Economic Disparities in Middle Childhood Development: Does Income Matter?

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A large literature has documented the influence of family economic resources on child development, yet income’s effects in middle childhood have been understudied. Using data from the National Longitudinal Survey of Youth (N = 3,551), the author examined the influence of family income in early and middle childhood on academic skills and behavior problems during middle childhood. Early childhood income had enduring effects on children’s behavior problems and academic skills in middle childhood. Middle childhood income did not influence academic skills but did affect the development of behavior problems during middle childhood. Children from low-income households were particularly sensitive to the effects of family income. The quality of home environment during early and middle childhood explained a portion of the effects of income on academic skills and behavior problems.

Keywords: cognitive development, home environment, income, middle childhood, social development

Despite recent reductions in child poverty that accompanied the most unprecedented period of economic growth in U.S. history, many children continue to live in households with inadequate economic resources. The proportion of children living in poor households continues to hover around 17%, which amounts to nearly 13 million children per year (U.S. Census Bureau, 2004). Child poverty is a major concern for researchers and policy makers because associations between income and child development are some of the most consistent in research across disciplines. Developmental differences between children from low-income families and their more economically advantaged counterparts emerge in early childhood and persist or even are exacerbated in adolescence and early adulthood (Duncan & Brooks-Gunn, 1997).

Income and Child Development

A large body of research has examined the effects of poverty and family income on child development. Several important conclusions can be drawn from this literature. Effects of income and economic disadvantage tend to be larger for academic achievement and ability than for mental health and behavioral functioning (Blau, 1999b; Duncan & Brooks-Gunn, 1997, 2000). Associations between income and cognitive ability and academic achievement tend to fall in the moderate range, whereas effects on mental health and behavior problems tend to be small. Nevertheless, income effects may be largely spurious and the result of unmeasured differences that are correlated with both income and child outcomes (Mayer, 1997). In other words, unmeasured characteristics, such as parental mental health or motivation, that lead parents to earn more money in the paid labor force may also enhance child development, thereby giving rise to a spurious link between income and child development. Studies that have used analytic techniques that aim to limit the influence of omitted variables, such as fixed effects regressions or instrumental variable techniques, have tended to uncover somewhat smaller or insignificant income effects when compared with investigations that do not take these unmeasured characteristics into account (Blau, 1999b; Mayer, 1997; Morris & Gennetian, 2003).

Among the studies that have uncovered significant links between income and child development, most have discovered that income effects are nonlinear, such that the developmental trajectories of children in families at the lower end of the income distribution tend to be more sensitive to income changes than are the trajectories of children in higher income families (Dearing, McCartney, & Taylor, 2001; Duncan & Brooks-Gunn, 1997; Duncan, Brooks-Gunn, Yeung, & Smith, 1998; Taylor, Dearing, & McCartney, 2001; Duncan & Brooks-Gunn, 1997; Duncan & Brooks-Gunn, Yeung, & Smith, 1998; Taylor, Dearing, & McCartney, 2004). Furthermore, family income is volatile from year to year, and development tends to be more strongly associated with cumulative measures of family income than with income in a single year (Blau, 1999b; Duncan, 1988; Korenman, Miller, & Sjaastad, 1995; Mayer, 1997). The timing of income also seems to be important, but existing studies have yielded mixed results.

Duncan et al. (1998) found that economic conditions during early childhood were more influential on children’s developmental trajectories than was income in later childhood. However, more recent work by the National Institute of Child Health and Human Development (NICHD) Early Child Care Research Network (2005) found that poverty experienced between 4 and 9 years of
age was more detrimental for development than was poverty during the first 3 years of life.

Income and Middle Childhood Development

Despite recent research on the effects of income on children’s development, few studies have directly addressed income effects on development in middle childhood. Middle childhood, spanning from age 5 to age 12, represents an important stage in the life course, when children begin formal schooling and engage with the world outside their family. Children undergo significant changes across cognitive, social, emotional, and physical domains of development. Among the more important are developing the ability to learn more systematically, developing a self-concept that is more strongly related to their abilities, learning to respect and comply with teachers and other adults, and learning to get along with peers (Collins, 1984; Eccles, 1999; Kowaleski-Jones & Duncan, 1999).

During middle childhood, children master fundamental social and cognitive skills that provide the foundation for development in adolescence and adulthood (Chase-Lansdale, Wakschlag, & Brooks-Gunn, 1995; Eccles, 1999; Erikson, 1963; Kowaleski-Jones & Duncan, 1999).

There has been a tendency in the literature examining income effects on child development to focus on early childhood or on more long-term development, into adolescence or early adulthood. Only a few studies have examined income’s associations with development in middle childhood. These studies have documented significant links between income and academic skills, externalizing behavior problems, and antisocial behavior (McLeod & Shannah, 1996; Pagani, Boulerice, & Tremblay, 1997; Pungello, Kupersmidt, Burchinal, & Patterson, 1996; Smith, Brooks-Gunn, & Klebanov, 1997). Most of these studies, however, have focused on poverty, not on differences in economic resources across the income distribution, and few have examined the unique contributions of income during early childhood and income during middle childhood. The aim of this investigation is to improve our understanding of how income in early childhood and middle childhood influences development in middle childhood.

Theoretical Foundations

The theoretical foundations for this study are in family stress theory, which has been best articulated in the work of Elder (1974); McLoyd (1990); and Conger, Ge, Elder, Lorenz, and Simons (1994). Family stress theory suggests that income or economic disadvantage threatens proximal processes in the home environment through its links with parental emotional well-being and parent–child interactions. According to family stress theory, low-income individuals suffer from more persistent economic stress and experience more uncontrollable negative life events, such as violence, sickness, and job loss, than do their more economically advantaged counterparts. These factors are linked to lower marital quality, greater marital instability, and worse mental health, including higher levels of depression, anxiety, and psychological distress and lower levels of self-esteem. These dimensions of parents’ emotional well-being are, in turn, associated with less effective parenting practices, which are, on average, more harsh and inconsistent and also less nurturing and responsive to children’s needs. Ultimately, these parenting practices can be harmful to child development, especially children’s social and behavioral well-being (Conger et al., 1994; Elder, 1974; Jackson, Brooks-Gunn, Huang, & Glassman, 2000; McLoyd, Jayaratne, Ceballo, & Borquez, 1994; Mistry, Vandewater, Huston, & McLoyd, 2002).

Quality of Home Environment as a Pathway of Income’s Influence

An abundance of literature has emerged documenting the importance of a high-quality home environment for child development, which is characterized as stimulating, warm, responsive, and supportive. Cognitive stimulation in a variety of forms, including reading and conversing with children, helping children learn their numbers, and taking children on outings to the library, has been shown to enhance child development across cognitive, academic, and socioemotional domains (for a review, see Bradley & Corwyn, 2002). Warm, responsive, and supportive caregiving in the home environment fosters development across some of these domains as well, as such caregiving teaches children how to regulate their emotions, develop secure attachments, and accurately appraise social situations (for a review, see Bradley & Corwyn, 2002).

