, Ages 6-14	[-0.33]	[-2.26]
Income-to-Needs Ratio at Age 14	[[-0.33]]	[[-2.94]]
Number of Location Moves, Ages 6-8	0.28	2.21
Number of Location Moves, Ages 9-11	0.13	0.93
Number of Location Moves, Ages 12-14	-0.24	-1.51
Number of Location Moves, Ages 6-14	[0.62E-1]	[1.14]
Moved Location at Age 14	[0.26]	[1.07]
Number of Parental Separations, Ages 6-8	0.43	1.43
Number of Parental Separations, Ages 9-11	0.22	0.68
Number of Parental Separations, Ages 12-14	0.74	2.05
Number of Parental Separations, Ages 6-14	[0.50]	[3.01]
Parents Separated at Age 14	[[-0.36]]	[[-0.01]]

Years Receiving		
Welfare, Ages 6-8	0.37	2.62
Years Receiving		
Welfare, Ages 9-11	-0.24	-1.45
Years Receiving		
Welfare, Ages 12-14	-0.73	-0.05
Years Receiving		
Welfare, Ages 6-14	[0.13E-1]	[0.34]
Receiving Welfare		
at Age 14	[[-0.16]]	[[-0.69]]
Years in SMSA, Ages 6-8	0.31	1.71
Years in SMSA, Ages 9-11	-0.37	-1.23
Years in SMSA, Ages 12-14	0.23	0.89
Years in SMSA, Ages 6-14	[0.41]	[1.55]
In SMSA at Age 14	[[0.34]]	[[1.60]]
Years Living with		
One Parent, Ages 6-8	-0.28	-1.88
Years Living with		
One Parent, Ages 9-11	0.21	1.23
Years Living With		
One Parent, Ages 12-14	0.72E-1	0.52
Years Living With		
One Parent, Ages 6-14	[0.34]	[0.99]
Living With One Parent		
at Age 14	[[0.59]]	[[2.55]]

Log-Likelihood = -122.93

N = 431

Note: The coefficients shown for the Non-Time Varying Variables
are from the Probit with time-varying variables
measured in period-specific form.

[.....] = Coefficients and T-Statistics from Probit with time-
varying variables measured over years 6-14, in place of
period-specific variables.

[[.....]] = Coefficients and T-Statistics from Probit with
variable measured at age 14, in place of period-
specific variables.

Appendix C

Means and Standard Deviations of Variables Used in Probit Equations

Variable	High School Graduation	Teen Out- of-Wedlock Birth
	Mean (Standard Deviation)	Mean (Standard Deviation)
<u>Non-Time Varying Variables</u>		
Race (black = 1	0.50 (0.50)	0.30 (1.20)
Female = 1	0.52 (0.50)	
Nonwhite x Female	0.28 (0.45)	
Religion (any religion = 1)		-0.24 (-0.64)
Catholic	0.15E-1 (0.12)	
Jewish	0.72 (0.45)	
Protestant	0.21E-1 (0.14)	
Mother's Age at First Birth		-0.37 (-0.17)
Head Foreign Born	0.21 (0.41)	
Father High School Graduate	0.22 (0.41)	
Father Some College	0.93E-1 (0.29)	
Father College Graduate	0.93E-1 (0.29)	
Mother High School Graduate = 1		-0.71 (-3.13)
Mother High School Graduate	0.38 (0.48)	
Mother Some College	0.70E-1 (0.26)	
Mother College Graduate	0.02 (0.23)	

One Parent in 1968 (hence no education variable is available for either parent)	0.19 (0.40)	
No Parents in 1968 (hence no education variable is available for either parent)	0.37E-1 (0.19)	
Mother Out-of-Wedlock Birth = 1		0.35 (1.28)
Number of Siblings	2.66 (1.63)	
Preschool Child Care Time (Total number of hours allocated to child care in preschool years, ages 4 and 5)	2146.90 (676.98)	
Bad Neighborhood in 1976 ¹		-0.49E-1 (-0.71)

Time-Varying Variables

Years Child Lived in Family whose Income below the Matched Poverty Line for Year = 1	
Years in Poverty, Ages 6-8	0.78 (1.13)
Years in Poverty, Ages 9-11	0.64 (1.06)
Years in Poverty, Ages 12-14	0.64 (1.05)
Years in Poverty, Ages 6-14	2.06 (2.86)
In Poverty at Age 14	0.20 (0.40)

¹The sum of positive responses to: 1) burglaries and robberies, 2) muggings, rapes, pushers, junkies, or too few police, 3) crowded area with too many people, too much noise, and bad traffic, 4) a poor neighborhood for kids, or 5) unkept yards, grounds, houses poorly kept up, or infrequent or sloppy garbage pickups being a problem in the neighborhood.

