Online Appendix to "The Impact of Family Income on Child Achievement: Evidence from the Earned Income Tax Credit"

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June 29, 2011

This document is a companion online appendix to "The Impact of Family Income on Child Achievement: Evidence from the Earned Income Tax Credit." It contains a description of the Children of the NLSY data and measures of school accountability and welfare reform used in the paper. It also reports first- and second-stage coefficient estimates for all variables in specifications from Tables 3 and 5 of the paper.

1 Description of Children of the NLSY Data

Child Characteristics

Most child characteristics are taken directly from the Children of the NLSY survey responses in even numbered years from 1986 to 2000. PIAT math and reading tests were administered biennially primarily to children ages five to fourteen.[1] We create normalized measures of PIAT math and reading using the standardized scores. These scores are initially normed by the NLSY based on a random sample of children in 1968 to have a constant mean (100) and standard deviation (15) for each age. For interpretation purposes, we re-normalize math, reading recognition, and reading comprehension scores by subtracting the sample mean from the NLSY random sample and then dividing by the sample standard deviation. This produces individual test scores with a mean of zero and standard deviation of one for the random sample of respondents. To create a combined math-reading score, we average the normalized math and reading measures and then re-normalize to a mean of zero and standard deviation of one (based on the random sample).

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[1] Many children ages 5-7 do not have valid scores for the reading recognition test, because their scores were out of range based on the national norming sample in 1968. Starting in 1994, the tests were given only to children who had not reached their 15th birthday by the end of the calendar year. Around two percent of children took the PIAT tests after their 15th birthday before this rule was put in place. We include these children in our analysis, but the results are very similar if they are excluded. See the NLSY79 User's Guide for details.

Parental Characteristics

Most parental characteristics are taken directly from the NLSY. Additionally, we create an age-adjusted, normalized AFQT measure using the percentile scores based on the 1979 calculation. We first create a normalized value by subtracting off the mean from the random sample and dividing by the sample standard deviation. Then, we regress these normalized scores on age dummies and use the residuals from this regression as our adjusted AFQT measure. We also fill in missing values for education, marital status, and spousal age using observed values in surrounding years.

Family Income

We calculate total family income combining all available measures of income in the NLSY, deflating them using the annual CPI-U so that they are in year 2000 dollars. Because some of the income components are missing in one or more years, we use a detailed imputation procedure to maintain a large representative sample. (We note, however, that imputations play little role in estimation of our contemporaneous effects model; they are more important for models with lagged income. This is because income is only observed every other year after 1994, and models with lagged income require the odd-numbered years.) We begin by describing the available measures of family income from a battery of questions that vary slightly over time; then, we discuss imputation of missing values. Appendix A discusses details regarding the aggregation of these measures into total family income and determining EITC and tax amounts.

We utilize reported income of the respondent (i.e., the child's mother) and her spouse from the following sources: (i) wages, salary and tips (including income from military service); (ii) business and farm income; (iii) unemployment income; (iv) income from savings, net rental income, and social security income; (v) veteran benefits, worker compensation, and disability payments; (vi) welfare/AFDC, food stamps, Supplemental Security Income or other public assistance; and (vii) child support.

For all survey years (1979-1994, 1996, 1998, 2000), we impute each of these income sources separately based on the full panel of responses for individuals. Our different imputations largely reflect the relative importance of each income measure in computing total family income. Sources (i)-(iii) are imputed separately for the mother and her spouse, while all other sources are combined for both and imputed as a single measure. For wage, salary, and military income (source i), we use an individual-specific regression of income on age and age-squared to impute missing income observations. Only observations when an individual is age 22 or older are used in the regression,

and we only impute missing observations when at least 8 non-missing observations are available. To impute missing observations for sources (ii) and (iv), we use individual-specific regressions of income on age (only using observations when an individual is age 22 or older and requiring at least 6 non-missing values). To impute missing observations for all other sources, we use individual-specific means (for ages 22 or older when at least four non-missing values are available). For non-survey years 1995, 1997, and 1999, we impute each income source as the average of adjacent year reports. (These 'odd year' imputations are only used in the dynamic specifications of Tables 2 and 5 of the paper.) More detailed notes on the imputation procedure are available from the authors upon request.