Economic disadvantage and income loss threaten the overall quality of children’s home environment and have negative consequences for children’s development (Baharudin & Luster, 1998; Dearing et al., 2001; Dubow & Ippolito, 1994; Garrett, Ng’andu, & Ferron, 1994; Klebanov, Brooks-Gunn, McCarton, & McCormick, 1998; Smith et al., 1997; Votruba-Drzal, 2003). In fact, home environments have been one of the most commonly studied pathways of income’s influence on child development. Duncan and Brooks-Gunn (2000) reported that differences in the quality of home environments explain up to 50% of income’s effects on cognitive development. Home environments are significant mediators of the influence of income and economic disadvantage on socioemotional development as well (Dearing et al., 2001; Duncan, Brooks-Gunn, & Klebanov, 1994).

Like the broader literature addressing income’s effects on development, studies examining home environments as mediators of the influence of income or economic disadvantage on child development have most often focused on preschool-aged children. During early childhood, children are more dependent on their primary caregivers and have fewer academic and social opportunities outside their home environment. As children age into middle childhood, their development increasingly takes place outside of the confines of their home environment, in school and peer networks. It is unclear whether the quality of home environment continues to be a salient pathway of income’s influence on development in middle childhood. Bradley, Corwyn, Burchinal, McAdoo, and Garcia Coll (2001) found somewhat stronger associations between home environment and preschoolers’ cognitive development when compared with school-aged children. This finding raises questions about whether home environments are important for understanding income effects on development in middle childhood.

Research Questions

The goals of this study are twofold. The first is to examine whether income in early and middle childhood influences the growth of academic skills and behavior problems during middle childhood. We know that income in early childhood is important for child development, yet it is not clear whether income in middle childhood affects middle childhood development beyond the in-
fluence of early childhood income. The second goal is to improve our understanding of the role of the quality of children’s home environment as a mediator of income effects on middle childhood development. In particular, this study considers whether home environments in early and middle childhood are important pathways for income’s influence in middle childhood.

Analytic Plan

Overall, this study is aimed at determining the extent to which middle childhood academic achievement improves and behavior problems decline in response to an increase in early or middle childhood income. The challenge in identifying income’s effect is that one cannot simply make comparisons between children in families with different levels of income, as income is not randomly allocated to families. Indeed, there are very few examples of randomized experiments involving income allocations to families (for exceptions, see Mallar & Maynard, 1981; Morris & Gennetian, 2003). This raises significant concerns about omitted variable bias. In the absence of data from randomized experiments, the best way to statistically control for the influence of omitted variables has been the subject of great debate, particularly when analyses involve an outcome measured at two time points (Allison, 1990; Cain, 1975; Cronbach & Furby, 1970; Johnson, 2005). In the current study, we use change models and residualized change models to address concerns related to omitted variable bias.

The change models and residualized change models used in these analyses come from two regression equations that are based on what I refer to as an accumulation of inputs model, which has been articulated most clearly in the work of NICHD Early Child Care Research Network and Duncan (2003) and Blau (1999a). This model suggests that child i’s development at time t is an additive function of all income, child, and family inputs to the child’s development prior to that point in time. So, for example, as shown in Equation 1, a child’s development at the end of early childhood (ChildE), defined here as when the child is between 5 and 6 years old, is the sum of the child’s history of a set of time-varying variables reflecting income (I), child (C), and family (F) characteristics as well as a series of time-invariant child (C) and family (F) characteristics. In this equation, the influences of unobserved differences across individuals that are constant over time are represented by α, whereas the effects of unobserved differences that are time varying are shown by αt.

\[ \text{Child}_E = \beta_{1E}I_{E} + \beta_{2E}C_{E} + \beta_{3E}F_{E} + \beta_{4E}C + \beta_{5E}F + \alpha_{E} + \alpha_t + \epsilon_{E} \]  

(1)

Under these same basic assumptions, a child’s development at the end of middle childhood (M), with middle childhood defined as the time between ages 5–6 and 11–12, can be expressed as a function of these same early childhood characteristics as well as a set of time-varying variables from middle childhood, representing income (I), child (C) and family (F) characteristics, and unobserved differences (α). This model is represented in Equation 2.

\[ \text{Child}_M = \beta_{1M}I_{M} + \beta_{2M}C_{M} + \beta_{3M}F_{M} + \beta_{4M}C_{M} + \beta_{5M}F_{M} + \alpha_{M} + \alpha_t + \epsilon_{M} \]  

(2)

Equations 1 and 2 are referred to as level models, because they predict children’s level of development at the end of early childhood and at the end of middle childhood, respectively, with the accumulation of all measured inputs up to that time (NICHD Early Child Care Research Network & Duncan, 2003).

The goal in this analysis is to get less biased estimates of the effects of early childhood income (βE) and middle childhood income (βM) on academic and behavioral development in middle childhood. In Equation 2, βE and βM reflect the effect of an income increase in early and middle childhood, respectively, on middle childhood development. As explained earlier, a challenge that researchers face when using Equations 1 or 2 to estimate income’s effects is that omitted variables or unmeasured characteristics that are correlated with the income terms and with children’s development may bias the regression results. These omitted variables may lead researchers to either overstate or understate income’s effects. Suppose parents who make more money also have better mental health and that mental health is unmeasured in the data but linked to children’s development. Omitted variable bias would then lead to an overstatement of income’s effects. However, if parents whose children are developmentally delayed work longer hours to earn more money so that they can provide stimulating experiences at home, omitted variable bias would lead to an underestimation of income’s influence.

An approach that has been advocated for addressing concerns of omitted variables that are inherent in regression equations is a simple change model (Allison, 1990; NICHD Early Child Care Research Network & Duncan, 2003). One can generate this model by subtracting Equation 1 from Equation 2, which results in the model presented in Equation 3.

\[ \Delta \text{Child}_i = \beta_{1M}I_{M} + \beta_{2M}C_{M} + \beta_{3M}F_{M} + \alpha_{M} + \Delta \epsilon_i \]  

(3)

The dependent variable in the simple change model is the change in child outcomes (ΔChild). The early childhood terms and the time-invariant terms cancel each other out on the right-hand side of the equation. Changes in children’s development between the end of early childhood and the end of middle childhood are modeled as a function of middle childhood characteristics. The advantage of using this model is that it eliminates the threat of bias posed by stable omitted variables (represented by α in Equations 1 and 2), which are assumed to have a consistent effect on child development over time and to be linked to income and child development (Allison, 1990; Johnson, 2005; NICHD Early Child Care Research Network & Duncan, 2003). It is important to note that the βM coefficient in this model has the same interpretation in this model as it did in Equation 2. It reflects the effect of a unit increase in income during middle childhood on child outcomes at the end of middle childhood.

