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Family and neighborhood income: additive and multiplicative associations with youths' well-being ☆

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Abstract

The present study extends prior research on additive and multiplicative ways by which family and neighborhood income relate to youths' well-being. Integrating substantive and methodological concepts, we demonstrate how various hypotheses would be revealed empirically with continuous income measures and clarify the relationship among different conceptual models. Substantively, we highlight ways in which match and mismatch between family and neighborhood income may encourage positive or negative social comparisons and may influence youths' ability to participate in social networks and to access enriching resources. We illustrate these models using a sample of 877 primarily white boys and girls representatively drawn from three US communities. We find that youths' receptive vocabulary is more strongly positively related to income in one context (family or neighborhood) when income is low in the other context (neighborhood or family), particularly for white children. Attention-deficit/hyperactivity disorder and impairment of daily functioning are highest among youth who live in contexts where their families' financial circumstances are advantaged or deprived in relation to their neighbors.

Keywords: Income inequality; Neighborhoods; Statistical interaction; Child development; Adolescent development

1. Introduction

Socioeconomic indicators are well-known correlates of health and attainment for adults and youth. For instance, income loss has been associated with adults' greater anxiety and depression (see Dooley et al., 1996 for a review) and youth in poorer families have been found to exhibit more behavior problems (conduct disorder, oppositional defiant disorder, and attention-deficit/hyperactivity disorder) than their higher income peers (see Lahey et al., 1999 for a review). Physical health has also been found to be inversely associated with both family-level and community-level socioeconomic status (see Robert, 1999 and Williams, 1990 for reviews). And, the generally lower educational attainment and economic advancement of youth from financially impoverished family backgrounds have been well documented (see Haveman and Wolfe, 1995 for a review). Such associations are also seen at an aggregate level, where communities of more concentrated poverty also contain higher rates of social problems such as crime, drug abuse, child maltreatment, and school drop-out (e.g., Coulton et al., 1995; Esbensen and Huizinga, 1990; Sampson and Groves, 1989).

Although these relationships are fairly robust, work remains to be done in order to understand them, especially as they apply to youth. One area that has been receiving increasing attention by researchers is the coupling of family resources with community resources. Yet, prior research on interactions between economic resources in these two contexts has often relied on categorical rather than continuous measures of income. Our exposition applies well-known methods for interpreting

interactions to show how conceptually interesting hypotheses would be revealed empirically with continuous income measures. In doing so, we highlight relationships among seemingly distinct conceptual models. We illustrate these models using a sample of youth from three US communities who live in a range of economic circumstances, concentrated neither in the extremes of economic deprivation nor prosperity. Although we cannot test the posited social mechanisms that may underlie these findings, we suggest ways in which these processes might be pursued in future research.

1.1. Models of family and neighborhood income

Family and neighborhood income are correlated, yet the association can fall well-below unity, and families of any given income level may experience varying broader neighborhood economic contexts. When such variation is captured in a survey sample, researchers can ask questions such as: Can more abundant public resources associated with greater neighborhood income compensate for inadequate private financial resources due to low family income? How do youth respond to contexts in which their families are relatively poorer or wealthier than their neighbors?

1.1.1. Existing models and research

Recently, a number of studies have looked at how either family income or neighborhood income relate to child and adolescent well-being. One motivation for such research is the expectation that families with greater economic resources are better able to purchase goods and services needed to meet children's basic needs and to foster optimal socialization, such as food, housing, books, extracurricular lessons, and high quality child care. As might be expected, this kind of association appears to be stronger with cognitive than socioemotional child development (Duncan and Brooks-Gunn, 1997). Another major finding from past research suggests that the relationship between economic poverty or income loss in the family and the child's well-being is mediated through parental psychopathology (depression, irritability, and mood fluctuations) and poorer parenting (harsh and inconsistent parenting, chaotic home life; e.g., Conger et al., 1994; Lempers and Clark-Lempers, 1997; McLeod and Shanahan, 1993; McLoyd, 1990).

