

## Testing Equivalence of Mediating Models of Income, Parenting, and School Readiness for White, Black, and Hispanic Children in a National Sample

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This paper examines complex models of the associations between family income, material hardship, parenting, and school readiness among White, Black, and Hispanic 6-year-olds, using the Early Childhood Longitudinal Study–Kindergarten Cohort (ECLS–K). It is critical to test the universality of such complex models, particularly given their implications for intervention, prevention, and public policy. Therefore this study asks: Do measures and models of low income and early school readiness indicators fit differently or similarly for White, Black, and Hispanic children? Measurement equivalence of material hardship, parent stress, parenting behaviors, child cognitive skills, and child social competence is first tested. Model equivalence is then tested by examining whether category membership in a race/ethnic group moderates associations between predictors and young children's school readiness.

Starting early in elementary school, ethnic minority children in the United States experience a significant gap in their academic achievement relative to their White counterparts (Lee & Burkham, 2002). Children clearly face racial and ethnic inequalities in the distribution of school and neighborhood resources, and analyses of these inequalities have been undertaken in studies of the "achievement gap" among children (Crosnoe, in press; Hanushek, Kain, & Rivkin, 2004; Phillips, Crouse, & Ralph, 1998; Reardon, 2004). Findings of educational disparities as early as kindergarten, however, raise questions regarding the roles of family environment and parenting behaviors in predicting this gap in early childhood (Fryer & Levitt, 2004; Lee & Burkham, 2002). To address these questions, this paper and a companion paper (Gershoff, Aber, Raver, & Lennon, 2006) test multiple mediating pathways of income, material hardship, parent stress, parenting behaviors, and school readiness with a nationally representative sample of Kindergarten-aged children (see Figure 1). In keeping with prior work, we consider both children's

cognitive and socioemotional functioning as two important indicators of children's school readiness (Aber, Jones, & Cohen, 2000; Raver & Zigler, 1997; Raver, 2002).

### *Analyzing Complex Questions of Race/Ethnicity, Family Income, Parenting, and School Readiness*

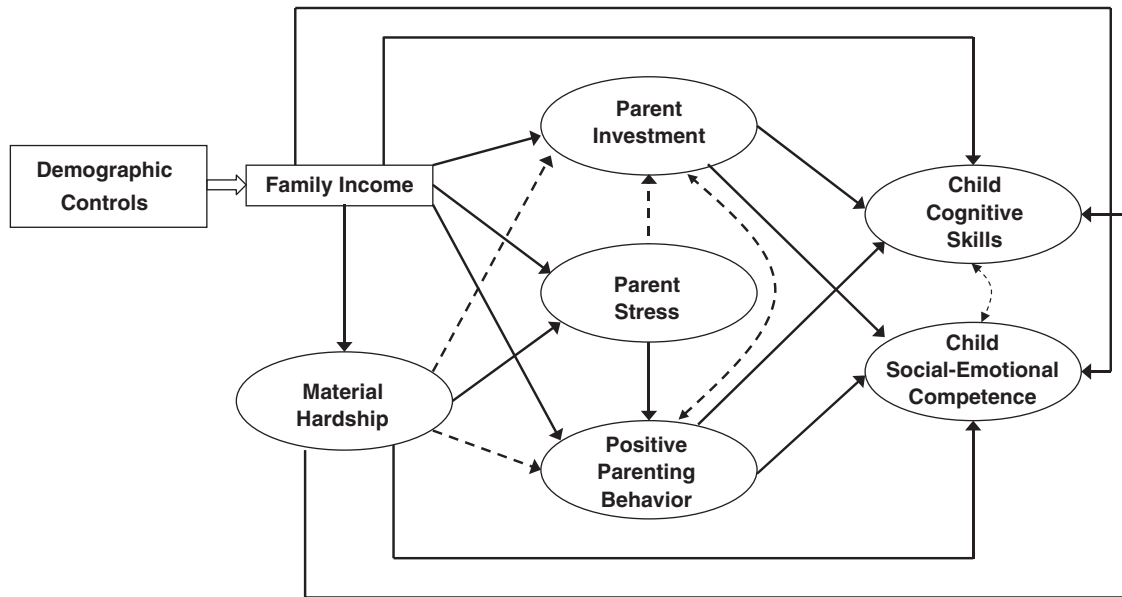
How can the complex associations among race, ethnicity, income, family process, and child outcomes be disentangled? One approach has been to compare mean differences in children's school achievement as a function of mean differences in income between race/ethnic groups. In short, the gap in school readiness is paralleled by a racial and ethnic gap in children's experiences of income inequality, where African American and Hispanic-American children face substantially higher likelihood of spending a greater amount of time in poverty, than do White children (Brooks-Gunn, Duncan, & Maritato, 1997; Duncan & Aber, 1997; McLloyd, 1998). A wealth of rigorous research has used this first approach, with much of the difference in school readiness among young White children and young children of color convincingly demonstrated to be a result of differences in income, even after controlling for families' characteristics (such as levels of maternal education; Duncan, Yeung, Brooks-Gunn, & Smith, 1998; Duncan & Magnuson, 2005).

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Note. Model of multiple mediating pathways from income to child outcomes proposed by Yeung, Linver, and Brooks-Gunn (2002) are depicted with solid lines. Additional pathways tested in Gershoff et al. (2006) are presented with dashed lines.

Figure 1. Mediating model of family income, material hardship, parenting, and school readiness.

A second approach has been to test whether the *measures* of hardship, parenting behaviors, and school readiness are equivalent across race/ethnic groups. Why would this be important? In blunt terms, both researchers and practitioners have viewed some developmental research, including past measures of parenting and child intelligence, as ethnocentric and untrustworthy in capturing dimensions of competence among ethnic minority families and their children. In response to such critiques, many investigators strive to meet a higher empirical standard, demonstrating that measures are psychometrically sound across multiple groups that differ by race, ethnicity, and language. Measurement equivalence establishes whether a given set of assessments tap a latent construct such as child cognitive skill in similar ways across racially and/or ethnically different groups. While there are a number of different hierarchically ordered components of measurement equivalence (see Bollen, 1989), the question of whether latent constructs such as child cognitive skill maintain factorial invariance (with equivalent parameter estimates for factor loadings from latent to observed variables) was the primary focus of our concern (see Kline, 1998). The benefit of establishing measurement equivalence is greater accuracy: We reduce the risk of introducing unacceptably large amounts of error into our models (Bollen, 1989; Ferreira, Deeb-Sossa, Harris, & Bollen, 2005). Once measurement equivalence has been estab-

lished, both researchers and practitioners may place greater trust in the inferences that are drawn from those measures (Bingenheimer, Leventhal, & Brooks-Gunn, 2005; Hughes, Seidman, & Williams, 1993; Hui & Triandis, 1985; Knight & Hill, 1998; Whiteside-Mansell, Bradley, Little, Corwyn, & Spiker, 2001).

A third approach is to consider the role of race/ethnicity as a moderator in the models that we build with our measures. Broadly defined, questions of model equivalence refer to whether observed associations among a set of predictors and outcomes are similar or different across two or more groups. Previously, "general theoretical constructs [were] assumed to be universal" in much developmental research (Phinney & Landin, 1998, p.93). More recently, investigators have begun to challenge this key assumption by including measured indicators of race, ethnicity, or culture as exogenous or endogenous predictors of the developmental construct in question (Phinney & Landin, 1998).

These three approaches (namely considering mean differences, establishing measurement equivalence, and testing model equivalence across race/ethnic groups) offer three distinct ways of explicitly incorporating race and ethnicity into developmental models. Following Knight and Hill (1998), we focus squarely on the latter two of these three approaches. We first examine the measurement equivalence of families' experiences of material hardship, parenting behaviors, and school readiness. Given space con-

straints and limits on the level of detail that can be included in any given study, the following analyses are limited to the assessment of measurement equivalence at the scalar level (see Bingenheimer et al., 2005; Perreira et al., 2005 for discussions of other types of measurement equivalence). In addition, we examine model equivalence for a set of competing mediating models of the associations among income, material hardship, parenting behaviors, and children's school readiness. We ask whether category membership in a race/ethnic group serves as a moderator in such models, with race/ethnic group membership associated with differences in slope between predictors and outcomes across different groups. Our aim is to understand the extent to which paths that predict children's school readiness might differ in some respects, and may be similar in other respects, across the three largest race/ethnic groups represented in the Early Childhood Longitudinal Study–Kindergarten Cohort (ECLS–K), a newly available large, nationally representative, and longitudinal data set designed to study the course of educational stratification among American school children.