A disadvantage of this more traditional version of the simple change model is that it differences out the early childhood income, child, and family characteristics as well as all time-invariant characteristics and allows no way of estimating the influence of these factors. A basic assumption of the simple change model is that early childhood characteristics and time-invariant characteristics have the same impact on development in early childhood as they do in middle childhood (NICHD Early Child Care Research Network & Duncan, 2003). To the extent that the influences of these factors are constant, they are controlled for when the difference is taken. There may be reasons to doubt this assumption. For exam-
ple, it is possible that the effect of early childhood income, child, or family characteristics may grow over time. Similarly, the effects of time-invariant characteristics of children or families, such as child race/ethnicity, gender, or maternal aptitude, may become more salient for child development in middle childhood. In other words, there may be an interaction between these factors and time itself. To consider this possibility, it is important to model the influence of these variables in the simple change model, allowing the coefficients $\beta_{1E}, \beta_{2E}, \beta_{3E}, \beta_4,$ and $\beta_5$ to change between early and middle childhood.

$$
\Delta \text{Child}_i = \beta_{1D} \text{Child}_{i-1} + \beta_{2M} \text{Child}_i + \beta_{3M} \text{Child}_{i-1} + \Delta \beta_{1E} \text{F}_{i-1} + \Delta \beta_{2E} \text{C}_{i-1} \\
+ \Delta \beta_{3E} \text{F}_i + \Delta \beta_{4E} \text{C}_i + \Delta \beta_{5E} \text{F}_{i-1} + \Delta \beta_{6E} \text{C}_{i-1} + \Delta \alpha_i + \alpha_{iM} + \Delta \epsilon_i \quad (4)
$$

In this equation, the first difference of Equations 1 and 2 no longer removes the terms representing early childhood and time-invariant characteristics. Instead, $\Delta \beta_{1E}, \Delta \beta_{2E}, \Delta \beta_{3E}, \Delta \beta_{4E},$ and $\Delta \beta_5$ are included in the model and represent the change in the impact of these characteristics. That is, these terms represent the change in the effect of the early childhood and time-invariant characteristics beyond their effects in early childhood. The coefficients on the variables from middle childhood in this model are interpreted in the same manner as they were in the level regression in Equation 2 and in the simple change model in Equation 3. They reflect the influence of a unit change in middle childhood characteristics on development in middle childhood.

In Equations 1 and 2, omitted variable bias was a concern when omitted characteristics were correlated with income and child outcomes. In Equations 3 and 4, the case for omitted variable bias becomes more complicated. There are two conditions under which omitted variables may bias coefficients. First, omitted variables that vary over time and are correlated with income and children’s development may produce bias in the simple change model; these are represented by $\alpha_{iM}$ in Equation 3. This source of bias, however, is not unique to the first difference approach. Second, omitted variables that have a significantly different impact on development in early and middle childhood and that are correlated with income and children’s development may generate biased estimates of income effects, which are represented with the $\Delta \alpha_i$ and $\Delta \alpha_{iM}$ terms (Allison, 1990; Johnson, 2005; NICHD Early Child Care Research Network & Duncan, 2003).

A second approach that has been advocated by some scholars for analyzing change in children’s development across two time points is a residualized change model (Cain, 1975; Cronbach & Furby, 1970). The residualized change model is similar to the traditional change model; however, the middle childhood assessment is used as the dependent variable, and the early childhood assessment is used as an independent variable. It can be found in Equation 5.

$$
\text{Child}_i = \beta_{1D} \text{Child}_{i-1} + \beta_{2M} \text{Child}_i + \beta_{3M} \text{Child}_{i-1} + \Delta \beta_{1E} \text{F}_{i-1} + \Delta \beta_{2E} \text{C}_{i-1} \\
+ \Delta \beta_{3E} \text{F}_i + \Delta \beta_{4E} \text{C}_i + \Delta \beta_{5E} \text{F}_{i-1} + \Delta \beta_{6E} \text{C}_{i-1} + \Delta \alpha_i + \alpha_{iM} + \Delta \epsilon_i \quad (5)
$$

One can derive Equation 5 from the simple change model by adding the early childhood assessment to both sides of the equation. The coefficients on the early childhood and time-invariant characteristics reflect the change in the effect of these variables on child outcomes in middle childhood, beyond their effect in early childhood. The coefficients on the middle childhood terms have the same interpretation as they did in the simple change model and the level model presented in Equation 2.

Allison (1990) has suggested that when there is a causal effect of children’s outcomes from early childhood on their development in middle childhood, the residualized change model may be a better specification. There is evidence to suggest that this may be the case for outcomes considered in this analysis. Theoretical work by economists Cunha, Heckman, Lochner, and Masterov (2005), for example, made the case that skills in early childhood beget skills at later stages in the life cycle, a phenomenon they referred to as self-productivity. Furthermore, developmental research on reading skills has suggested that early reading skills serve as a catalyst for the growth of reading skills over time (Cunningham & Stanovich, 1997). Still, there is a general consensus in the literature that simple change models tend to perform worse in the presence of measurement error and are unable to take into account random variability in the early childhood outcome, which gives rise to additional bias stemming from the correlation between the early childhood assessment and the error term (Allison, 1990; Johnson, 2005; NICHD Early Child Care Research Network & Duncan, 2003).

It is important to note, however, that simple change models are not without limitations, especially when compared with random effects regressions. The complete reliance of traditional change models on within-individual variation in income prevents these models from capturing a significant amount of variation in the processes of interest, because much of this variation is between individuals. In contrast, random effects regressions and growth curve modeling exploit variation within and between individuals when individual development is examined over time (Singer & Willett, 2003). In the current analyses, I estimate both simple change models and residualized change models to examine the robustness of associations between income and middle childhood development to different model specifications. The change and residualized change models estimated for this study follow the form of Equations 4 and 5, respectively.

To address the second research question in this study, I examine measures of the quality of home environments in middle and early childhood as mediators of relations between income in middle childhood and early childhood and development in middle childhood. Traditional tests of mediation were conducted via the ordinary least squares (OLS) regression techniques described by Baron and Kenny (1986) and MacKinnon and Dwyer (1993). Altogether, there were four steps to these analyses. First, I entered measures of the quality of home environments in early and middle childhood as predictors into the main effects regression models to examine their association with middle childhood development. In a second series of OLS regressions, I regressed home environments in early and middle childhood on income and the child and family covariates from the main effects regression models, to test the effect of income on home environments. Third, I calculated the indirect effects of income through home environments by multiplying the effects of home environments on child outcomes from the first series of regressions by the effect of the income on home environments. In the final step of the
mediation analyses, I examined the statistical significance of these indirect effects using statistical tests described by MacKinnon and Dwyer (1993). Indirect effects of early childhood income were estimated through both the early childhood home environment and the middle childhood home environment. Only one indirect effect of middle childhood income was estimated, operating through middle childhood home environments. The results of the second series of OLS regressions, testing the effect of income on home environments, are not included in the tables of results for the sake of brevity. These are available by request. Because some children in the sample used in these analyses were from the same families, data on the children are not independent; therefore, I used the cluster command in Stata 9 (StataCorp, 2005) to make standard error adjustments in all analyses to account for data dependence.

Method

Sample

Data for these analyses are drawn from a merged mother–child data set from the 1980–2000 waves of the National Longitudinal Survey of Youth (NLSY) and the 1986–2000 waves of the mother and child supplements of the NLSY. The NLSY began studying the educational and labor market experiences of young adults in the United States in 1979. The original sample consisted of a nationally representative group of 12,686 youths between the ages of 14 and 21, with purposive oversampling to increase the number of poor and minority individuals. Nearly each year since 1979, the NLSY has gathered data on such topics as education, employment, and income (Center for Human Resource Research [CHRR], 1997). Starting in 1986, the NLSY began collecting biennial information in the NLSY mother and child supplements about the children of female participants. These data have included assessments of children’s social and cognitive development as well as measures of environmental factors associated with child development (CHRR, 1993).