At the neighborhood level, past studies have typically used measures of neighborhood composition, like mean or median neighborhood income, linked to politically or administratively defined geographic areas, such as census tracts. In such research, living among neighbors who are collectively financially well-off is typically assumed to be correlated with higher levels of local institutional resources and better "collective socialization" of children by community adults, both of which may be associated with healthy child development (e.g., Brooks-Gunn et al., 1997). Such local community characteristics may benefit youths' intellectual development through the recruitment of more experienced and better educated teachers, the presence of role models to promote high educational expectations, and access to ample reference resources and substantial technological equipment at local libraries and schools. Youths' social

and emotional development might also be facilitated in such neighborhoods, for example due to substantial investments in recreational activities, sufficient police protection, low crime rates, and ample monitoring of neighborhood youth by local adults (Sampson et al., 1997). The empirical evidence has supported such expectations for the presence of more affluent neighbors being associated with increases in young children's cognitive development (e.g., Chase-Lansdale et al., 1997) as well as teenagers' success in school (e.g., Crane, 1991; Datcher, 1982; Duncan, 1994; Ensminger et al., 1996). And, the presence of poorer neighbors has been related to young children's behavioral problems and teenagers' early childbearing and delinquency (Duncan et al., 1994; Gottfredson et al., 1991; Simcha-Fagan and Schwartz, 1986; South and Crowder, 1999).

Three other models have been posited in the recent neighborhood literature (contagion, relative deprivation, and competition; Brooks-Gunn et al., 1997), although they have been less often tested or revealed empirically due to limitations of sampling designs and measurement strategies. In the 1960s and 1970s, models of interplay between resources in the two contexts were prominent in particular lines of research on delinquency and education (e.g., Johnstone, 1978; Michael, 1961; Nelson, 1971). In these lines of research, two central consequences of higher or lower income youth being embedded in neighborhoods of varying SES were considered: (1) an *additive component*, similar to that already noted, in which youth embedded in wealthier contexts would be exposed to a higher valuation of schooling and avoidance of crime regardless of their own family's income level, and (2) a *relative deprivation component*, in which poorer youth embedded in wealthier contexts would be more conscious of their family's comparatively lower economic position, perhaps leading to greater delinquent activities or lowered educational expectations (Nelson, 1971:144 also see Johnstone, 1978). Around this time, similar concepts were applied in other areas of research as well, for example study of how residing among neighbors of similar or different religious affiliation as one's own associated with youths' mental health (Rosenberg, 1962). Studies by Jarjoura and Triplett (1997) and McLeod and Edwards (1995) draw on these concepts using more contemporary data and analytic techniques.

Kupersmidt and colleagues (Kupersmidt et al., 1995) provide a recent developmental examination of the interplay between family and neighborhood. They lay out four ways family and neighborhood SES might jointly influence youths' well-being: (1) a *risk* model in which neighborhood "risks" (e.g., concentrated neighborhood poverty) would operate additively or multiplicatively with "risks" in the family context (e.g., family poverty) to lead to youths' poorer outcomes, (2) a *protective* model in which low-risk neighborhoods would protect youth living in risky family contexts, but have no effect on youth in low-risk families, (3) a *potentiator* model in which low-risk neighborhoods would facilitate positive outcomes mostly for youth in low-risk family contexts, and (4) a *person–environment fit* model in which "mismatch" between the typical neighborhood characteristics and the child's own characteristics would relate to poorer outcomes. Sucoff and Upchurch (1998) applied Kupersmidt and colleagues' protective and potentiator models when studying black adolescents' risk of childbearing.

1.2. Additive and multiplicative models with continuous income measures

Although spelling out important conceptual ideas, prior research often relied on categories of income in empirical models, although such categorization can result in loss of power or misleading results (Maxwell and Delaney, 1993). Even when continuous measures have been used, the ways in which a particular concept would be revealed empirically has not been explicitly articulated, perhaps because of the added steps required in interpreting interactions between continuous measures. In this section, we take on this task, linking theoretical concepts with statistical techniques. Where relevant, we connect our conceptual frameworks with models offered in prior research.