Before moving forward with a more detailed review of the literature, it is important to lay out the definitions and parameters that inform this study. Racial and ethnic categories are recognized in much social science literature as relatively fluid socio-historical constructs used by different groups to negotiate social stratification. They are also recognized, however, as having meaning to individuals and groups as important forms of social identity and community membership (Barbarin, 1999; Foster & Martinez, 1995). We use race/ethnic categories of "Black," "Hispanic," and "White" to denote three groups of children who are identified by their parents as falling into a single race/ethnic category during the first year of the ECLS–K survey administration. Analyses of within-group variance and analyses of model-fit for children belonging to Asian, Native American/Alaskan Native, Hawaiian Native/Pacific Islander race/ethnic groups or to more than one race/ethnic category (e.g., biracial children) are equally important but are not included in this paper. There are also a multitude of ways that Black and Hispanic children's experiences of institutions, neighborhoods, social networks, and parental employment patterns may differ from one another and from those of White children and one of us has analyzed these neighborhood differences extensively in previous research (see Duncan & Aber, 1997). Despite their compelling dimensions, we set those additional questions aside in this paper in order to

focus on the following ones. Given a large survey effort to follow the educational trajectories of a group of over 20,000 Kindergartners, (1) do the survey's measures appear to tap underlying dimensions of material hardship, parent stress, parenting behaviors, and children's school readiness in common or disparate ways across different groups of children?; and (2) do models of family income, material hardship, parent stress, parenting behaviors, and children's school readiness indicators appear to fit differently or similarly for Black, Hispanic, and White children? We briefly review two areas of research to provide a clear rationale for testing these two questions.

#### *A Closer Look at Measurement of Our Key Variables*

Are differences in early achievement between different sociocultural groups due to measurement problems or are they reflective of "true" differences in cognitive skills between groups (Knight & Hill, 1998; McArdle, Johnson, Hishinuma, Miyamoto, & Andrade, 2001; Whiteside-Mansell et al., 2001)? Early concerns regarding the extent to which measures of cognitive skills may be culturally biased has led to extensive debate and research on standardized measures of school readiness for ethnic minority and ethnic majority children. Psychometric analyses of both language and social–emotional measures have been extensively conducted, with scholars arriving at very different conclusions regarding the reliability and validity of many commonly used standardized assessments (Doucette-Gates, Brooks-Gunn, & Chase-Lansdale, 1998; Fantuzzo & McWayne, 2002; Mercer, 1979). The investigators responsible for the design of the ECLS–K took great care in selecting measures to be included, but to our knowledge the measurement equivalence of school readiness outcomes has not been extensively analyzed. This paper provides us with the opportunity to do so.

Similarly, a growing number of studies have pointed out that we do not yet have sufficient confidence that instruments used to assess parenting are comparable across different ethnic minority and ethnic majority subgroups (Bingenheimer et al., 2005; Garcia Coll et al., 1996; Hill, Bush, & Roosa, 2003; McGuire & Earls, 1993). That is, there is substantial evidence for measurement inequivalence in domains of parenting attitudes, beliefs, values and practices. In particular, measurements of parenting practices involving family cohesion, parental discipline, parental expressions of warmth, and control appear to be particularly open to questions of cross-ethnic validity (Knight, Tein, Shell, & Roosa, 1992; Simons

et al., 2002). Alternately, some investigators have found scant evidence for differences in the way that measures reflect latent constructs of parenting style. Perhaps this disparity in findings across studies is due to ways in which some domains of parenting draw upon adults' similar styles and skills regardless of cultural frame, while other domains such as discipline, emotional expressiveness, and warmth may be culturally framed. Because the ECLS-K collected data on a wide range of parenting constructs, we have ample opportunity to test the hypothesis that some parenting constructs might demonstrate factorial invariance while other parenting constructs might vary considerably in the way that measures tap a latent construct.

Finally, there has been very little research on the extent to which measures of material hardship and parents' stress accurately or inaccurately reflect latent constructs. Recent analyses by Meyer and Sullivan (2003) suggest that income is subject to considerable error in measurement, and that expenditures and current consumption provide less error-prone measures of families' material well-being. But do measures of material hardship and concomitant parents' stress operate similarly or differently across different ethnic/cultural communities (see Alegria & McGuire, 2003; Brown, 2003)? For example, measures of depression and interparental conflict have been included in studies of family process across cultural and racial groups, but less is known regarding whether these constructs demonstrate factorial invariance across race/ethnic groups (see Crockett, Randall, Shen, Russell, & Driscoll, 2005; Perreira et al., 2005, for recent exceptions).

*A Closer Look at Moderation: Differences in the Magnitude of Associations Among Poverty and Child Outcomes Across Race/Ethnic Groups*

Even if we find that measures work similarly across racial and ethnic groups, we do not know whether poverty takes a similar or different toll on children of color than it does on White children. That is, if measurement equivalence were established, would we find that the mediating model outlined by Gershoff et al. (2006) fits each group similarly or differently? Empirical evidence suggests that ethnic minority families face a larger cascade of structural, poverty-related stressors and have access to fewer supports than do White families, such that the effects of low or falling income may be more negative among families of color than for White families. For example, Black parents face more extensive segregation in poorer neighborhoods, greater likelihood of

job loss, longer bouts of unemployment with greater likelihood of loss of fringe benefits, lower access to monetary and nonmonetary assets, and greater likelihood of racial discrimination in trying to enter the labor market than do White parents (Duncan & Aber, 1997; Holtzer & Stoll, 2000; Kalil & Deliere, 2002; Murry, Smith, & Hill, 2001; Spalter-Roth & Deitch, 1999; Wilson, 1987; Wilson, Tienda, & Wu, 1995).

In addition, numerous researchers studying parenting among ethnic minority, low-income families argue that communities of color draw strength from racially and ethnically specific cultural norms to cope with these structural constraints. A range of developmental studies of parental socialization and developmental outcomes with low-income, minority samples suggest that developmental pathways that predict positive outcomes among children of color may be different in some cases, and similar in other cases, than those that have been found to be advantageous for White children (Brody et al., 1994; Garcia Coll et al., 1996; Harrison, Wilson, Pine, Chan, & Buriel, 1990; McLloyd, 1998; Pinderhughes, Nix, Foster, & Jones, 2001; Simons et al., 2002).

For example, there has recently been substantial debate regarding the extent to which models of parental discipline, warmth, and acceptance as predictors of children's lower likelihood of developing externalizing behavior problems are equivalent or inequivalent across ethnic majority and ethnic minority groups in the United States. Some investigators have argued that harsh parenting that includes physical punishment has negative consequences for all young children, regardless of ethnic minority membership (Gershoff, 2002; Pinderhughes et al., 2001). Others find that the association between harsh and punitive parenting practices and children's externalizing problems holds only for White families and not for African American and recently immigrated Mexican families (Deater-Deckard & Dodge, 1997; Gonzales, Pitts, Hill, & Roosa, 2000; Hill et al., 2003; Simons et al., 2002). Interestingly, less attention has been paid to the ways in which other dimensions of parenting (e.g., parents' mental health, their investments in cognitively stimulating activities) may be differentially predicted by material hardship and may be differentially predictive of child outcomes across different cultural contexts. In short, the universality of models of socialization is substantially under question, and a number of investigators have called for tests of measurement and model equivalence across racial and ethnic groups, particularly for models with significant implications for intervention, prevention, and public policy (Mistry,

Vandewater, Huston, & McLoyd, 2002; Roosa, Dumka, Gonzales, & Knight, 2002).

A third group of studies in the area of child poverty examines families' racial and ethnic group membership as moderators in models of income loss, poverty, and child outcomes. Some studies have found ample evidence for inequivalence in models of poverty, parenting, and child outcomes, with job loss and longer durations of poverty predicting a steeper slope of increase in ethnic minority children's anxiety and depression, school attendance, and academic performance (Kalil & Deliere, 2002; Shanahan, Davey, & Brooks, 1998). Recent analyses examining associations between poor and nonpoor families' investments of a wide range of inputs including cognitive stimulation, teaching, parenting style, safety and supervision, and children's social and cognitive competence suggest a very complex picture of interactions between poverty and ethnic group membership (Bradley, Corwyn, Burchinal, McAdoo, & Garcia Coll, 2001). Other studies have found little or no evidence for model inequivalence (Guttman & Eccles, 1999; Mistry et al., 2002), leading investigators to suggest that the costs of poverty to young children substantively overwhelm any cultural or ethnic specificity in impacts that may be found. A third set of studies finds evidence of moderation along some pathways in the model being tested, with no evidence of moderation for other pathways. For example, in one study of low-income families in Philadelphia, financial strain was associated with reduced feelings of parenting efficacy for both Black and White families, and yet the two groups turned to very different sets of monitoring strategies to promote their children's positive outcomes (Elder, Eccles, Ardel, & Lord, 1995). Similarly, recent support for the economic stress model has been found for both European American and Mexican American families, with family ethnic group membership and level of acculturation playing important moderating roles for relations between marital conflict and child adjustment (Parke et al., 2004).