We trim the sample to exclude the approximately 1% of observations with two-year after-tax total income changes of greater than $40,000 in absolute value (in year 2000 dollars). We note that welfare income measures in the NLSY sometimes show implausibly large jumps across surveys. Therefore, we further trim the 11% of observations with welfare changes exceeding $2,500 (in absolute value) if there is not a corresponding change in earned income (of the opposite sign) that is at least as large. Modest changes in these trimming rules have little effect on our estimates; however, failure to trim at all greatly reduces the precision of our estimates. For example, trimming observations with welfare changes exceeding $4,000 (in absolute value) without a corresponding change in earned income trims 7.5% of observations and yields similar results compared to the baseline IV estimates: the effect of income on combined math-reading achievement is 0.066 (s.e.=.027) versus 0.061 (s.e.=.023) in Table 3 of the paper.

2 State-level School Accountability and Welfare Reform Measures

Our measures of accountability and welfare reform are taken from Appendix Table A2 of Miller and Zhang (2009). Their accountability measures are largely due to Hanushek and Raymond (2005), who distinguish between 'consequential' accountability, which attaches consequences to school performance, and 'report card' accountability, which simply provides public report cards for schools. Their data reports three states as introducing accountability in '1993 or earlier'. Based on checks of State Department of Education websites, we code the introduction of accountability in Wisconsin as 1991, North Carolina as 1993, and Connecticut as 1988. Other states that were early to introduce 'consequential' accountability include Texas (1994) and Kentucky (1995).

Miller and Zhang (2009) document the introduction of three types of welfare reforms that took place at the state level since the early 1990s: limits on the amount of time a person (over a spell or

over one's lifetime) can remain on welfare; sanctions (including partial or full reduction in welfare benefits) on recipients not meeting work or schooling requirements; and schooling requirements for children (e.g. maintaining minimum grades or requiring attendance). The following states introduced at least one of these reforms prior to 1996: New Jersey (1992); Illinois, Iowa, and Utah (1993); Arkansas, Georgia, Michigan, South Dakota, and Vermont (1994); Arizona, Indiana, Massachusetts, Mississippi, and Missouri (1995).

3 Additional Coefficient Estimates from Main Specifications

Tables A and B of this Online Appendix report coefficient estimates and standard errors for all variables included in specifications for Tables 3 and 5 of the paper.

References

Hanushek, Eric, and Margaret Raymond. 2005. "Does School Accountability Lead to Improved Student Performance?" *Journal of Policy Analysis and Management*, 24(2): 297–327.

Miller, Amalia, and Lei Zhang. 2009. "The Effects of Welfare Reform on the Academic Performance of Children in Low-Income Households." *Journal of Policy Analysis and Management*, 28: 577–599.

Table A. Full Set of Parameter Estimates for the First and Second Stages of Table 3.

	1st Stage Current Income (i)	2nd Stage Combined Math and Reading (ii)	2nd Stage Reading Recognition (iii)	2nd Stage Reading Comprehension (iv)	2nd Stage Math (v)
Current Instrument	1.270**				
	(0.381)				
Current Income		0.0610**	0.0359*	0.0613**	0.0582**
		(0.0231)	(0.0195)	(0.0273)	(0.0273)
Child Male	0.2238	0.0571**	0.0259*	0.0669**	0.0526**
	(0.2023)	(0.0168)	(0.0144)	(0.0193)	(0.0185)
Child Age	-0.1661**	0.0047	0.0134**	0.0150**	-0.0164**
	(0.0478)	(0.0060)	(0.0054)	(0.0070)	(0.0068)
0 Siblings	-0.0516	-0.0109	-0.0079	-0.0088	-0.0111
	(0.3653)	(0.0295)	(0.0269)	(0.0331)	(0.0328)
1 Sibling	---	---	---	---	---
$\geq$ 2 Siblings	-0.2408	0.0288	0.0077	0.0246	0.0411*
	(0.2821)	(0.0211)	(0.0171)	(0.0233)	(0.0228)
Black	-1.3790**	-0.0144	-0.0213	-0.0403	0.0249
	(0.3161)	(0.0410)	(0.0340)	(0.0464)	(0.0465)
Hispanic	-1.1171**	0.0581	0.0448	0.0571	0.0464
	(0.3703)	(0.0369)	(0.0312)	(0.0422)	(0.0412)
White	---	---	---	---	---
Zero Lagged Pre-Tax Inc.	-0.2060**	0.0055	-0.0006	0.0020	0.0126
	(0.0734)	(0.0099)	(0.0081)	(0.0116)	(0.0113)
Lagged Pre-Tax Income	-0.2930*	0.0060	-0.0012	-0.0029	0.0193
	(0.1626)	(0.0183)	(0.0149)	(0.0214)	(0.0205)
Lagged Pre-Tax Income^2	0.1788	0.0018	0.0054	0.0075	-0.0083
	(0.1098)	(0.0110)	(0.0090)	(0.0128)	(0.0122)
Lagged Pre-Tax Income^3	-0.0555*	-0.0005	-0.0016	-0.0020	0.0024
	(0.0311)	(0.0030)	(0.0024)	(0.0035)	(0.0034)
Lagged Pre-Tax Income^4	0.0073	0.0000	0.0002	0.0002	-0.0003
	(0.0038)	(0.0004)	(0.0003)	(0.0004)	(0.0004)
Lagged Pre-Tax Income^5	-0.0003**	0.0000	-0.0000	-0.0000	0.0000
	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Notes: Specifications mirror those in Table 3 of the published paper. Income is measured in $1,000 of year 2000 dollars. All models are estimated in two-year differences to account for unobserved child fixed effects. Sample size is 8,608 for all the columns.   Standard errors are reported in parentheses and are clustered at the family level. **Significant at the 5% level, *significant at the 10% level.