This study is based on five birth cohorts of children captured by the NLSY and the NLSY child supplement during early and middle childhood. For the purposes of these analyses, early childhood is defined as the period in a child’s life from birth to 5–6 years of age, and middle childhood is considered to be the time from 5–6 to 11–12 years of age. The first cohort consists of children who were 5–6 years old at the beginning of the NLSY child and mother supplements in 1986 and who were successfully followed until they were 11–12 years old in 1992. The second, third, fourth, and fifth cohorts include children who passed through this same developmental period during 1988–1994, 1990–1996, 1992–1998, and 1994–2000, respectively. Altogether, 3,511 children were eligible to be included in the sample. Of these children, roughly 75% had valid data on all child outcomes and covariates. The other 25% were missing some data. Statistical comparisons of children who were missing data and those with valid data on all measures showed that the children who were missing data were more disadvantaged across several dimensions. For example, they tended to have lower family income in middle childhood, generally scored slightly lower on the academic skills measures, and were more likely to be of an ethnic minority background. Traditional approaches to handling missing data, such as listwise deletion or mean imputation, have been criticized for biasing estimates, misrepresenting statistical power, and leading to invalid conclusions (Acock, 2005). Therefore, missing data were imputed for the current study by expectation maximization, which uses a maximum likelihood approach (Dempster, Laird, & Rubin, 1977). Although it is far superior to the more traditional approaches, the standard errors from this approach may still be a bit too small, because imputation using expectation maximization involves a single imputation as opposed to multiple imputations, which allow researchers to incorporate imputation uncertainty into standard error calculations (Acock, 2005). Analyses conducted on the full sample with imputed data and those conducted only on cases with valid data yielded similar results. The results presented hereafter are those from the full sample with missing data imputations.

Measures

Academic achievement. The NLSY has used the Peabody Individual Achievement Test (PIAT; Dunn & Markwardt, 1970) to assess the academic achievement of children 5 years of age and older every year since its beginning in 1986 (CHRR, 2000). Two subtests of the PIAT, Reading Recognition and Mathematics, were used in these analyses as measures of reading and math skills, respectively. The math subtest consists of 84 multiple-choice items of increasing difficulty that measure mathematics skills taught in mainstream education. Items begin with number recognition and advance through algebra and geometry. The Reading Recognition subtest is composed of 84 items that test children’s ability to recognize and pronounce words. Easier items ask children to match letters, whereas more difficult items require children to read aloud words that become increasingly complex (Dunn & Markwardt, 1970; Markwardt, 1989). The PIAT subtests have demonstrated good reliability and have shown strong construct and predictive validity (Dunn & Markwardt, 1970). Raw scores were used for these analyses. Descriptive information on children’s reading and math skills can be found in Table 1.

Socioemotional development. Socioemotional development was measured with the Behavior Problems Index (BPI; Zill & Peterson, 1986). Each year the NLSY has used the BPI to measure behavior problems of children ages 4 and older (CHRR, 2000). Items from the BPI were drawn primarily from the Achenbach and Edelbrock (1981) Behavior Problems Inventory. The BPI measures behavior problems using parental reports on 28 questions that ask how often children exhibited specific behaviors in the prior 3 months. Items on the BPI measure both internalizing behavior problems, such as depression and anxiety, and externalizing behavior problems, such as hyperactivity and peer problems. Respondents rated each item using three response categories indicating whether particular behaviors were often true, sometimes true, or not true of their child (CHRR, 1993). Individual items were recoded to 1 if parents reported a behavior was often true or sometimes true and were recoded to 0 otherwise. Summing across all 28 items after they had been recoded in this manner and imputing a decimal place resulted in the raw total score. The BPI has demonstrated good reliability and considerable predictive and construct validity (CHRR, 1993). Raw total BPI scores were used in these analyses. Table 1 contains the average levels of behavior problems at the end of early childhood and middle childhood.

Income. Income is the primary independent variable of interest in these analyses. The income measures used in this study were based on the net family income variable that is released each year by the NLSY. Each year, the NLSY asks respondents to report on income they received in the prior calendar year from a variety of sources, including wages, salaries, interest, dividends, alimony, business earnings, government transfer programs, and income from other household members. On the basis of respondents’ answers to these questions, the NLSY creates a total net family income variable. Each year a slightly different program is used to compute net family income, but the programs have been remarkably similar in their structure over the years.

Two income terms were created to examine the independent influences of income in early and middle childhood. Each was measured cumulatively as the average total family income across several years of the child’s life. Early childhood income was measured as the average family income from birth to 5–6 years old. Middle childhood income was calculated as the average family income between 5–6 and 11–12 years of age. Before these composite income measures were constructed, family income from each year was expressed in Year 2000 dollars, so that incomes measured across different years were comparable. The decision to use a cumulative income measure was based on prior research and the assumption that a child’s development at any given point in time is the product of a family’s
cumulative income up to that point in the child’s life, not simply income in the year of the assessment of development. The influence of income was modeled via the natural log of income. Using a semilog function to model relations between income and child development fits a steeper slope at lower income levels, thereby implying that low-income children’s development is more responsive to income changes than is the development of children living in families at the middle and upper ends of the income distribution. Table 1 contains average family income in early and middle childhood.

**Home environment.** Home environments during early and middle childhood were examined as mediators of relations between income and child development. Two home environment measures reflect the accumulation of children’s experiences in their home environment throughout these two stages of development. Both are based on the Home Observation for Measurement of the Environment (HOME) Inventory, a widely used measure designed by Caldwell and Bradley (1979). The HOME Inventory assesses multiple dimensions of home environments using both interviewer observation and maternal report. Bradley and Caldwell developed an abbreviated version of the HOME Inventory for the NLSY, often referred to as the HOME Short Form (HOME-SF), which measures cognitive stimulation and emotional support in the home environment. The HOME-SF includes a subset of items from the original HOME Inventory and has been shown to have good psychometric properties and to capture the same domains as the longer version of the instrument (Baker & Mott, 1989; CHRR, 1993).

Total scores on the HOME-SF are the basis of the early and middle childhood home environment measures used in these analyses. They were calculated via dichotomous scoring of each item, so that a score of 1 indicated the presence of a developmentally supportive aspect in the child’s home environment and a score of 0 indicated its absence. These items were then added to generate the total score (CHRR, 1993). The NLSY child supplement used developmentally appropriate versions of the HOME-SF for children of different ages. Up to four different versions of the HOME-SF were used to measure important characteristics of children’s home environments from birth to 11–12 years of age (e.g., Part A: younger than 3 years old, Part B: 3–5 years old, Part C: 6–9 years old, Part D: 10 years old and older). To combine HOME-SF total scores across several years, total scores from each available assessment over the course of the child’s life had to be placed on a common metric. Therefore, I calculated the average proportion of items endorsed per assessment for each HOME-SF assessment by dividing the total HOME-SF score by the total number of items on the instrument. I then computed the early childhood home environment measure by averaging the proportion of items endorsed per available assessment on the HOME-SF from birth to age 5–6. I calculated the middle childhood home environment measure by averaging the proportion of items endorsed per available assessment on the HOME-SF from birth to age 5–6. I calculated the middle childhood home environment measure by averaging the proportion of items endorsed per available assessment on the HOME-SF from birth to age 5–6.