Table 1 organizes conceptual frameworks with their associated empirical hallmarks. Income can be hypothesized to protect youth from risky outcomes or to promote youths' achievement of healthy outcomes. We summarize "healthy" outcomes in Table 1, for which higher scores indicate more competent functioning, such as higher grades in school, greater participation in extracurricular activities, or increased facility in social interactions. "Risky" outcomes, coded such that higher scores are less healthy—such as antisocial activity or repeating a grade in school—would show the reverse patterns (i.e., switching *positive* with *negative* and *negative* with *positive* in the table).

As is well known, the presence of an interaction means that a predictor variable's association with the outcome variable will differ depending on the value of another predictor variable. Statistically, these different associations are sometimes called *conditional effects*. In Table 1, at the far right, the sign of the interaction between family and neighborhood income is summarized (positive, negative, or zero). The four middle columns of the table contain the sign of conditional effects. On the left are the signs of conditional effects for family income when neighborhood income is low and high. On the right are the signs of conditional effects for neighborhood income when family income is low and high.

In the *additive* models, family income and neighborhood income each positively relate to healthy outcomes, with no interaction between the two. Model I in the first row of Table 1 summarizes these unmoderated associations. The conditional effects for family income are the same regardless of the level of neighborhood income. And, the conditional effects for neighborhood income are the same, regardless of the level of family income. The converse would be true for risky outcomes (i.e., the slopes would be expected to be negative). Such models encompass the majority of studies and hypotheses of family and neighborhood income summarized above.

The multiplicative models bring together and extend prior hypotheses about joint neighborhood and income effects. We will discuss these models in two groups—those that are *monotonic*—higher income is always associated with better child well-being—and those that are *non-monotonic*—situations of relative disadvantage (family income less than neighborhood income) or relative advantage (family income greater than neighborhood income) are sometimes associated with higher child well-being than situations of high family and high neighborhood income or with lower child well-being than situations of low family and low neighborhood income.

Table 1
Primary frameworks for possible additive and multiplicative associations between child healthy outcomes and income in the family and neighborhood

Model	Conditional effect of family income in the context of			Conditional effect of neigh. income in the context of			Fam. × neigh. interaction
	Low NI		High NI	Low FI		High FI	
I. Additive	Positive	=	Positive	Positive	=	Positive	Zero
II. Multiplicative monotonic							
(a) Eliminating	Positive	...	Zero	Positive	...	Zero	Negative
(b) Lessening	Positive	>	Positive	Positive	>	Positive	Negative
(c) Initiating	Zero	...	Positive	Zero	...	Positive	Positive
(d) Enlarging	Positive	<	Positive	Positive	<	Positive	Positive
III. Multiplicative non-monotonic							
(a1) Relative disadvantage and relative advantage as healthy situations	Positive	...	Negative	Positive	...	Negative	Negative
(b1) Relative disadvantage as a healthy situation	Zero	...	Negative	Positive	...	Zero	Negative
(c1) Relative advantage as a healthy situation	Positive	...	Zero	Zero	...	Negative	Negative
(a2) Relative disadvantage and relative advantage as risky situations	Negative	...	Positive	Negative	...	Positive	Positive
(b2) Relative disadvantage as a risky situation	Zero	...	Positive	Negative	...	Zero	Positive
(c2) Relative advantage as a risky situation	Negative	...	Zero	Zero	...	Positive	Positive

Note. NI = neighborhood income. FI = family income. Fam. = family. Neigh. = neighborhood. Zero = no significant association. Positive = significant positive association. Negative = significant negative association. Ellipses indicate that the slopes range between the sign on the left and the sign on the right.