Why do these studies yield such disparate findings? Barbarin (1999) suggests that at least part of the problem of interpretation may arise because of the multiple meanings of racial categories. This difficulty may also stem from methodological challenges: There are no easy means of testing moderation using standard OLS regression techniques when predicting multiple outcomes in different developmental domains with a large number of predictors. Instead, the task of having to enter a large numbers of interaction terms, multiple times, as each dependent variable is

regressed on a long list of predictors, may lead to results that are unwieldy or difficult to sum up. This paper addresses these concerns by jointly considering the roles of income and race/ethnic group membership in predicting multiple domains of school readiness using structural equation model-fitting techniques (SEM, Arbuckle & Wothke, 1995).

### *Research Questions*

In sum, evidence clearly points to a stark set of economic disparities between ethnic minority children and White children in the United States. Evidence also clearly points to the ways in which parental responses to material hardship, optimal parenting, and child outcomes may be substantially influenced by the sociocultural contexts in which families raise their children. In response to others' calls for greater attention to the joint importance of these racial, cultural, and socioeconomic contexts in which developmental processes unfold, we ask the following questions:

- (1) Are hypothesized outcomes, mediators, and predictors relatively invariant or variant in their measurement across three ethnic groups? There are specific, strong reasons to examine whether measures tapping children's competencies, parenting, stress, and material hardship are factorially similar or different across groups. This is a particularly important question in light of (a) increasing racial diversity across the nation and (b) extension of survey instruments from relatively less culturally variant constructs (e.g., income) to developmental constructs that have been recently argued to vary substantially across multiple sociocultural contexts (Simons et al., 2002).
- (2) Do recently tested models of multiple mediating pathways predicting from income to school readiness (Gershoff, Aber, & Raver, 2003; Gershoff et al., 2006) fit similarly or differently for Black, Hispanic, and White families? We examine whether structural parameters representing the strength of association between disadvantage and children's cognitive and social-emotional competencies are best characterized as similar, or as different, across three racial and ethnic groups of children in the United States. We examine these models to detect whether there is any evidence that the "cost" of these disparities may be magnified for ethnic minority children. We expand our own and others' models

by simultaneously testing a set of theoretically driven hypotheses regarding the “investment” and “family stress” pathways in models of poverty and school readiness (Gershoff et al., 2006; Yeung, Linver, & Brooks-Gunn, 2002).

One caveat must be offered before moving forward. It is important to note that we rely on ECLS–K categorizations of race/ethnic classification that do not make distinctions among different sub-groups within each large, race/ethnic label (e.g., “Mexican,” “Puerto Rican,” “Dominican” among those in the Hispanic category) and that this is a significant shortcoming of the following analyses. While APA guidelines for avoiding racial and ethnic bias in language recommend use of more specific over less specific terms (e.g., “Cuban” vs. “Hispanic”), the diversity of ethnic groups within the ECLS–K precludes us from using more ethnically specific terms. Following guidelines provided by the U.S. Office of Management and Budget (1997), “Hispanic” is used to refer to families of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin. Capitalized color terms are used to refer to non-Hispanic families, with “Black” including families “having origins in any of the black racial groups of Africa” (including those of Caribbean descent) and with “White” including families “having origins in any of the original peoples of Europe, the Middle East, or North Africa” (Waksberg, Levine, & Marker, 2000).

We also recognize that there is likely to be as much or more variance within any given race/ethnic group as between groups (Ceballo & McLoyd, 2002). For example, we do not analyze distinctions on the basis of national origin, recency of immigration, citizenship status, or whether arrival in the United States was voluntary or involuntary, factors with which race, ethnicity, social class, and income are often confounded (Garcia Coll et al., 1996; Parke et al., 2004). We also restrict our analyses to the three largest race/ethnic groups, recognizing that analyses of Alaskan/Native American, Hawaiian/Pacific Islander, Asian American, and multiracial families are beyond this paper’s scope.

## Method

### *Sample*

The ECLS–K is a nationally representative sample of 21,260 children enrolled in 944 Kindergarten programs during the 1998–1999 school year de-

signed to study the development of educational stratification among American school children (West, Denton, & Germino-Hausken, 2000). The study was developed by the U.S. Department of Education, National Center for Education Statistics (NCES), and implemented by Westat, a research corporation based in Rockville, MD. NCES recommended removing five students from the sample for substantial data errors (NCES, 2002), thus leaving a sample of 21,255 children for the analyses presented here. In order to provide information on the sample that actually participated in the study, all demographic data reported here are unweighted.

Sample selection for the ECLS–K involved a dual-frame, multistage sampling design. At the first stage, 100 primary sampling units (PSUs) were selected from a national sample of PSUs comprised of counties and county groups. At the second stage, public schools were selected within the PSUs from the Common Core of Data (a public school frame) and private schools were selected from the Private School Survey. Finally, an average of 23 kindergartners was selected for participation from each of the sampled schools (West et al., 2000). Children of Asian racial background were over-sampled. Schools participated with a weighted response rate of 74%; among the participating schools, the completion rates were 92% for the children, 91% for the teachers, and 89% for the parents.

At the spring 1999 assessment, the mean age of the children in the sample was 6 years and 3 months,  $SD = 4$  months; 51% of the children were male and 49% were female. Children’s racial ethnicity (using new Office of Management and Budget, 1997 guidelines) were 55% White/non-Hispanic, 18% Hispanic, 15% Black/non-Hispanic, 6% Asian, 2% Native American/Alaska native, 1% Hawaiian Native/Pacific Islander, and 3% more than one race or another race. Seventy five percent of the children came from two-parent families, with an additional 21% in single-mother families and 2% in single-father families.

### *Measures*

Brief descriptions and reliability statistics for all observed indicators of income, poverty-related material hardship and stress, parenting investments and parenting behaviors, and child outcomes, as well as control variables of parent marital status, education, and work status, are described below (with latent constructs italicized for clarification). Where appropriate, reliability statistics are first presented for the sample as a whole ( $\alpha_F$ ) and then for

Whites ( $\alpha_W$ ), Blacks ( $\alpha_B$ ), and Hispanics ( $\alpha_H$ ). More extensive details regarding the wording of all items can be found in Gershoff et al. (2006) but are not repeated here, for the sake of brevity.

*Race/Ethnicity of child.* Parents completed a set of questions regarding their classification of their child's racial and ethnic group membership. Parents first identified whether the child was Hispanic, and then, following new Office of Management and Budget (1997) guidelines, parents could select more than one race for their child. These variables were combined to yield five composite race/ethnicity categories of "White non-Hispanic," "Black non-Hispanic," "Hispanic," "Asian," and "other" (which included Pacific Islanders, Native Americans, Alaska natives, and multiracial children; Zill & West, 2001). The following analyses use data for children who fall into three of these five categories, labeled "White," "Black," and "Hispanic."

*Covariates hypothesized to be exogenous.* Family highest education was reported as the highest of nine levels of education achieved by the child's parents or single parent as of fall 1998. At that assessment, the parent respondent also reported on their own and their partner's work status, including whether either adult was not in the labor force, looking for work, working part time, and working full time. In addition, the parent respondent provided a count of the total number of adults and children in the household at that time. In the spring of children's Kindergarten year, parents' marital status was reported as married, separated, divorced, widowed, or never married.

*Income.* In the spring assessment, parents reported their total household income over the course of the last year. We used the imputed income variable provided in the restricted—use ECLS-K dataset (NCES, 2001). The original variable was top-coded at \$999,999.99, yielding a mean of \$40,000 ( $SD = \$56,399$ ), and was highly skewed (6.37). Income was therefore coded by stratifying families into 1 of 13 grouping to match the category groupings created by NCES for later waves of data collection (e.g., first grade). The first 8 income categories are in \$5,000 increments (for \$0 – \$40,000), the next 4 categories were coded in larger increments (\$25,000 and \$100,000), and the final category is for families with annual incomes greater than \$200,000. As outlined by Gershoff et al. (2006), this transformed variable was highly correlated with the original variable and has a lower likelihood of violating assumptions of normality.