**Family characteristics.** A series of time-varying and time-invariant family characteristics that are often related to family economic resources and child development was included in these analyses as controls. Time-invariant characteristics included the mother’s academic aptitude and age at the birth of her first child. The global measure of mothers’ academic aptitude comes from the Armed Forces Qualification Test (U. S. Department of Defense, 1982), which was administered to respondents in 1980. It measures math, verbal, and reasoning skills and is based on the Armed Services Vocational Aptitude Battery (CHRR, 1997). The second time-invariant family characteristic was an indicator of whether a child’s mother was a teenager when she had her first child.

Several time-varying family characteristics were included in the model as well. Each of these characteristics was represented in two sets of independent variables; the first reflected the family characteristic cumulatively during early childhood (i.e., from birth to 5 years old), and the

### Table 1

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<tr>
<th>Variable</th>
<th>Early childhood</th>
<th>Middle childhood</th>
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<tr>
<td><strong>Child outcomes</strong></td>
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<td>Reading skills</td>
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<td><strong><em>M</em></strong></td>
<td>16.62</td>
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<td><strong><em>SD</em></strong></td>
<td>6.37</td>
<td>13.54</td>
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<tr>
<td>Math skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>14.98</td>
<td>50.04</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>6.19</td>
<td>9.98</td>
</tr>
<tr>
<td>Behavior problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>92.16</td>
<td>89.96</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>58.34</td>
<td>64.12</td>
</tr>
<tr>
<td><strong>Family characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>34,774.84</td>
<td>40,784.08</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>21,788.74</td>
<td>25,517.55</td>
</tr>
<tr>
<td>Mother’s marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never married</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>23.10</td>
<td>14.84</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>39.02</td>
<td>34.47</td>
</tr>
<tr>
<td>Married</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>63.93</td>
<td>61.35</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>41.18</td>
<td>44.14</td>
</tr>
<tr>
<td>Divorced/separated</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>12.62</td>
<td>22.87</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>25.65</td>
<td>37.35</td>
</tr>
<tr>
<td>Widowed</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>0.36</td>
<td>0.95</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>4.70</td>
<td>8.99</td>
</tr>
<tr>
<td>No. children in household</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>2.01</td>
<td>2.64</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>0.94</td>
<td>1.11</td>
</tr>
<tr>
<td>Mother’s employment status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in paid labor force</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>37.81</td>
<td>27.71</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>36.85</td>
<td>36.69</td>
</tr>
<tr>
<td>Part time</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>14.80</td>
<td>13.93</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>22.54</td>
<td>24.84</td>
</tr>
<tr>
<td>Full time</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>47.39</td>
<td>57.20</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>37.46</td>
<td>39.77</td>
</tr>
<tr>
<td>Mother’s education</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>12.08</td>
<td>12.35</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>2.07</td>
<td>2.14</td>
</tr>
<tr>
<td>Mother’s academic aptitude</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>33.16</td>
<td>26.11</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>17.88</td>
<td>38.33</td>
</tr>
<tr>
<td>Child race/ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>%</em></strong></td>
<td>50.72</td>
<td>50.00</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>%</em></strong></td>
<td>44.95</td>
<td>49.75</td>
</tr>
<tr>
<td>Hispanic</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>%</em></strong></td>
<td>33.31</td>
<td>47.14</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>21.74</td>
<td>41.25</td>
</tr>
<tr>
<td>Home environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong><em>M</em></strong></td>
<td>73.10</td>
<td>73.48</td>
</tr>
<tr>
<td><strong><em>SD</em></strong></td>
<td>12.79</td>
<td>11.76</td>
</tr>
</tbody>
</table>
second represented the family characteristic cumulatively during middle childhood (i.e., between 5–6 years old and 11–12 years old). Family structure in early childhood and family structure in middle childhood were each represented by a set four variables that reflected the proportion of years the mother was never married, married, divorced or separated, or widowed. Maternal employment was represented with three variables as the proportion of years during early childhood and during middle childhood that mothers worked full time, worked part time, or were not involved in the paid labor force. Full-time employment was defined as working 35 hr per week or more. Women who worked between 10 and 35 hr per week were considered to be employed part time. Women who worked less than 10 hr per week were not considered to be involved in the paid labor force. To avoid multicollinearity, one of the categorical variables across each domain was excluded from the regression analyses. Each variable was represented in the regression analyses in 10% increments. So, for example, a child whose mother was employed full time for 50% of the years during middle childhood would be coded as a 5 on the middle childhood full-time employment variable.

Household caretaking responsibilities were measured with two continuous variables reflecting the average number of children in the household during early childhood and middle childhood. The final time-varying family characteristic, maternal education, was measured in two variables as the average of the mother’s total years of schooling in early childhood and middle childhood.

Child characteristics. Child characteristics related to developmental trajectories were included in these analyses as well. Gender was represented with a dummy variable along with child age measured in months. Child race/ethnicity was included in the regression equations with a series of dummy variables representing whether the child was of non-Hispanic Black, non-Hispanic White, or Hispanic origin. The influence of child age was reflected in a variable measuring the change in child age, measured in months, that took place between the assessments at the end of early childhood and the end of middle childhood. Finally, a series of dummy variables indicating when the child aged from 5–6 years to 11–12 years was included in the model. Descriptive statistics on all child, family, and home environment measures are presented in Table 1.

### Table 2

#### Academic Skills Level Models

<table>
<thead>
<tr>
<th>Variable</th>
<th>Reading</th>
<th>Math</th>
<th>Reading</th>
<th>Math</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle childhood income</td>
<td>0.47</td>
<td>0.15</td>
<td>−0.05</td>
<td>−0.26</td>
</tr>
<tr>
<td>$B$</td>
<td>0.59</td>
<td>0.59</td>
<td>0.42</td>
<td>0.42</td>
</tr>
<tr>
<td>Early childhood income</td>
<td>3.56***</td>
<td>2.56***</td>
<td>2.44***</td>
<td>1.80***</td>
</tr>
<tr>
<td>$SE B$</td>
<td>0.64</td>
<td>0.65</td>
<td>0.41</td>
<td>0.42</td>
</tr>
<tr>
<td>Home environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle childhood home environment</td>
<td>1.04***</td>
<td>0.88***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$B$</td>
<td>0.28</td>
<td>0.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early childhood home environment</td>
<td>1.49***</td>
<td>0.79***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$SE B$</td>
<td>0.24</td>
<td>0.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.26</td>
<td>0.25</td>
<td>0.27</td>
<td></td>
</tr>
</tbody>
</table>

**Note.** Dependent variables in these analyses were academic skills at the end of middle childhood. All models include controls for child birth year cohort, time-invariant characteristics of children and their family, and time-varying characteristics of children and families from early childhood and middle childhood. ***p < .001.

### Results

#### Overview

The results of the regression analyses examining the effects of income on development in middle childhood are presented in Tables 2, 3, 4, and 5. Beginning with academic achievement and continuing through behavior problems, the results of level regression models are presented first, followed by the change models. In Model 1 of the level regression analyses, development at the end of middle childhood was regressed on early childhood characteristics, middle childhood characteristics, and all time-invariant characteristics of children and their family. In Model 2, I introduced measures of the quality of home environments to consider whether they were significant pathways for income’s influences.