In discussing possible conceptual bases for these models, we highlight ways in which youth gain access to resources or gain attention by participating in social networks, making social comparisons, or purchasing services. These substantive concepts are by no means exhaustive, and other mechanisms could be posited for each model. We use Fig. 1 to help visualize these models and associated mechanisms by plotting *hypothetical* data with reading comprehension as a healthy outcome.

1.2.1. Monotonic models

We will begin by discussing Models IIa–IId in Table 1. These are cases in which higher economic resources in one context *lessens*, *eliminates*, *initiates*, or *enlarges* the association between economic resources in the other context and child well-being.

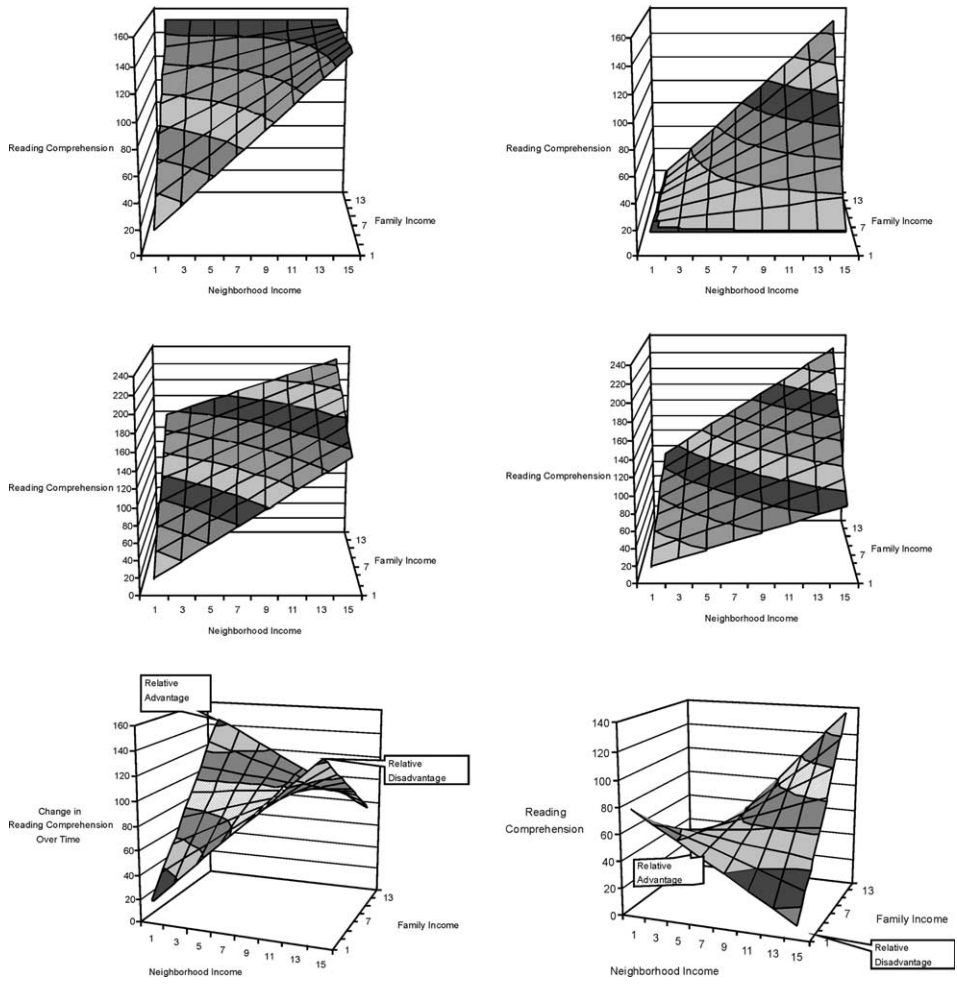

Fig. 1. *Hypothetical* illustrations of the models described in Table 1. *Note:* The plotted values are *hypothetical* illustrations of the multiplicative models described in the introduction and are *not* based on actual data.