*Endogenous mediators.* *Material hardship* was assessed using parents' report of food insecurity, parents' report of inadequate medical care, transformed

scores of their residential instability, and transformed scores of the number of months that the family has experienced financial problems. Food insecurity was assessed through parents' reports in the spring on 18 items of the Household Standard Food-Security/Hunger Survey Module created by the U.S. Department of Agriculture (USDA: Bickel, Nord, Price, Hamilton, & Cook, 2000;  $\alpha_F = .89$ ,  $\alpha_W = .89$ ,  $\alpha_B = .87$ ,  $\alpha_H = .88$ ). Residential instability, defined as the number of child's moves since birth, was calculated by subtracting 1 from parents' fall reports of the total number of places the child had lived since birth. During the fall interview, parents were also asked whether they "had serious financial problems or were unable to pay monthly bills" and were asked to indicate the number of months the problem had lasted if they answered "yes." Inadequacy of medical care was comprised of whether the child was insured, had visited a primary care physician in the last year, and whether the child had received dental care in the last year.

*Parent stress* was assessed in the spring using three indicators including parental report of parenting stress derived from aggregated and transformed scores on 8 items from the Parenting Stress Index (Abidin, 1983,  $\alpha_F = .66$ ,  $\alpha_W = .64$ ,  $\alpha_B = .67$ ,  $\alpha_H = .69$ ); transformed scores of parental depressive symptoms as assessed by caregivers' responses on at least 8 of 12 items adapted from the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977,  $\alpha_F = .86$ ,  $\alpha_W = .85$ ,  $\alpha_B = .87$ ,  $\alpha_H = .87$ ); and marital conflict on at least 14 of 20 items adapted from the Conflict Tactics Scale (Straus, 1990,  $\alpha_F = .81$ , as well as for all three sub-groups).

*Parent investment* was assessed in the fall and was specified by four observed indicators. These included parents' purchase of cognitively stimulating materials such as computer, books, audiotapes, and the presence of those materials in the home ( $\alpha_F = .64$ ,  $\alpha_W = .51$ ,  $\alpha_B = .56$ ,  $\alpha_H = .65$ ); parent activities with the child out of the home including trips to libraries, concerts, museums, zoo, and sports events ( $\alpha_F = .45$ ,  $\alpha_W = .39$ ,  $\alpha_B = .54$ ,  $\alpha_H = .50$ ); and extracurricular activities outside the home, including lessons, classes, and activities that young children might be enrolled in ( $\alpha_F = .56$ ,  $\alpha_W = .55$ ,  $\alpha_B = .51$ ,  $\alpha_H = .57$ ). Finally, parents' report of their own involvement in their child's school was also included, based on parents' response to at least 6 of 8 items on questions involving parents' contact with teachers, attendance at an open house, attending a class event such as a sports event, acting as a volunteer or helping to fundraise for the child's school ( $\alpha_F = .58$ ,  $\alpha_W = .51$ ,  $\alpha_B = .61$ ,  $\alpha_H = .57$ ).

*Positive parenting behavior* was assessed in the spring and was specified by four observed indicators. Parental warmth was calculated across 5 items, including whether mother and child “have warm, close times together,” “expresses love and affection,” or “often too busy or tired to express warmth with child” ( $\alpha_F = .53$ ,  $\alpha_W = .52$ ,  $\alpha_B = .53$ ,  $\alpha_H = .51$ ). Data were strongly skewed, and were therefore transformed, with log transformation. Parental cognitive stimulation was also included as a key parenting behavior and was composed of 9 items regarding how often families reported reading books, telling stories, singing songs, involving children in household chores, carrying out nature, science, construction projects, and playing a sport or exercising together ( $\alpha_F = .72$ ,  $\alpha_W = .71$ ,  $\alpha_B = .72$ ,  $\alpha_H = .74$ ). Parents’ use of physical punishment was aggregated across parents’ selection of different forms of punishment of increasing severity and parent’s self-report of their use of spanking (for further elaboration, see Gershoff et al., 2006). Parents’ reported use of rules and routines was calculated across eight activities that included television watching, mealtimes as a family, and set time for child’s bedtime on weeknights and weekends ( $\alpha_F = .55$ ,  $\alpha_W = .54$ ,  $\alpha_B = .55$ ,  $\alpha_H = .58$ ).

*Child school readiness outcomes. Cognitive skills* were directly assessed by ECLS survey research staff using three measures adapted from the Peabody Individual Achievement Test–Revised (Markwardt, 1997), the Peabody Picture Vocabulary Test-3 (Dunn & Dunn, 1997), the Primary Test of Cognitive Skills (Lochner & Levine, 1990), and the Woodcock–Johnson Psycho-Educational Battery–Revised (Woodcock & Johnson, 1990). For these analyses, we used the re-estimated kindergarten IRT scores that were released with the first grade ECLS–K data (NCES, 2001). The internal reliability statistics included here were detailed in the psychometric report for the ECLS–K (Rock & Pollack, 2002). Measures of cognitive skills included reading ( $\alpha = .95$ ), math ( $\alpha = .94$ ), and general knowledge ( $\alpha = .89$ ) assessed directly from children in the spring. Internal reliability for race/ethnic groups could not be estimated, as individual items on the ECLS–K are not provided for measures of cognitive skill (nor for the measures of socio-emotional competence, described below).

*Social-emotional competence* was assessed using the Social Rating Scale, a measure adapted by the ECLS–K from the Social Skills Rating Scale (SRS: Gresham & Elliott, 1990). The reliability statistics provided below are from the psychometric report for the ECLS–K (Rock & Pollack, 2002). Ratings were derived from teachers’ and parents’ ratings of chil-

dren’s self-regulation ( $\alpha$ s ranging from .47 to .89) and social competence with peers (parent-rated:  $\alpha = .68$ ; teacher-rated:  $\alpha = .89$ ), internalizing mental health problems (parent-rated:  $\alpha = .61$ ; teacher-rated:  $\alpha = .78$ ), and teachers’ reports of children’s externalizing behavior problems ( $\alpha = .90$ ).

### *Analytic Strategy*

To address questions of measurement equivalence, this paper takes the following steps. After weighting the data to account for clustered sampling, covariance matrices for all study variables were created for each of the three ethnic groups (see below for further detail). In conducting analyses of differences in parameter estimates, we faced several empirical challenges.

The standard means of testing differences between measures or models in SEM is to set parameters such as variances, covariances, and error terms to be equal to one another and to compare the fit of this constrained model against another, less parsimonious model where paths are free to vary (Bollen, 1989; Byrne, 2001). While comparisons of fit statistics such as significant differences in CFI, RMSEA, or chi-square values tell us whether there is a reasonable likelihood that models differ, these omnibus tests of model fit do not tell us how they differ, nor about the magnitude of differences between specific parameters across different groups. In short, to our knowledge there are no other clearly defined standards on which to base claims of sufficient differences between parameter estimates, with large samples.

In this paper, extensive preliminary analyses using omnibus tests to compare equivalence models against measurement models—where all variances, covariances, and error terms were freed—yielded significant chi-square differences at the  $p < .001$  level (analyses available from authors on request). Next, analyses of path estimates from latent endogenous variables to all observed indicators were carried out to determine the relative magnitude of differences between groups. To determine the relative magnitude of the difference between the three groups for each path, all differences between parameter estimates for each path were calculated in proportional terms as the difference between the larger and the smaller unstandardized parameter estimate, divided by the larger of the two unstandardized estimates (following K. A. Bollen, personal communication, 2001). All differences were then compared in light of Cohen’s (1988) guide for reporting the relative magnitude of effect sizes, where  $d = .20$  represents the threshold for an effect size to be considered

“small.” With few other directives to follow, we feel that this represents a reasonable guide for how seriously differences between groups should be taken. For example, when parameter estimates for reading scores predicted by a latent cognitive competence construct only differ by 4% of the largest of the parameter estimates, it seems fair to suggest that measured reading scores function as an observable indicator of cognitive competence in a similar fashion across both groups. However, if differences between parameters for the same observed indicator differ by as much as 20% or 30% we might readily accept the claim that this difference is nontrivial and is worth discussing. In keeping with recent calls for closer attention to the practical importance of findings rather than simply their statistical significance, in this study we set “the bar” at 20% (McCartney & Rosenthal, 2000).