The change models are presented with the simple change models first and the residualized change models second. The independent variables in Model 1 of the change models were middle and early childhood characteristics as well as time-invariant characteristics of children and their family. In Model 2, I added measures of home environments to consider whether they explained the effects of income in early and middle childhood. The coefficients on covariates in the regression analyses have been excluded for the sake of brevity but are available by request.

When one is interpreting these coefficients, it is crucial to remember that both the early and the middle childhood income terms are represented in natural log form. Thus, the coefficients on the income terms translate into the effect or the change in the effect of a log-unit income increase on children’s development. This is a large income increase. A log-unit income increase essentially means that family income is increasing by 2.7-fold. Therefore, for a family with a total average income in early or middle childhood of $5,000 per year, a log-unit income increase would raise their average family income per year to about $13,590. For the average
family in this study, who had $36,150 per year in early childhood income, a log-unit increase would, on average, raise their income to about $98,270.

Academic Skills

Level models. The results of the level regressions for academic skills at the end of middle childhood are displayed in Table 2. In Model 1, it can be seen that middle childhood income seemed to have no effect on reading or math skills. There was, however, a significant relation between early childhood income and academic skills at the end of middle childhood. That is, a log-unit increase in early income was associated with a 3.56-point (0.26 of a standard deviation) improvement in reading skills and a 2.44-point (0.24 of a standard deviation) increase in math skills. When measures of home environment from early and middle childhood were introduced in Model 2 of Table 2, the coefficients on the early childhood income terms fell by over 25%, thereby suggesting that the effect of early childhood income was partially mediated by home environment. Formal tests of mediation revealed that the quality of the early home environment mediated 60% and 70% of the reduction in the early childhood income coefficient in the reading and math models, respectively. The remaining declines were explained by lagged effects of early income on middle childhood home environment. Statistical tests revealed that all of the indirect paths of early income on math and reading scores, operating through early and middle childhood home environments, were significantly different from zero. Early childhood income continued to be significantly linked to middle childhood reading and math skills even after the introduction of the home environment measures.

Change models. The results of the regression analyses using residualized and simple change models for reading and math skills are presented in Table 3 and Table 4, respectively. It is important to remember that the coefficients on middle childhood income from the level and change models are comparable. The change models simply generate less biased estimates of the effect of middle childhood income. Consistent with the findings of the level analyses, the change models revealed no association between middle childhood income and academic skills at the end of middle childhood. There was, however, a significant influence of early childhood income on reading and math skills in the change models. The early childhood income coefficients in the change models reflect the change in the effect of early childhood income on children’s academic skills in middle childhood. In both the residualized and the simple change models for reading and math, the coefficients on early income suggest that its effects on academic skills grew during middle childhood. In particular, in the traditional change models, a log-unit increase in early childhood income related to a 2.57-point (0.22 of a standard deviation) gain in reading skills and a 1.96-point (0.23 of a standard deviation) improvement in math skills. The residualized change models revealed similar, although slightly larger, estimates.

When measures of home environments from early and middle childhood were added to the change analyses of reading scores in Model 2 of Table 3, the coefficients on the early income terms dropped by about 30%, thereby suggesting that the change in the effect of early childhood income on middle childhood reading skills was partially mediated by home environment. In both the residualized and the simple change models, early childhood home environment

<table>
<thead>
<tr>
<th>Table 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading Skills Change Models</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Simple change</th>
<th>Residualized change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>Reading skills end of early childhood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td>Middle childhood income</td>
<td>0.05</td>
</tr>
<tr>
<td>B</td>
<td>0.53</td>
<td>0.53</td>
</tr>
<tr>
<td>Early childhood income</td>
<td>2.57***</td>
<td>1.83**</td>
</tr>
<tr>
<td>B</td>
<td>0.58</td>
<td>0.59</td>
</tr>
<tr>
<td>Home environment</td>
<td>Middle childhood home environment</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Early childhood home environment</td>
<td>1.08***</td>
<td>1.07***</td>
</tr>
<tr>
<td>B</td>
<td>0.22</td>
<td>0.22</td>
</tr>
<tr>
<td>R²</td>
<td>.15</td>
<td>.17</td>
</tr>
</tbody>
</table>

Note. The dependent variables in the traditional change models were changes in reading skills from the end of early childhood to the end of middle childhood. In the residualized change models, the dependent variables were reading skills at the end of middle childhood. All models include controls for child birth year cohort, time-invariant characteristics of children and their family, and time-varying characteristics of children and families from early childhood and middle childhood. * p < .05. ** p < .01. *** p < .001.
environment explained about 70% of the reduction in the early childhood income coefficient. The remainder was explained by a lagged effect of early childhood income on middle childhood home environment. Formal tests of mediation showed that the indirect effects of early childhood income on reading skills through the quality of the home environment in early and middle childhood were significantly different from zero under both change model specifications. The addition of the home environment measures to the change analyses of math skills in Model 2 of Table 4 yielded results similar to those for reading, although the early income coefficient dropped by only about 20%. The quality of early and middle childhood home environments explained similar amounts of the increase in the effect of early childhood income on children’s math skills. The indirect effects of early childhood income operating through early and middle childhood home environments were statistically significant in both change model specifications.

behavior Problems Level models. The final series of analyses considered the effects of income on middle childhood behavior problems. Results of the level regressions are found in Table 5. Higher scores on the behavior problems measure were indicative of more behavior problems. Unlike academic achievement, income in middle and early childhood was linked to problem behaviors. A log-unit increase in early childhood income was linked to a 19.31-point (0.30 of a standard deviation) decline in middle childhood behavior problems. A log-unit increase in middle childhood income was related to a 5.95-point (0.09 of a standard deviation) drop in children’s behavior problems at the end of middle childhood. Although the effect of middle childhood income was significant only at the trend level, it is useful to note that the significance value for the middle childhood income coefficient was equal to .07. When the two measures of the quality of children’s home environment were introduced in Model 2 of Table 5, the coefficients on middle and early childhood income fell by 40% and 35%.

Table 4
Math Skills Change Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Simple change</th>
<th>Residualized change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>Math skills end of early childhood</td>
<td>0.61***</td>
<td>0.59***</td>
</tr>
<tr>
<td>B</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle childhood income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>-0.33</td>
<td>-0.45</td>
</tr>
<tr>
<td>SE B</td>
<td>0.38</td>
<td>0.39</td>
</tr>
<tr>
<td>Early childhood income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>1.96***</td>
<td>1.62***</td>
</tr>
<tr>
<td>SE B</td>
<td>0.39</td>
<td>0.40</td>
</tr>
<tr>
<td>Home environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle childhood home environment</td>
<td>0.47*</td>
<td>0.71*</td>
</tr>
<tr>
<td>B</td>
<td>0.19</td>
<td>0.19</td>
</tr>
<tr>
<td>Early childhood home environment</td>
<td>0.40*</td>
<td>0.44**</td>
</tr>
<tr>
<td>B</td>
<td>0.16</td>
<td>0.16</td>
</tr>
<tr>
<td>SE B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R^2</td>
<td>.11</td>
<td>.35</td>
</tr>
</tbody>
</table>

Note. The dependent variables in the traditional change models were changes in children’s math skills from the end of early childhood to the end of middle childhood. In the residualized change models, the dependent variables were math skills at the end of middle childhood. All models include controls for child birth year cohort, time-invariant characteristics of children and their family, and time-varying characteristics of children and families from early childhood and middle childhood.