Lessening and eliminating models. Increasing neighborhood income may *eliminate* an association between family income and child well-being, with no association being seen between family income and child well-being when neighborhood income is at its highest level. In Model IIa of Table 1, the conditional effect for family income is positive when neighborhood income is low and the conditional effect for family income is zero when neighborhood income is high. A parallel moderation is illustrated for neighborhood income when family income is low and high. The left/top panel of Fig. 1 visualizes this model. Alternatively, increasing income in one context may lessen the magnitude of the association between income in the other context and youth well-being without fully eliminating it. This can be seen in Table 1, Model IIb, where the conditional effect for family (neighborhood) income is positive in both the case where neighborhood (family) income is low and high, but it is larger in magnitude among lower income neighborhoods (families). This model is illustrated in the left/center panel of Fig. 1.

What conceptual frameworks might suggest these patterns? Consider a framework in which children's reading comprehension benefits from inputs at home that are correlated with higher family income, such as having more books and other reading materials at home and hiring private reading tutors, as well as inputs in the community that are correlated with higher neighborhood income, such as higher quality schools, community libraries, and other enriching local activities. When income is low in one context, these correlations between inputs and income would clearly result in the positive association with reading comprehension seen for income in the other context. But, why the lessening or elimination of the association? One hypothesis may be that some of the inputs at home and school are interchangeable; and, each additional input relates to reading comprehension at a decreasing rate (the first input has a bigger effect on reading comprehension than the second input, etc). [1] An alternative hypothesis may be that parents adjust their level of inputs at home according to those in the community, leading to the larger slopes seen when family or neighborhood income is low: If the neighborhood offers few inputs then the parents may try to compensate and higher income parents may be better able to purchase private inputs; If the family has few economic resources then they may actively seek out the resources publicly available in the community to compensate, and higher income neighborhoods may offer more such resources.

It is worth commenting that the difference between the lessening and eliminating models may or may not be meaningful theoretically; and, whether the association weakens or becomes insignificant may be difficult to discern empirically, given limited sample variation and sample size. Connecting to prior research, Kupersmidt et al.'s (1995) *protective neighborhood* model—in which neighborhood resources would only benefit youth living in poor families—is an example of a conceptual model in which the positive association between neighborhood income and a healthy outcome is fully eliminated by increasing family income. Their *multiplicative risk* model is more consistent with a lessening model for risky outcomes. Low income

[1] In such a framework, logging income would also allow the association between family (neighborhood) income and child outcome to increase at a decreasing rate.

in either context would be associated with increased chances of a risky outcome, but these associations would be larger when income is also lower in the other context.

Initiating and enlarging models. Other theories might suggest that higher economic resources in one context may initiate or enlarge the association between economic resources in the other context and youth well-being. These are Models IIc and IId in Table 1 which are illustrated in the right/top and right/center panels of Fig. 1.

The initiating and enlarging models are the converse of the lessening and eliminating models: They show a (stronger) positive association between income in one context and youth well-being when economic resources are *higher* in the other context. We can extend the concepts of inputs just discussed to posit mechanisms that conform with these models. In doing so, we will consider neighborhood resources that are not readily available, but must either be identified through social networks or purchased with private funds. Examples might include fees for school clubs, for advanced placement (AP) exams or for private tutoring; or, social distance from neighbors that inhibits awareness and use of community resources. In this kind of model, limited access may prevent children from lower income families embedded in higher income contexts from benefitting from the community's greater resources (resulting in a lesser or no association between neighborhood income and child well-being for low income families). Conversely, the increased capacity of higher income families to purchase enriching activities may be impeded in lower income communities where relatively fewer activities are available (resulting in a lesser or no association between family income and child well-being in low income communities). Relating to prior research, our enlarging model is synonymous with the *potentiator* model discussed by Kupersmidt and colleagues.

1.2.2. Non-monotonic models

Note that each of the remaining models in the panel labeled "non-monotonic" contains at least one *negative* conditional effect. That is, *increasing* economic resources are associated with *lower* child well-being in certain circumstances. Depending on the particular situation when such negative slopes occur, these negative slopes relate to extremes in situations of relative disadvantage, relative advantage, or both.