To test model equivalence across multiple groups, a constrained model (where paths from exogenous and endogenous latent constructs are set to equivalence across the multiple groups) is usually compared against a less parsimonious model where paths are allowed to vary across groups. When evidence supporting model inequivalence is found, nested models with subsets of paths alternately constrained or freed are then tested to determine where the sources of nonequivalence lie. Kenny (2002), however, suggests that if the latent constructs themselves are inequivalent at the measurement level across groups, such model comparisons may be uninformative or misleading. Rather than run the risk of inferring differences in parameter estimates when differences might lie at the measurement level, we heed Kenny’s (2002) advice and test the full model for each race/ethnic group, separately.

## Results

Descriptive statistics for all study variables were conducted and are presented in Table 1. As with Gershoff et al. (2006), we then followed a two-step process before undertaking our analyses. First, maximum likelihood estimation methods were used for imputation of missing data using the EM function in the Missing Value Analysis available in SPSS. The majority of the variables had missing data in 17% or fewer cases (the overall average was 10.68%); the exceptions were the two variables that referred to a father or father-figure in the household, namely father’s work status and marital conflict with 33% and 34% missing, respectively. Second, to adjust for the differential probabilities of each child’s selection at each sampling stage and the effects of nonre-

sponse, all of the variables in the analyses below were weighted using a weight calculated by NCES to be used with fall and spring child, parent, and teacher data (weight name: BYCPTW0; NCES, 2001). Because Amos 4.0 is not able to use data weights, we created covariance matrices in SPSS based on the EM imputed and weighted data. These covariance matrices were then uploaded into Amos 4.0 (Arbuckle & Wothke, 1995) for use in structural equation analyses.

### *Measurement Equivalence*

As a preliminary omnibus test of measurement equivalence for the full model, two contrasting models were specified where (a) all variances, covariances, and factor loadings were free to vary versus (b) all variances, covariances, and factor loadings were fixed to equivalence (Bollen, 1989; Kline, 1998). This omnibus test yielded evidence for inequivalence across all factor loadings, variances, and covariances,  $\Delta\chi = 4,897$ ,  $df = 55$ . The model in Figure 1 was therefore divided into three measurement models, and all loadings from latent to measured (observed) variables were freed to vary across three racial-ethnic groups for each measurement model. Again, omnibus tests of measurement models (with all factor loadings constrained to equality across all three race/ethnic groups) yielded significant differences in chi-square values, yielding a clear indication that factor loadings for all latent constructs do not fit equivalently across race/ethnic groups. Each set of latent constructs was then subjected to the analyses described earlier. As a quick reminder, one requirement for identification is that every latent variable must have a scale, or metric. In order to establish those scales, either the variance of each latent variable must be set to a constant, or the loading of one indicator per factor must be set to 1.0. As a statistical check, the analyses reported below were run twice, in two “rounds,” with the first round corresponding to the former and the second round corresponding to the latter of those two approaches.

### *School Readiness*

Concerning the criterion variables of “school readiness” ( $\eta$ s labeled “cognitive skills” and “social-emotional competence”), an initial model where all paths were set to equivalence across the three race/ethnic groups was compared against the unconstrained model in which all paths were freely estimated across groups. The fit of the constrained model was significantly worse than the freely

Table 1  
Means and Standard Deviations (SDs) for All Weighted Variables by Race–Ethnic Group

	Blacks		Hispanics		Whites	
	Mean	SD	Mean	SD	Mean	SD
Family highest education	4.00	1.54	3.66	1.82	5.16	1.83
Mother's work status	3.11	1.19	2.67	1.32	2.85	1.24
Father's work status	3.57	0.60	3.72	0.60	3.84	0.52
Parent's marital status	0.34	0.47	0.66	0.47	0.79	0.40
Family size	4.58	1.60	4.84	1.56	4.40	1.17
Family income	5.21	3.14	5.88	3.10	8.46	2.89
Food insecurity <sup>a</sup>	0.30	0.54	0.34	0.58	0.14	0.39
Residential instability <sup>a</sup>	0.97	0.55	1.02	0.57	0.95	0.59
Inadequacy of medical care <sup>a</sup>	0.80	0.21	0.89	0.26	0.79	0.19
Months of financial troubles <sup>a</sup>	−0.83	2.26	−1.09	2.08	−1.27	2.02
Parenting stress <sup>a</sup>	0.42	0.28	0.42	0.28	0.40	0.24
Depressive symptoms <sup>a</sup>	0.41	0.30	0.33	0.29	0.33	0.26
Marital conflict	1.78	0.30	1.74	0.36	1.74	0.33
Purchase of cognitively stimulating materials	2.06	0.87	2.03	0.92	3.00	0.80
Parent activities with child out of home	1.99	1.44	1.86	1.36	2.16	1.32
Extracurricular activities <sup>a</sup>	0.50	0.54	0.41	0.52	0.75	0.55
Parent involvement in school	3.60	1.92	3.78	1.80	4.67	1.61
Warmth <sup>a</sup>	1.15	0.26	1.08	0.28	1.12	0.23
Cognitive stimulation	2.75	0.52	2.65	0.54	2.83	0.46
Physical punishment <sup>a</sup>	0.71	0.39	0.53	0.34	0.54	0.31
Rules and routines	4.79	1.72	4.95	1.81	5.05	1.72
Math skills	23.56	7.50	23.95	8.02	29.70	8.59
Reading skills	28.89	9.45	28.54	9.21	33.55	10.15
General knowledge skills	22.00	6.71	22.80	6.81	29.84	6.99
Self-regulation	2.93	0.42	3.03	0.38	3.10	0.38
Social competence	3.17	0.47	3.20	0.46	3.32	0.44
Internalizing mental health problems	1.59	0.38	1.55	0.35	1.56	0.34
Externalizing behavior problems	1.89	0.74	1.65	0.60	1.64	0.62

Note. <sup>a</sup>The mean and SD presented are that of the transformed variable used in the analyses.

estimated model,  $\chi^2_{\text{difference}} = 62.820$ ,  $df = 8$ ,  $p < .0001$ . A first follow-up round of analyses suggested that  $\lambda$ s (paths from latent constructs to measured indicators) differed by as much as 29%. A second round of analyses suggested that differences between groups ranged from 1% to 16%. For example, children's externalizing behaviors were predicted by social competence latent construct with  $B$ s of  $-1.18$  for Whites,  $-1.19$  for Black children, and  $-1.00$  for Hispanic children, representing as much as a 16% difference between Black and Hispanic children. Tests of competing nested models to determine the extent of factorial invariance confirm that this represented the only factorial pathway that differed significantly (with factor loadings differing for Hispanic children vs. the other two groups). All other paths leading from latent to observed indicators of child cognitive skills and social–emotional competence were equivalent across all three race/ethnic groups, with a

final model (reflecting invariance on all paths but one) fitting adequately,  $\chi^2 = 1,924.48$ ,  $df = 61$ ,  $p < .0001$ , CFI = .964, RMSEA = .040 (see Table 2).

#### *Mediating Constructs of Positive Parenting Behavior and Parental Investment*

Omnibus tests of factorial invariance were then carried out for the two mediating constructs of positive parenting behavior and parental investments, yielding significant evidence supporting measurement inequivalence ( $\chi^2_{\text{difference}} = 144.775$ ,  $df = 12$ ,  $p < .0001$ ). Differences between  $\lambda$ s for measures of the  $\eta$  of parents' investments ranged from negligible (12%) to moderate (27%). In the second round of analyses (with the path from parent investment to extracurricular activities set to 1), differences in parameter estimates for the  $\eta$  of parental investment to observed indicators were somewhat

Table 2

Unstandardized Regression Coefficients for Paths From Etas "Cognitive Skills" and "Social Competence" to Measured Indicators Across Two Rounds of Analyses<sup>a</sup>

	White		Black		Hispanic		Difference in $\lambda$	
	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\Delta\lambda_s$	$\Delta\lambda_s$
	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
Child cognitive skills → math skills	7.20	0.96	6.35	0.95	6.76	0.95	.12	.02
Child cognitive skills → reading skills	7.50	1.00	7.29	1.00	7.01	1.00	.07	
Child cognitive skills → general knowledge skills	4.53	0.60	4.28	0.62	4.58	0.65	.07	.07
Child social-emotional competence → self-regulation	0.34	1.00	0.37	1.00	0.33	1.00	.11	
Child social-emotional competence → social competence	0.29	0.84	0.32	0.85	0.29	0.85	.10	.01
Child social-emotional competence → internalizing mental health problems	-0.16	-0.46	-0.18	-0.46	-0.14	-0.46	.21	.01
Child social-emotional competence → externalizing behavior problems	-0.41	-1.18	-0.47	-1.19	-0.33	-1.00	.29	.16

Note. <sup>a</sup>Standard errors and confidence intervals are not shown but are available from the first author.

magnified between race/ethnic groups. All unstandardized regression coefficients ( $B$ s) for paths leading from parental investment to observed measures differing by at least 20% across at least two out of the three race/ethnic groups.