Table 5
Behavior Problems Level Models

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle childhood income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>-5.95†</td>
<td>-3.59</td>
</tr>
<tr>
<td>SE B</td>
<td>3.27</td>
<td>3.21</td>
</tr>
<tr>
<td>Early childhood income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>-19.31***</td>
<td>-12.52***</td>
</tr>
<tr>
<td>SE B</td>
<td>3.19</td>
<td>3.10</td>
</tr>
<tr>
<td>Home environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle childhood home environment</td>
<td>-9.73***</td>
<td>1.54</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE B</td>
<td>1.54</td>
<td>1.41</td>
</tr>
<tr>
<td>Early childhood home environment</td>
<td>-8.16***</td>
<td>1.41</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R^2</td>
<td>.09</td>
<td>.13</td>
</tr>
</tbody>
</table>

Note. Dependent variables in these analyses were behavior problems at the end of middle childhood. All models include controls for child birth year cohort, time-invariant characteristics of children and their family, and time-varying characteristics of children and families from early childhood and middle childhood.

† p < .10. *** p < .001.
respectively. Tests of mediation revealed that 60% of the reduction in the effect of early childhood income was due to differences in early home environment, and the remaining reduction was attributed to middle childhood home environment. Indirect paths of early childhood income through early and middle childhood home environments were statistically significant. The reduction of the middle childhood income coefficient was attributed to children’s home environment during middle childhood. This indirect effect was significantly different from zero.

Change models. Residualized and simple change models for problem behaviors are displayed in Table 6. Both change models yielded results that were consistent with the level models with respect to the influence of middle childhood income. In Model 1 of Table 6, middle childhood income was linked to reductions in children’s behavior problems. In particular, a log-unit increase in middle childhood income was linked to a little over a half of an item (0.12 of a standard deviation) reduction in the number of items endorsed on the behavior problems measure in the change models. There was more mediation of the middle childhood income effect in the residualized change model than in the simple change model, with coefficients on the middle childhood income term dropping by 20% and 6% in the residualized and simple change models, respectively. The indirect effects of middle childhood income on problem behaviors through the quality of middle childhood home environment were significantly different from zero in the residualized and simple change models.

The change models, however, uncovered conflicting results regarding the effect of early childhood income on behavior problems. The early childhood income term was significant in the residualized change model but not in the traditional change model presented in Table 6. In fact, the coefficient on early childhood income was substantially smaller in the traditional change model when compared with the residualized change specification. The coefficient on early childhood income fell by 30% when the two home environment quality measures were introduced to the residualized change model in Model 2 of Table 6. Mediation tests showed that the change in early income’s effect on children’s behavior problems was explained by a combination of the early and middle childhood home environments. In particular, about 44% of the reduction in the early income coefficient was explained by the early home environment, and the remaining 56% was explained by the lagged effect of early childhood income on the middle childhood home environment. The indirect paths of early childhood income on middle childhood behavior problems operating through home environments in early and middle childhood were significantly different from zero.

Discussion

The results of this study suggest that income does indeed affect development in middle childhood. The timing of income effects, however, seems to vary by domain of development.

Early Childhood Income and Middle Childhood Development

The results of both the level and the change analyses reinforce existing literature, which has documented the importance of early income on children’s academic achievement. This finding is consistent with an economic perspective, which suggests that early

<table>
<thead>
<tr>
<th>Variable</th>
<th>Simple change</th>
<th>Residualized change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>Child behavior problems end of early childhood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE B</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle childhood income</td>
<td>−7.86**</td>
<td>−7.41*</td>
</tr>
<tr>
<td>SE B</td>
<td>2.98</td>
<td>2.99</td>
</tr>
<tr>
<td>Early childhood income</td>
<td>−3.81</td>
<td>−3.14</td>
</tr>
<tr>
<td>SE B</td>
<td>2.79</td>
<td>2.80</td>
</tr>
<tr>
<td>Home environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle childhood home environment</td>
<td>−4.09**</td>
<td></td>
</tr>
<tr>
<td>SE B</td>
<td>1.42</td>
<td></td>
</tr>
<tr>
<td>Early childhood home environment</td>
<td>1.56</td>
<td>−3.12**</td>
</tr>
<tr>
<td>SE B</td>
<td>1.27</td>
<td>1.19</td>
</tr>
<tr>
<td>R²</td>
<td>.02</td>
<td>.02</td>
</tr>
</tbody>
</table>

Note. The dependent variables in the traditional change models were changes in behavior problems from the end of early childhood to the end of middle childhood. In the residualized change models, the dependent variables were behavior problems at the end of middle childhood. All models include controls for child birth year cohort, time-invariant characteristics of children and their family, and time-varying characteristics of children and families from early childhood and middle childhood.

* p < .05. ** p < .01. *** p < .001.
investments are particularly important because they maximize the time for realizing returns on the investments (Duncan & Magnuson, 2003). The finding is also supported from a developmental perspective, because early childhood has been established as a time when children are uniquely responsive to their environments (Shonkoff & Phillips, 2000). Beyond the existing literature, however, the change models suggest that the effect of early income on academic skills grows during middle childhood. Early income seems to set children on academic trajectories that are difficult to alter. According to this analysis, the math and reading skills of children living in low-income households during early childhood and their more advantaged counterparts seem to diverge further and further over time.

Several factors may explain why the effect of early childhood income seems to grow during middle childhood. As children age from early to middle childhood, their academic skills advance, and there is greater variation in the overall distribution of their skills. It may be that as academic skills become more advanced during middle childhood, developmental differences related to income are exaggerated, as skills beget skills (Cunha et al., 2005). Consequently, the trajectories of high-performing students continue to accelerate, whereas their more economically disadvantaged counterparts continue to struggle with mastering basic academic skills (Cunningham & Stanovich, 1997). Another possibility is that early childhood income has a delayed effect on academic skills. This could be due to a lagged effect of early childhood income on family process. In other words, early childhood income may continue to affect home environments in middle childhood and, in turn, influence academic skills during this developmental stage. Indeed, the current investigation has found that middle childhood home environments in part mediated the growing effect of early childhood income on academic skills in middle childhood. Alternatively, it may be that the total effect of early childhood income on children’s development is not entirely instantaneous and evident immediately at the end of early childhood. Instead, it may take until middle childhood before the influences of economic resources in early childhood are fully evident.

Unlike other studies, the results of the level and residualized change models suggest that early income has enduring effects on children’s behavior problems as well. Although this finding is new, it is not altogether surprising. As highlighted in the earlier discussion of family stress theory, parents with limited economic resources are more likely to exhibit parenting practices that are more harsh and inconsistent and less responsive to children’s needs (Conger et al., 1994; Elder, 1974; Jackson et al., 2000; McLoyd et al., 1994; Mistry et al., 2002). Consistent, warm, and responsive parenting is key to enhancing children’s development, especially during the early years, as children develop secure attachments with caregivers, self-regulatory abilities, and other aspects of healthy development, such as empathy and the ability to get along with peers (Chase-Lansdale et al., 1995). Healthy development across these domains in early childhood may provide children with the important developmental capacities that are central for meeting the increasingly complex social demands that children encounter during middle childhood. It is important to note, however, that the increase in the effect of early childhood income on behavior problems was much smaller and not significantly different from zero in the simple change model. This raises concerns about the possibility that the early childhood income coefficient in the residualized change model may be biased because of a correlation between the early childhood assessment and the error term. Therefore, this finding should be interpreted with caution.