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Table B. Full Set of Parameter Estimates for the First and Second Stages of Table 5.

A. Current and Lagged Income (a-1)

	1st Stage Current Income (i)	1st Stage Lagged Income (a-1) (ii)	2nd Stage Combined Math and Reading (iii)
Current Instrument	1.7093***	0.3870	
	(0.4891)	(0.4331)	
Lagged (a-1) Instrument	-0.1002	0.7635**	
	(0.4476)	(0.3359)	
Current Income			0.0436*
			(0.0236)
Lagged Income (a-1)			0.0216
			(0.0408)
Child Male	0.1620	-0.2436	0.0708**
	(0.2383)	(0.1932)	(0.0211)
Child Age	-0.1568**	-0.0562	-0.0009
	(0.0578)	(0.0548)	(0.0059)
0 Siblings	-0.1259	0.1309	0.0131
	(0.4259)	(0.3617)	(0.0316)
1 Sibling	---	---	---
≥ 2 Siblings	-0.0690	-0.0390	0.0149
	(0.3297)	(0.2598)	(0.0222)
Black	-0.9670**	0.3386	-0.0581
	(0.3661)	(0.2882)	(0.0406)
Hispanic	-1.2446**	0.2618	0.0466
	(0.4427)	(0.3590)	(0.0464)
White	---	---	---
Zero Lagged Pre-Tax Inc.	-0.1750*	0.1069	-0.0055
	(0.1010)	(0.1045)	(0.0116)
Lagged Pre-Tax Income	-0.1249	0.3981*	-0.0157
	(0.2160)	(0.2099)	(0.0283)
Lagged Pre-Tax Income^2	0.0921	-0.2192*	0.0128
	(0.1415)	(0.1323)	(0.0173)
Lagged Pre-Tax Income^3	-0.0347	0.0579	-0.0032
	(0.0387)	(0.0356)	(0.0047)
Lagged Pre-Tax Income^4	0.0050	-0.0068	0.0003
	(0.0046)	(0.0042)	(0.0006)
Lagged Pre-Tax Income^5	-0.0002	0.0003	-0.0000
	(0.0002)	(0.0002)	(0.0000)
F-Statistic for Instruments	6.17	3.59	

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Table B, continued. Full Parameter Estimates for the First and Second Stages of Table 5.