Average Income-to-Needs Ratio
(Average over Specified
Ages of the Ratio of
Family Income to the
Matched Poverty Line)

Average Income-to-Needs Ratio, Ages 6-8	2.06 (1.56)
Average Income-to-Needs Ratio, Ages 9-11	2.31 (1.73)
Average Income-to-Needs Ratio, Ages 12-14	2.56 (1.99)
Average Income-to-Needs Ratio, Ages 6-14	2.31 (1.69)
Income-to-Needs Ratio at Age 14	2.72 (2.34)

Years Child Lived in SMSA
that Year = 1

Years in SMSA, Ages 6-8	2.18 (1.28)	2.21 (1.27)
Years in SMSA, Ages 9-11	2.15 (1.32)	2.19 (1.30)
Years in SMSA, Ages 12-14	2.15 (1.34)	2.18 (1.32)
Years in SMSA, Ages 6-14	6.47 (3.82)	6.58 (3.77)
Lived in SMSA at Age 14	0.71 (0.45)	0.72 (0.45)

Number of Parental Separations
(parents of child
separated or divorced
in that year = 1)

Number of Parental Separations, Ages 6-8	0.08 (0.28)	0.09 (0.30)
Number of Parental Separations, Ages 9-11	0.09 (0.29)	0.09 (0.30)
Number of Parental Separations, Ages 12-14	0.06 (0.25)	0.06 (0.25)
Number of Parental Separations, Ages 6-14	0.23 (0.47)	0.25 (0.49)
Parents Separated at Age 14	0.03 (0.16)	0.03 (0.16)

Number of Years Mother
Worked (mother worked
outside the home
in that year =1)

Years Mother	1.58
Worked, Ages 6-8	(1.29)
Years Mother	1.63
Worked, Ages 9-11	(1.33)
Years Mother	1.77
Worked, Ages 12-14	(1.30)
Years Mother	4.98
Worked, Ages 6-14	(3.37)
Mother Worked at Age 14	0.59
	(0.49)

Number of Location Moves
(change in household
location of the family
in that year = 1)

Number of Location	0.56	0.50
Moves, Ages 6-8	(0.77)	(0.75)
Number of Location	0.52	0.51
Moves, Ages 9-11	(0.76)	(0.74)
Number of Location	0.38	0.37
Moves, Ages 12-14	(0.69)	(0.66)
Number of Location	1.46	1.38
Moves, Ages 6-14	(1.64)	(1.57)
Moved Location at Age 14	0.13	0.13
	(0.34)	(0.34)

Number of Years Lived
with One Parent (living
with one parent in
that year = 1)

Years Lived with One	0.68
Parent, Ages 6-8	(1.20)
Years Lived with One	0.80
Parent, Ages 9-11	(1.27)
Years Lived with One	0.89
Parent, Ages 12-14	(1.32)
Years Lived with One	2.35
Parent, Ages 6-14	(3.51)
Lived with One Parent	0.31
at Age 14	(0.46)

Number of Years Family
 Received Welfare (family
 receiving welfare in
 that year = 1)

Family Welfare	0.35
Reciency, Ages 6-8	(0.86)
Family Welfare	0.41
Reciency, Ages 9-11	(0.96)
Family Welfare	0.46
Reciency, Ages 12-14	(0.96)
Family Welfare	1.22
Reciency, Ages 6-14	(2.50)
Family Welfare Reciency	0.15
at Age 14	(0.36)

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Endnotes

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2. A survey of such research studies since 1980 (Appendix A) reveals that most employ observations on the individuals studied at age 14, though in some cases even later.