### Middle Childhood Income and Development

Another important conclusion of this study is that middle childhood income seems to affect behavior problems in middle childhood beyond the effect of early childhood income. Income in middle childhood, however, did not affect academic achievement in middle childhood. There are several possible explanations for these differences in effects. First, compared with academic skills, behavior problems may respond more quickly to changes in family processes that are related to income in middle childhood. In contrast, academic skills, which tend to be more heavily affected by early inputs, may be more difficult to alter during middle childhood. Second, dimensions of parenting that are central to the development of academic skills and those parenting practices that are more important for explaining behavior problems may be differentially responsive to income changes. For example, warmth, sensitivity, and emotional responsiveness may react more quickly to income changes, thereby having a more immediate effect on children’s behavior problems. In contrast, characteristics of parenting that are central to the development of children’s academic skills, such as the provision of cognitive stimulation in children’s home environment, may change more slowly in response to income changes.

The lack of a significant link between middle childhood income and academic skills in middle childhood should be interpreted with caution. It may be that there is a greater lag in middle childhood income effects on academic achievement than on behavior problems. Indeed, a small number of studies have revealed significant links between middle childhood income and academic achievement during adolescence (Duncan et al., 1998; Pungello et al., 1996). Thus, middle childhood income should not be disregarded as unimportant to academic trajectories. Its effects simply may not be evident until adolescence or early adulthood.

### Quality of Home Environments: Important Pathways for Income Effects

In addition to improving our understanding of income effects on development in middle childhood, this study also provides a more detailed picture of the mediating roles of the quality of early and later home environments. In nearly all of these analyses, home environment quality partially mediated associations between income and development in middle childhood. This study highlights the central role of early childhood home environment quality in explaining the enduring influences of early childhood income on academic skills and behavior problems in middle childhood. Early home environments were especially salient for understanding early income’s influences on reading skills and behavior problems.

Furthermore, even though children’s lives were unfolding increasingly outside of their household, the quality of home environment in middle childhood was important for understanding relations between income and all three domains of development. For academic skills, there seemed to be a lagged effect of early childhood income on home environment in middle childhood,
which had implications for development. In regard to children’s behavior problems, the quality of home environment in middle childhood was an important mediator of the effect of middle and early childhood income.

Overall, the quality of children’s early home environment tended to explain less of the association between income and math skills than it did for reading skills or behavior problems. This may be an artifact of the measure of home environment quality used in this study, which emphasizes two primary dimensions of the home environment: cognitive stimulation and emotional support. Items related to cognitive stimulation in this measure are focused on characteristics of the home environment, such as shared reading and the availability of books and other reading materials, that are important to the development of early literacy skills (for a review, see Morrison, Bachman, & Connor, 2005). Very few items on the measure of home environment quality are aimed specifically at assessing aspects of the home environment that contribute to the development of math skills.

Unfortunately, when compared with the voluminous literature documenting relations between home environment quality and reading skills, research on the associations between children’s home environment and the development of math skills is underdeveloped. At the present time, it is difficult to know which dimensions of the home environment are most important for understanding variability in math skills. An alternative hypothesis for why home environments tend to explain less of the association between income and math skills in middle childhood is that schools may be more important than the home environment for understanding the development of children’s math skills in middle childhood. Although schooling effects have been found for math skills (Naito & Miura, 2001), the existing literature cannot shed light on the relative contributions of children’s home and school contexts for the development of their math skills.

Finally, although children’s home environment was an important mediator in middle childhood, it rarely explained more than 30% to 40% of income’s effects on development. In other words, home environment in all cases only partially mediated the effects of income. This suggests that this study has fallen short of understanding all of the pathways by which income affects development in middle childhood.

Policy Implications

Given that this study has uncovered significant effects of income on development in middle childhood, it is useful to consider their implications for policies aimed at enhancing the life chances of children. Overall, the effects of income on development in middle childhood were relatively small. A log-unit or 2.7-fold increase in early childhood income across the level and change models was linked to, at most, a 2–3-point improvement in academic skills and a two-item reduction in the number of behavior problem items that parents endorsed. A log-unit increase in middle childhood income was linked to about a half-item reduction on the behaviors problems measure. Increasing these cumulative measures of family income by this magnitude would require increasing income, on average, during each year of middle childhood and early childhood, not simply a one-time income transfer. Thus, it would take large income transfers to translate into these fairly modest changes in the life of low-income children during middle childhood.

Although income transfer programs may be part of an effective strategy for promoting the academic and social development of low-income children during middle childhood, existing income transfer programs, such as Temporary Assistance for Needy Families and the Federal Earned Income Tax Program, may have only small implications for development in middle childhood. For example, in 2000 the maximum Temporary Assistance for Needy Families benefit for a family of three (parent and two children) ranged from a low $164 in Alabama to a high of $923 in Alaska, which represent annual income transfers of $1,968 and $11,076, respectively (U.S. House of Representatives, 2000). Similarly, in 2003 the maximum annual Federal Earned Income Tax Program benefit for a family of three (parent and two children) was $4,000 (U.S. Department of the Treasury, Internal Revenue Service, 2003). This is not to say that we should abandon income transfer programs. Indeed, they provide a minimal safety net for millions of Americans. The point is simply to recognize that, on the basis of the results of this study, the anticipated gains of these programs for children’s development in middle childhood are small and that such programs may not be the most cost-effective or efficient way of improving development.

From a developmental perspective, these findings are not altogether surprising, as proximal environments tend to be the most influential on children. In other words, children’s experiences in their everyday interactions matter most for their development. Thus, changes in more distal contexts are not likely to be as successful in improving developmental trajectories. Interventions such as the Infant Health and Development Project, the Perry Preschool Project, and Fast Track, which have been focused on changing children’s proximal environments, have succeeded in promoting meaningful and sustainable change in the life of children who are at risk (Brooks-Gunn et al., 1994; Conduct Problems Prevention Research Group, 2002; Schweinhart & Weikart, 1980). For example, IHDP, which provided 3 years of multiple proximal interventions (e.g., home visits, enriched child care), resulted in nearly a standard deviation improvement in the IQ of heavier infants (2,001–2,500 g) and about one half of a standard deviation improvement for the lighter weight infants (2,000 g or lighter) and the intervention group as a whole when compared with controls (Brooks-Gunn et al., 1994; Hill, Brooks-Gunn, & Waldfogel, 2003). The cost of this program was roughly $10,000 per year for 3 years, but IHDP had larger impacts on development than would be anticipated from an income transfer program of this magnitude (St. Pierre, Layzer, & Barnes, 1995). If we are committed to improving the social and academic trajectories of low-income children, it may be most effective to take a two-pronged approach that combines existing income transfer programs with interventions targeted at more directly influencing the developmental trajectories of low-income children.

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