Model IIIa1 is symmetric, with negative slopes for both family and neighborhood income, and it results in peaks of healthy outcomes in both situations of relative advantage and relative disadvantage (see left/bottom panel of Fig. 1). Although at first glance this model looks very different from the multiplicative models just considered, it is informative to note that this model is a simple extension of the eliminating model. But, rather than stopping at zero, we allow the slopes to become negative as income in the other context continues to increase. Approaching the models in this way helps clarify the similarities and differences among models. For example, all three models illustrated in the left panels of Fig. 1 predict positive slopes for income in one context when income in the other context is low. And, although the ideas of match and mismatch might seem uniquely relevant to non-monotonic models, as we have already discussed, match or mismatch between the family and neighborhood income level can motivate monotonic models. What is unique in the non-monotonic situation is the fact that relative advantage and/or relative disadvantage becomes

more risky than living in a context of low resources in both contexts or more beneficial than living in a context of high resources in both contexts.

What mechanisms might explain the peaks in contexts of relative disadvantage and relative advantage, and the requisite negative slopes, in the left/bottom panel of Fig. 1? One compatible conceptual framework might posit that social comparisons, either on the part of the youth himself or herself or on the part of teachers and peers, allow youth in the mismatch contexts to gain access to resources and/or gain attention. For example, one argument for a negative slope for family income in the highest income neighborhoods might be that poorer children in high income areas stand out as needing extra help, and that teachers and other community adults in these contexts have the resources of time and money to provide extra attention and assistance. And, the negative slope for neighborhood income among youth from high income families might also be produced by social comparisons. For instance, youth from higher income families who are embedded in lower income communities might occupy higher status positions among their peers or gain favor from adults and teachers because of desirable characteristics associated with their family's resources. Note that, as in the left/bottom panel of Fig. 1, even with these peaks, high income youth in high income neighborhoods may still show higher well-being than low income youth in low income neighborhoods. Still, we find that this model has greater conceptual appeal for gains over time rather than promoting absolute levels of healthy youth outcomes (as in the *Y*-axis label of the left/bottom panel of Fig. 1).

Alternatively, relative advantage and relative disadvantage may both provide risky situations for some aspects of child development, or for some youth (see Model IIIa2 and the right/bottom panel of Fig. 1), as in Kupersmidt et al.'s (1995) *person–environment fit* model. Under this model, deviations of family income from neighborhood income in either direction would be associated with lower child well-being. Negative social comparisons might underlie such a model. For example, youth whose circumstances differ recognizably from their peers may be socially rejected, leading to poorer socioemotional outcomes. And, negative social comparisons in the school environment may also relate to a disinvestment in schooling, thus influencing cognitive outcomes as well. Above we discussed ways in which mismatch may increase access to resources through attention from peers and adults, but mismatch may also reduce a youth's access to some resources. For instance, youth whose need for specialized instruction, be it remedial or advanced, differs from that of most other students in the community may lack access to educational programs targeted at their needs, likely leading to boredom and/or frustration and subsequently poorer outcomes. We can also alter our model of inputs and consider that some neighborhood resources are uncorrelated with income (e.g., posit that caregiving exchanges among neighboring parents may occur regardless of income levels). In such a model, smaller social distance might provide greater access to community resources not only for wealthy families in wealthy communities but also for poorer families in poorer communities. Children living in either relative advantage or relative disadvantage would then lack access to such resources due to greater social distance.

The IIIb and IIIc models in Table 1 list cases in which only one, but not both, extremes occur, that is only being relatively wealthier or relatively poorer than neighbors matters for youth well-being. For example, the *relative deprivation* model of the delinquency and educational literature noted above suggests that such mismatch would matter only when family income falls below the typical income in a youth's neighborhood; higher income youth embedded in lower income neighborhoods would show no such detriments. For simplicity we omit from Table 1 a final possible configuration in which relative advantage and relative disadvantage would both be associated with youth well-being but operate in opposite ways.