3. The importance of these "timing" effects has been emphasized by both developmental psychologists and sociologists. See, for example, Alwin and Thornton (1984), Krein (1986), and Wallerstein and Kelly (1986). Alwin and Thornton find it difficult to distinguish differential effects of early childhood and later childhood family influences on schooling experiences. The high degree of intertemporal correlation among many of their explanatory variables (e.g., parental education and occupation, family assets and income) constrain their efforts. For variables with less intertemporal stability, they find greater differences between early and later family influences.

4. This issue is also addressed by Cherlin and Horiuchi (1980), and more recently by Wu and Martinson (1990). Wu and Martinson document the diversity in family situations among children from parent history of respondents, concluding that "snapshot measures understate greatly the complexity of parental situation".

5. The sample used for the estimates includes the children who are aged 14-16 in 1979 (age 3-5 in 1968). There are 825 children in the sample used for the high school graduation estimate, of whom 635 graduated. The sample used for the out-of-wedlock birth estimate includes 431 females, of whom 59 gave birth as a teen. The specification of the models follows that of Haveman, Wolfe, and Spaulding (1990) and An, Haveman, and Wolfe (1991). The estimated models are shown in Appendix B. Definitions of the variables, and their means and standard deviations are shown in Appendix C. The family background variables are invariant across the education and out-of-wedlock birth models, and include race, gender, mother's age at first birth, whether or not mother had an out-of-wedlock birth, neighborhood quality, religion, father foreign born, father and mother education, number of siblings, and child care time received over childhood years.

6. The circumstance/event variables are:

High School Graduation
-Years in Poverty

Teen Out-of-Wedlock Birth
-Average Ratio of

	Income to Needs
-Years Living in SMSA	-Years Living in SMSA
-Number of Parental Separations	-Number of Parental Separations
-Years Mother Worked	-Years Receiving Welfare
-Number of Geographic Moves	-Number of Geographic Moves
	-Years with One Parent

7. The three observation periods are: 1) the early childhood period, ages 6-8, 2) the middle childhood period, ages 9-12, and 3) the adolescent period, ages 12-14.

8. The correlation between an income variable measured at a single point in time with its average over nine years can be viewed as a measure of accuracy of data reported at a point in time. The .88 correlation for the income-to-needs ratio fits within the range observed in other studies. Other researchers have found correlations of from .61 to .94 comparing responses to a single question on circumstance variables asked at widely separate occasions. See Bielby, Hauser and Featherman (1977) who used 1973 OCG data and Hauser and Sewell (1986) who used Wisconsin and Kalamazoo data. In the 1977 study, correlations of .87 and .94 are reported for repeated questions of parental schooling and occupational prestige among white men, and .64 and .92 among black men. In the 1986 study, correlations of .73 to .78 for replies to questions on father's schooling, and .61 to .75 to questions regarding father's occupational status, are reported.

9. The former is a somewhat constrained version of the latter, in which the effects of duration are equated over the three age periods.

10. The estimates (and subsequent simulations) of the effects of the early childhood and adolescent variables are from probit equations including observations for all three of the childhood time periods. The estimates of the effects of the non-time-varying variables in Appendix B are from the specification including the three period-specific, time-varying variables. In virtually no case did the significant (at the .05 level) coefficients on the variables shown become insignificant in the alternative specifications; similarly, none of the insignificant coefficients shown became significant.

11. The .2 level of significance is an arbitrarily chosen level; however, use of an alternative level such as .25 does not substantially change the results.

12. For example, the first row indicates that increasing the poverty variable as measured at age 14 window by one standard deviation would reduce the probability of graduating high school by .021 (from .770 to .749, or by a little more than two percentage

points). Increasing the same variable recorded over the years 6-14 would reduce the probability of graduating high school by .041 (from .770 to .729, or by more than four percentage points).

13. For example, in only 18 of the 33 cases did the pairwise comparisons pass our sign/significance test. In only 3 of the 11 cases in which the age-14 variable substitutes for the multi-year variable during the early childhood (age 6-8) period is this test passed, and in but 5 of the 11 cases in which the age-14 variable proxies for information during the adolescent (age 12-14) period. However, when the window variable serves as a proxy for full information over the entire age 6-14 childhood experience, the test is passed in 9 of 11 cases.