Differences across race/ethnic groups were greater when examining the unstandardized regression coefficients for the pathway leading from the  $\eta$  of positive parenting behavior to observed indicators (see Table 3). Differences in  $B$  values for a given pathway ranged from 12% (cognitive stimulation) to 57% (for use of physical punishment) across race/ethnic groups. In the second round of analyses, all paths differed across race/ethnic groups by at least

20% and as much as 54%. Paths from the latent construct of positive parenting behavior to measured indicators such as parents' expressions of warmth differed by as much as 38% between Hispanic families and White families. Paths between the latent positive parenting behavior construct and parents' use of physical punishment continued to differ by more than 50%, with lower  $B$ s for Hispanic and White ( $-.08$  and  $-.11$ , respectively), but a larger  $B$  (in absolute value terms) for Black families ( $-.18$ ). Tests of a series of nested models suggested that more parsimonious models with partial factorial invariance were always worse-fitting than fully unconstrained models, suggesting full measurement

Table 3

Unstandardized Regression Coefficients for Paths From Etas "Parent Investments" and "Positive Parenting Behavior" to Measured Indicators Across Two Rounds of Analyses<sup>a</sup>

	White		Black		Hispanic		Difference in $\lambda$	
	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\Delta\lambda_s$	$\Delta\lambda_s$
	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
Parent investment → purchase of cognitively stimulating materials	.42	1.72	0.45	2.07	.52	2.14	.19	.20
Parent investment → parent activities with child out of home	.54	2.19	0.64	2.94	.59	2.43	.17	.25
Parent investment → extracurricular activities	.25	1.00	0.22	1.00	.24	1.00	.11	
Parent investment → parent involvement in school	.74	3.01	1.01	4.60	.84	3.44	.27	.34
Positive parenting behavior → warmth	.08	0.15	0.09	0.18	.11	0.24	.30	.38
Positive parenting behavior → cognitive stimulation	.32	0.57	0.33	0.62	.36	0.74	.12	.22
Positive parenting behavior → physical punishment	-.06	-0.11	-0.09	-0.18	-.04	-0.08	.57	.54
Positive parenting behavior → rules and routines	.55	1.00	0.52	1.00	.48	1.00	.12	

Note. <sup>a</sup>Standard errors and confidence intervals are not shown but are available from the first author.

Table 4

Unstandardized Regression Coefficients for Paths From Etas "Material Hardship" and "Parent Stress" to Measured Indicators Across Two Rounds of Analyses<sup>a</sup>

	White		Black		Hispanic		Difference in $\lambda$	
	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\lambda_s$	$\Delta\lambda_s$	$\Delta\lambda_s$
	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
Material hardship → food insecurity	.17	0.20	.32	0.46	.36	0.62	.52	.68
Material hardship → residential instability	.16	0.18	.07	0.10	.09	0.15	.54	.45
Material hardship → inadequacy of medical care	.04	0.05	.03	0.04	.05	0.09	.43	.54
Material hardship → months of financial troubles	.86	1.00	.71	1.00	.57	1.00	.34	
Parent stress → parenting stress	.10	0.54	.15	0.74	.15	0.81	.34	.33
Parent stress → depressive symptoms	.18	1.00	.20	1.00	.18	1.00	.10	
Parent stress → marital conflict	.16	0.90	.20	1.00	.21	1.18	.23	.24

Note. <sup>a</sup>Standard errors and confidence intervals are not shown but are available from the first author.

inequivalence for all paths in these models ( $\chi^2$  of the fully inequivalent model = 1,670.56,  $df = 75$ , CFI = .923, RMSEA = .034).

#### Mediating Constructs of Hardship and Parent Stress

Our next set of analyses addressed whether latent  $\eta$ s of parent stress and parental reports of family material hardship predicted observed measures similarly (equivalently) or differently (inequivalently) across different ethnic and racial groups (see Table 4). As with the previous analyses, omnibus tests of inequivalence suggested that a constrained model fit significantly worse than did a model where lambdas could be freely estimated ( $\chi^2_{\text{difference}} = 504.929$ ,  $df = 10$ ,  $p < .000$ ). In the first follow-up round of analyses,  $B$ s for pathways from latent constructs to all observed indicators but one differed across race/ethnic category membership by as much as 23–54%. In the second iteration of analyses, the path  $\eta$  of parent stress to parents' depressive symptoms and the path from the  $\eta$  of material hardship to financial troubles were fixed to 1. For this round, differences in  $B$ s for the  $\eta$  of "parent stress" were small to moderate across race/ethnic groups. For example, the parenting stress pathway differed by as much as 33% across groups.

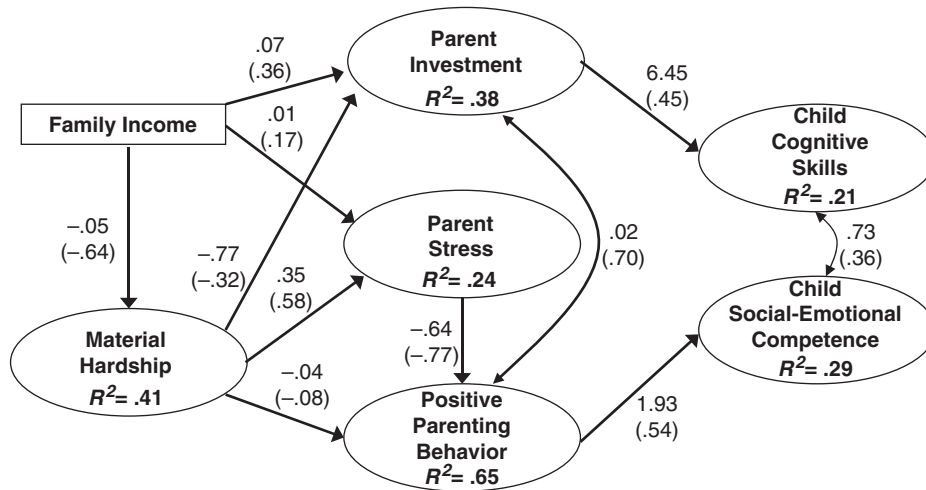
In addition,  $B$ s for pathways from the latent construct of material hardship to observed indicators differed substantially across race/ethnic groups. For example, loadings for paths leading from  $\eta$  of material hardship to the observed indicator of residential instability differed by 45% between Black and White families. In addition, loading from material hardship to the observed indicator of food insecurity differed by as much as 68%, with the  $B$  for White

families = .20 and the  $B$ s for Black and Hispanic families considerably higher (see Table 4). As with the previous analyses, nested models with some paths constrained to equivalence consistently offered worse fit than a model where all paths were freed to differ between race/ethnic groups, providing support for the fully inequivalent model ( $\chi^2 = 1,163.887$ ,  $df = 54$ ,  $p < .001$ ; CFI = .931, RMSEA = .033).

#### Model Equivalence

Model equivalence and tests of mediation were then tested following a set of steps outlined a priori (Baron & Kenny, 1986; Holmbeck, 1997; as outlined by Gershoff et al., 2006). The models were run separately for each race/ethnic group. For each group, a baseline model was tested with direct paths from income to parenting mediators only (Model 1). This was then followed by the test of a second model in which hardship mediates the association between lower income and higher parent stress, lower positive parenting behavior, and lower parent investment (Model 2). We then conducted a third test of parent stress as a mediator in predicting parenting investment and positive parenting behavior from income and hardship (Model 3). Next, we tested the role of the parenting variables as mediators in a model of the association between income, hardship, and child school readiness (Model 4). A last trimmed, "best-fitting" model was run for each group as a final step, yielding the path coefficient estimates presented in Figures 2–4.