1.3. Selection issues

Studies of neighborhood contexts are generally subject to the alternative explanation that there are selective differences between families who choose to, or are constrained to, live in poorer or wealthier community economic circumstances and those who choose not to, or are not constrained to, do so. Likewise, in studying the effects of family income, it is important to understand the mechanisms by which characteristics of family members may *lead to* lower family economic well-being (e.g., see Dooley et al., 1996 and Powers, forthcoming). We might be especially concerned that families who move into or remain in contexts of relative advantage and relative disadvantage differ from those who do not. For example, some parents may select communities with higher average income in part to access good schools and associated resources for their children. Some lower income families who are particularly motivated in this regard may stretch beyond their financial means in order to do so. That a higher income family lives in a relatively poorer area might indicate unmeasured individual or family problems precluding such strategic residential choice. Alternatively, a relatively higher income family might choose to live in a poorer neighborhood in order to buy a less expensive home and save money to spend on their children. In general, families living in contexts of economic mismatch may differ from those who do not. In the current study, although we lack the longitudinal data that would better allow us to distinguish such selection into particular economic circumstances from the consequences of those circumstances, we control for potentially confounding characteristics that are associated with family economic resources, neighborhood choices, and child outcomes.

2. Empirical illustration

We will illustrate the multiplicative models with data that are well suited to studying independent and joint associations of family and neighborhood income with youth well-being because the sampling design was structured to provide high variation on both measures of income, and moderate correlation between the two. The sample is also unusual in that it does not focus on neighborhood income as an issue of concentrated poverty in inner cities. Rather, the children come from a diverse range of urban and suburban communities. Although we can well estimate the

multiplicative models for income, we are limited by sample size, measures, and cross-sectional data from testing for the social mechanisms underlying the models just posited and will discuss below how future research might improve upon our illustration.

2.1. Data and method

The data source is the National Institute of Mental Health (NIMH) Methods for the Epidemiology of Child and Adolescent Mental Disorders (MECA) study that was fielded between October 1991 and July 1992 in four sites: (1) the cities of Hamden, East Haven, and West Haven, Connecticut, (2) Dekalb, Rockdale, and Henry Counties, Georgia, (3) Westchester County, New York, and (4) San Juan, Puerto Rico. Within each site, a complex sampling design was developed and implemented such that the sampled youth represented the particular counties or cities (see Lahey et al., 1996 for details). The analyses presented here are restricted to the three mainland US sites because of concerns about cost-of-living and cultural variation between the mainland United States and Puerto Rico and because the distribution of income in the Puerto Rican site was much lower than the three mainland US sites (the median income was $13,000 in the Puerto Rican site; in each of the three mainland sites, median income was between $50,000 and 60,000).

The sample was restricted in the following ways. Although reports by fathers and other caregivers are of substantive interest, most of the 987 adult respondents in the mainland MECA sample were the child's biological mother. Because of these sample size limitations, we focus on the 907 families with a mother informant. We then exclude 12 cases in which the mother or child had not completed an interview, 11 cases with missing covariate data, and seven additional cases with missing child outcome data, resulting in a sample of 877 youth. Approximately two-thirds of the youth were white (69%), with an additional 18% being African American, 5% Latino, 2% Asian American, and 5% other ethnicities. The sample was nearly evenly split on gender (48% female). When the three mainland samples are combined, the families had a median income level of $50,000, and over half of parents had completed at least some college education. Close to three-quarters of youth lived with both biological parents (71%), 12% lived with their mother and a step-father, and 17% with their mother only. About 10% of youth were each year of age between 9 and 17; in addition, there were three 18-year-old participants who were age 17 at the time the sample was selected.

The study's measures are described in detail by Goodman et al. (1998) and Shaffer et al. (1996). The distribution of each measure as used in the current study is summarized in Table 2.