B. Current, Lagged (a-1), and Lagged (a-2) Income

	1ˢᵗ Stage Current Income (i)	1ˢᵗ Stage Lagged Income (a-1) (ii)	1ˢᵗ Stage Lagged Income (a-2) (iii)	2ⁿᵈ Stage Combined Math and Reading (iv)
Current Instrument	1.7957**	1.2256*	-1.1028	
	(0.7216)	(0.6741)	(0.7950)	
Lagged (a-1) Instrument	0.3838	-0.2802	0.7946	
	(0.8116)	(0.7027)	(1.0023)	
Lagged (a-2) Instrument	-0.4404	0.5447	0.8875	
	(0.5880)	(0.5069)	(0.6753)	
Current Income				0.0551
				(0.0478)
Lagged Income (a-1)				0.0135
				(0.0733)
Lagged Income (a-2)				0.0206
				(0.0381)
Child Male	0.1548	-0.2383	-0.2881	0.0614**
	(0.2764)	(0.2209)	(0.2558)	(0.0293)
Child Age	-0.1760**	-0.0628	0.0635	0.0015
	(0.0730)	(0.0741)	(0.0781)	(0.0077)
0 Siblings	0.1147	0.4602	1.3191**	-0.0050
	(0.4923)	(0.3952)	(0.4554)	(0.0568)
1 Sibling	---	---	---	---
≥ 2 Siblings	0.1825	-0.0180	0.9120**	-0.0081
	(0.3715)	(0.2961)	(0.3544)	(0.0509)
Black	-1.2717**	0.3959	2.0588**	-0.0571
	(0.4255)	(0.3468)	(0.3984)	(0.0702)
Hispanic	-1.6949**	0.4068	1.4072**	0.0698
	(0.4880)	(0.3713)	(0.4558)	(0.0872)
White	---	---	---	---
Zero Lagged Pre-Tax Inc.	-0.1831	0.0905	0.2569*	-0.0033
	(0.1342)	(0.1374)	(0.1458)	(0.0172)
Lagged Pre-Tax Income	0.0639	0.5286*	0.1689	-0.0149
	(0.3046)	(0.2856)	(0.3187)	(0.0435)
Lagged Pre-Tax Income^2	-0.0252	-0.3057*	-0.1255	0.0151
	(0.1921)	(0.1712)	(0.2026)	(0.0264)
Lagged Pre-Tax Income^3	-0.0054	0.0783*	0.0504	-0.0043
	(0.0503)	(0.0438)	(0.0536)	(0.0071)
Lagged Pre-Tax Income^4	0.0018	-0.0088*	-0.0073	0.0005
	(0.0058)	(0.0050)	(0.0062)	(0.0008)
Lagged Pre-Tax Income^5	-0.0001	0.0004*	0.0004	-0.0000
	(0.0002)	(0.0002)	(0.0003)	(0.0000)
F-statistic for Instruments	3.98	1.39	2.16	

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Table B, continued. Full Parameter Estimates for the First and Second Stages of Table 5.

C. Current and Sum of (a-1) and (a-2) Lagged Income

	1st Stage	1st Stage	2nd Stage
	Current Income	Sum of (a-1) and (a-2) Lagged Income	Combined Math and Reading
	(i)	(ii)	(iii)
Current Instrument	2.0333***	-0.1417	
	(0.6156)	(0.9995)	
Lagged Sum Instrument	-0.1354	1.0925*	
	(0.3858)	(0.5812)	
Current Income			0.0515**
			(0.0226)
Sum of (a-1) and (a-2) Lagged Income			0.0186
			(0.0255)
Child Male	0.1568	-0.5287	0.0626**
	(0.2763)	(0.3979)	(0.0252)
Child Age	-0.1726**	-0.0031	0.0013
	(0.0731)	(0.1275)	(0.0076)
0 Siblings	0.1166	1.7772**	-0.0043
	(0.4924)	(0.7245)	(0.0551)
1 Sibling	---	---	---
≥ 2 Siblings	0.1794	0.8974	-0.0055
	(0.3711)	(0.5487)	(0.0379)
Black	-1.2549**	2.4360**	-0.0594
	(0.4228)	(0.6143)	(0.0670)
Hispanic	-1.6856**	1.8037**	0.0645
	(0.4870)	(0.6994)	(0.0638)
White	---	---	---
Zero Lagged Pre-Tax Inc.	-0.1993	0.3654	-0.0041
	(0.1299)	(0.2321)	(0.0155)
Lagged Pre-Tax Income	0.0584	0.7035	-0.0171
	(0.3033)	(0.4923)	(0.0345)
Lagged Pre-Tax Income^2	-0.0279	-0.4283	0.0164
	(0.1922)	(0.3091)	(0.0217)
Lagged Pre-Tax Income^3	-0.0042	0.1273	-0.0046
	(0.0504)	(0.0810)	(0.0060)
Lagged Pre-Tax Income^4	0.0016	-0.0158*	0.0005
	(0.0058)	(0.0093)	(0.0007)
Lagged Pre-Tax Income^5	-0.0001	0.0007*	-0.0000
	(0.0002)	(0.0004)	(0.0000)
F-Statistic for Instruments	5.53	1.77	

Notes: Specifications mirror those in Table 5 of the published paper. See Appendix in the published paper for the definitions of how the instruments are created. Income is measured in $1,000 of year 2000 dollars. All models are estimated in two-year differences to account for unobserved child fixed effects. Sample size is 6,543 in panel A and 5,019 in panels B and C. Standard errors are reported in parentheses and are clustered at the family level. **Significant at the 5% level, *significant at the 10% level.