For White families, results from analyses of Models 1–3 suggested that Model 2 (testing the mediation of income to parenting through hardship) fit better than Model 1 ( $\Delta$ RMSEA = .006) and Model



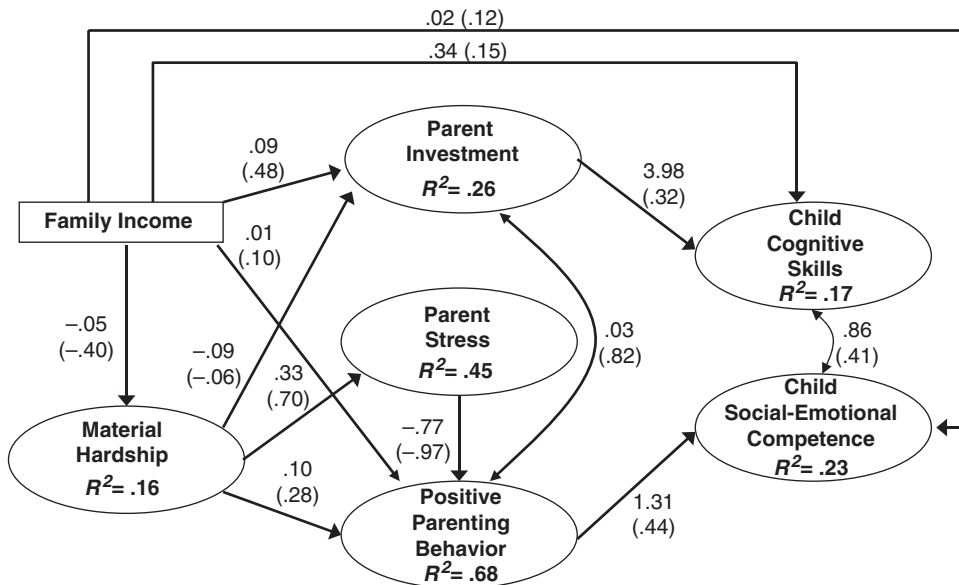
CFI = .984, RMSEA = .058, AIC = 14,145.33  $\chi^2(339) = 13,955.33$ .

Note. Unstandardized coefficients are provided first, with standardized coefficients in parentheses. All paths were significant.

Figure 2. Best-fitting model for White families (n = 11,738).

3 (where the association between income and parenting is mediated by paths through both material hardship and stress), in turn, fit better than Model 2 ( $\Delta$ RMSEA = .003). Partially mediated versions of Model 3 fit better than a fully mediated Model 3 (where direct paths from income to parenting constructs are constrained to 0, and indirect paths from

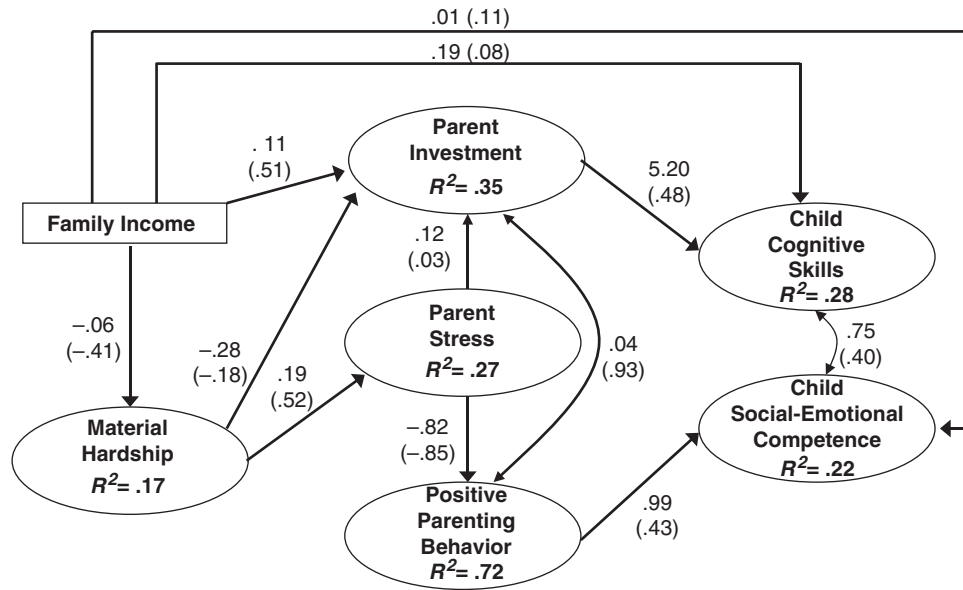
income to parenting constructs are freely estimated,  $\Delta$ RMSEA for the model with hardship only = .001 and  $\Delta$ RMSEA for the model with hardship and stress = .005). Inspection of the unstandardized path coefficients suggested that those for income → parent behavior and parent stress → parent investment were small and not significant; a trimmed model



CFI = .982, RMSEA = .059, AIC = 4277.72,  $\chi^2(336) = 4081.72$

Note. Unstandardized coefficients are provided first, with standardized coefficients in parentheses. All paths were significant.

Figure 3. Best-fitting model for Black families (n = 3,208).



CFI = .977, RMSEA = .066, AIC = 6060.09,  $\chi^2(338) = 5868.09$

Note. Unstandardized coefficients are provided first, with standardized coefficients in parentheses. All paths were significant.

Figure 4. Best-fitting model for Hispanic families ( $n = 3,762$ ).

with those two paths dropped yielded a nonsignificant difference in chi-square value ( $\chi^2_{\text{difference}} = 1.190$ ,  $df = 2$ ,  $p = .50$ ), supporting its choice as a more parsimonious model. Finally, tests of Model 4 yielded support for the mediating roles of parenting variables when modeling the association between income, hardship, and child school readiness ( $\Delta\text{RMSEA}$  over baseline model = .002). A fully mediated and partially mediated version of Model 4 fit equally well (with RMSEA = .058 and CFI = .984 for both), leading us to select the fully mediated version of Model 4 as the best fitting and final model. This final model for Whites can be found in Figure 2, with unstandardized and standardized parameter estimates provided.

For Black families, analyses of Models 1–3 suggested that a partially mediated version of Model 2 through hardship and parent stress fit better than both the baseline Model 1 (with direct paths from income to investments and positive parenting behavior only,  $\Delta\text{RMSEA} = .001$  and  $.006$ ) and a fully mediated version of Model 2 (where direct paths from income to parenting constructs are constrained to 0, and indirect paths from income to parenting constructs freely estimated,  $\Delta\text{RMSEA} = .001$  and  $.004$ ). A nonsignificant path coefficient was found for stress  $\rightarrow$  parent investment, and a trimmed model with that path constrained to 0 yielded a nonsignif-

icant decline in the chi-square value ( $\chi^2_{\text{difference}} = 0.371$ ,  $df = 1$ ). This trimmed model also yielded no change in RMSEA and CFI values, suggesting a more parsimonious model. Subsequent tests of Models 3 and 4 suggest support for the mediating roles of parent investments and positive parenting behavior, with a partially mediated version of Model 4 fitting slightly better than a fully mediated model (CFI = .001,  $\Delta\text{RMSEA} = .000$ ). See Figure 3 for further detail.

Analyses of Models 1–3 suggest that models of associations between income and parenting fit similarly for Hispanic families, with evidence of full mediation through hardship and partial mediation through parent stress (RMSEA = .005 for incremental improvements in fit offered by Models 2 and 3). Analysis of a fully mediated version of Model 4 was complicated by failure to solve. Nonetheless, a partially mediated version of Model 4 with both direct and indirect paths to child outcomes was successfully run, and yielded indicators of adequate fit,  $\chi^2 = 5,868.06$ ,  $df = 338$ ,  $p < .001$ , CFI = .977, RMSEA = .066 (see Figure 4).

In sum, tests of best-fitting models within each race/ethnic group yielded quite similar results. It is important, however, to also highlight the differences in magnitude of various coefficients associated for some of the more important model pathways,

between groups. Path coefficients were similar for most predictors of child cognitive competence. A few key exceptions were found. For example, income remained a stronger predictor of child cognitive competence, net of parent investments, for Black children than it did for White and Hispanic children (with unstandardized  $B$  for Black families = .34,  $B$  for Hispanic families = .19, and nonsignificant for White families). While pathways from income to material hardship fit similarly across all three groups, higher material hardship was more strongly associated with higher levels of parents' stress for Black families ( $B = .33$ ) than for Hispanic families ( $B = .19$ ) and White families ( $B = .24$ ). Higher stress, in turn, was more strongly related to lower levels of positive parenting behavior for Black and Hispanic families ( $B_B = -.77$  and  $B_H = -.82$ ) than for White families ( $B_W = -.64$ ). Lastly, coefficients for paths between positive parenting behavior and child social competence were larger for White families (e.g.,  $B_W = 1.93$ ) than for families of color ( $B_B = 1.31$  and  $B_H = .99$ ).

### Discussion

Do measures of hardship, parenting, and school readiness function equivalently for each race/ethnic group? Our analyses provide us with considerable reassurance that ECLS-K direct child assessments and adults' report of child outcomes are functioning relatively similarly across all groups of children tested. That is, it is of considerable relief to find that measures of children's reading, math, and general knowledge scores cohere in a similar fashion, for Black, Hispanic, and White children. In all three groups, reading and math scores provided the bulk of the shared variance in the latent construct of the cognitive skills domain of school readiness for all groups. Similarly, the ECLS-K provides important evidence of measurement equivalence (at the latent construct level) for the domain of social-emotional aspects of school readiness, with children's externalizing behaviors, internalizing behaviors, self-regulatory behavior, and social skills covarying in a similar fashion across all three groups.

Regarding parenting across multiple domains, we have more mixed results to report. We find only moderate levels of inequivalence across groups of Black, Hispanic, and White families in ways that parents invest in their children. This included ways that parents spend time with their children, organize their children's extracurricular and social activities, and ways that parents spend money on educationally enriching materials and activities. Moreover, we

found substantial evidence for nonequivalence among the observed measures of parenting behavior that encompassed dimensions of warmth, rules and routines, and parents' use of physical punishment. These findings are in keeping with the relatively low and more variable  $\alpha$ s (across different race/ethnic groups) for some of the parenting constructs in the ECLS-K. One implication is that there is considerable likelihood of error introduced when researchers treat measures of parenting behavior equivalently across groups. It is clear that factor loadings from some latent variables to their observed indicators (e.g., from parental behavior to parent's reported use of physical punishment) are different across the three race/ethnic groups. In short, the assertion of "general process models" of parenting, with common latent parenting variables, captured by a common set of observed indicators, is a flawed one (see Phinney & Landin, 1998).

What do these differences translate to, in measurement terms? As an example, one can consider the unstandardized  $\beta$  coefficients on the path leading from parent investment to parental involvement in their child's school, which differs by 34% between two race/ethnic groups. For a given White family with a unit latent level of investment, the parent would score 3.01 times a unit of measured involvement, while a Black parent with the same income and with an equivalent latent level of investment would demonstrate 4.60 times a unit level of involvement, and a Hispanic family with the same latent level of investment would score 3.44 in their involvement. Why would this difference in measurement pose a problem? Because a unit drop in investment (due to income or some other exogenous factor) would correspondingly be associated with a larger drop in the observable indicator (in this case, school involvement) for families of color, compared with White families, solely as a result of measurement error.

Do measures of material hardship and parents' stress also demonstrate inequivalence across race/ethnic groups? Our analyses of the ECLS-K suggest that they do. Coefficients for paths from the latent construct of material hardship to food insecurity were weaker for White families than for Hispanic and Black families. Conversely, coefficients for the path linking the latent construct of parents' experience of material hardship to parents' report of residential instability suggest the opposite pattern: A hypothetical White family would show a larger increase in the number of residential moves given a unit increase in their experience of material hardship than would a hypothetical Black family experiencing

the same increase in hardship. Path coefficients from parents' stress to measured indicators of parenting stress and interparental conflict were more similar across ethnic groups. Small to moderate differences were found for parents' reports of parenting stress and marital conflict, with higher path coefficients for ethnic minority families than for White families.

What are the implications of measurement inequivalence in key domains of parenting style and experiences of material hardship for developmental research? The concern for measurement bias has substantive relevance for both social scientific and social policy communities. On the side of science, estimates of coefficients on predictor variables are likely to be substantially biased. On the side of social policy, this inaccuracy poses significant hurdles. Specifically, developmental research has faced serious charges of racial and ethnic bias in the development of models and measures to tap child outcomes and family processes likely to support or compromise those outcomes. Program staff in interventions undergoing evaluation may feel rightful skepticism toward measurement in general, and to surveys regarding poor children's educational disadvantage in particular (see recent debates regarding the Head Start NRS, Meisels & Atkins-Burnett, 2004). The inability to trust in a common metric when measuring parents material hardship and competence may lead to participants' disenfranchisement from data collection and from school readiness programs as those programs undergo increasingly stringent program evaluations.

Do models function equivalently across race/ethnic group membership? Our findings highlight both similarities and differences when comparing models of the associations among socioeconomic disadvantage, mediating family process, and child school readiness across nationally representative groups of White, Black, and Hispanic children. Omnibus tests of model inequivalence provide clear support for racial and ethnic group membership as a moderator in models of poverty, material hardship, and children's ability to meet expectations of cognitive and socioemotional readiness as they enter school. Even when allowing paths from measured constructs to latent constructs to vary freely and when conducting the analyses separately for each of the three race/ethnic groups, some paths were found to vary considerably, while other paths were found to be similar across groups.

With this new, nationally representative data set, we find clear evidence that lower family income covaries with lower parental investment and lower cognitive competence for both White and ethnic

minority children. Results also support the mediating role of parent investments in predicting child outcomes. All three race/ethnic groups of families showed very similar paths from family income to families' ability to spend material resources and time with their young children. Evidence was also found for the link between income and parent's investments to be at least partially mediated by parents' experience of material hardship (and by parents' stress, for Hispanic families). The role of parent stress and material hardship in predicting parents' ability to "invest" in child cognitive potential (as indicated by this data set) is new to the field and important to explore using more rigorous causally oriented methods. Other differences between groups for this portion of the model were relatively minor, with a few differences found in the magnitude of association found between predictors and our criterion variables of interest. For example, parents' investments of time and resources appeared to be more strongly associated with children's higher performance on cognitive outcomes for Hispanic children than for Black children.

We also found clear evidence for the mediated "parenting processes" model. Namely, lower income was associated with increased hardship, higher stress, lower parenting behavior, and lower social skills in the kindergarten teachers' ratings. While all three race/ethnic groups showed clear evidence of more positive parenting behavior (as indicated by lower use of physical punishment, greater use of warmth, regular rules and routines, and cognitively stimulating engagement) as a predictor of more optimal social competence, the magnitude of this association differed somewhat across groups. Differences were that the negative associations between material hardship, parents' stress, and parenting behavior differed in magnitude across the three race/ethnic groups. One limitation of these analyses is that we relied on families' membership in pan-ethnic categories in our models. Analysis of differences within these pan-ethnic categories represents an important area for future work.

Given the welter of similarities and differences in the fit of complex models across three groups of children, interpreting these findings can be a challenge. Was it worth it to pursue tests of measurement nonequivalence so thoroughly, when the upshot of later analyses of model equivalence was that many portions of our model of poverty and school readiness are so similar across groups? We argue that it was. While prior analyses of data aggregated across diverse racial groups have offered a clear portrait of income and childhood for the nation as a whole, it

may obscure the toll that poverty takes for ethnic minority children who are most likely to experience it, and for children who face a range of cumulative, chronic, and deleterious disadvantages (Foster, 2002). Our findings support the perspective that children, families, and developmental outcomes are embedded within specific socioeconomic and cultural contexts. We may do children and developmental science a disservice by incorrectly applying a universal model to populations for whom the model does not fit (Brooks-Gunn, Duncan, & Aber, 1997; Garcia Coll et al., 1996; Roosa et al., 2002). Conversely, when we do focus our empirical lens more tightly on subgroups of children, we learn that much of the model of poverty and school readiness fits similarly rather than differently. Our view is that there is substantial merit to establishing this claim empirically while also placing it in the context of considerable measurement inequivalence. Identification of that inequivalence provides strong incentive for our field to develop innovative ways to balance emic and etic perspectives as we work with increasingly large samples and more diverse populations of children and their families (Lugo-Gil & Yoshikawa, 2004).

The strongest critique that could be leveled at these findings is that a set of exogenous factors such as parents' skills, deficits, or difficulties are the cause of both their poverty status and their children's social and cognitive performance, and that these models erroneously ascribe patterns of association to income rather than these omitted variables (Mayer, 1997). While this paper does not effectively address this critique, future waves of data from the longitudinal survey will allow for a clearer resolution to that debate. In the meantime, these analyses take initial important steps in answering recent calls for social scientists "to rethink, reshape, and strengthen their understanding of the centrality of race, culture and ethnicity to family processes among all populations, especially those of color" (Murry et al., 2001, p. 912). We believe that by testing for inequivalence at the measurement and structural levels, our models do empirical justice to the experiences of ethnic minority populations as well as ethnic majority populations. We hope to have contributed to this growing literature on ways to address this question with new empirical tools.

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