2.1.1. Measures of child well-being

We examine constructs related to both kinds of child well-being that we discussed above: cognitive and socioemotional outcomes. The youth's receptive vocabulary for standard American English was assessed with the Peabody Picture and Vocabulary Test—Revised (PPVT-R; Dunn and Dunn, 1981). The PPVT-R asks the child to indicate which of four pictures on a page best illustrates a vocabulary word vocalized

Table 2
Descriptive statistics for outcome and predictor variables

	Weighted	Unweighted				
	Mean	Mean	SD	Min	Median	Max
PPVT standardized score	106.28	104.89	19.48	40	105	160
ADHD symptom count—youth report	.98	1.10	2.20	0	0	13
ADHD symptom count—mother report	1.14	1.55	2.77	0	0	14
CIS-youth report	7.40	8.13	6.82	0	7	36
CIS-mother report	6.86	7.48	6.99	0	6	41
Log of family income	1.85	1.76	.59	.00	1.79	2.77
Log of neighborhood income	1.91	1.81	.30	1.10	1.79	2.60
Youth is white	.67	.69	.46	0	1	1
Youth is female	.50	.48	.50	0	0	1
Youth is high school age	.40	.36	.48	0	0	1
Youth is middle school age	.31	.32	.47	0	0	1
Family APGAR	13.47	13.35	2.03	5	14	15
Good marital adjustment with quarreling[a]	.36	.32	.47	0	0	1
Poor marital adjustment with quarreling	.16	.19	.39	0	0	1
Poor marital adjustment without quarreling	.19	.24	.43	0	0	1
Monitoring (mother report)	16.04	16.03	1.59	7	17	20
Monitoring (youth report)	15.13	15.17	2.10	5	15	20
Mom's psychopathology is missing	.01	.03	.18	0	0	1
Mom's psychopathology[b]	1.35	1.69	2.59	0	1	13
Dad's psychopathology is missing	.02	.06	.24	0	0	1
Dad's psychopathology[b]	0.74	.92	1.69	0	0	16
Mom's education is missing	.01	.01	.11	0	0	1
Mom has less than high school education[b]	.16	.14	.34	0	0	1
Mom has some college education[b]	.39	.42	.49	0	0	1
Mom has a graduate degree[b]	.25	.17	.38	0	0	1
Mom's occupational prestige is missing	.06	.04	.20	0	0	1
Mom's occupational prestige[b]	39.15	38.26	13.76	9.56	36.03	80.26
Dad's education is missing	.05	.04	.21	0	0	1
Dad has less than high school education[b]	.17	.16	.37	0	0	1
Dad has some college education[b]	.33	.35	.48	0	0	1
Dad has a graduate degree[b]	.31	.21	.41	0	0	1
Dad's occupational prestige is missing	.11	.13	.34	0	0	1
Dad's occupational prestige[b]	43.77	42.40	14.59	15.54	40.91	80.53
A second parent is absent from the household[c]	.17	.18	.38	0	0	1

Table 2 (*continued*)

	Weighted	Unweighted				
	Mean	Mean	SD	Min	Median	Max
The family received welfare in the last year	.08	.06	.25	0	0	1
At least one parent is unemployed	.07	.05	.22	0	0	1

Note. $n = 877$.

[a] Marital adjustment is dichotomized at the value of 19 (the approximate sample median). Those less than or equal to 19 are classified with poor marital adjustment. Those above 19 are classified with good marital adjustment. Partners are classified with quarreling if the mother responded three or less on the quarreling item (at least once a week). Those who responded above three are classified as without quarreling (two to three times a month or less). Cases in which a second parent is absent from the household are excluded before the statistics for marital adjustment and quarreling presented in Table 2 are calculated.

[b] Statistics calculated on non-missing cases.

[c] This dummy variable is created in conjunction with the measures of marital adjustment and quarreling; and, in addition to households in which the mother does not have a husband or partner present, it also indicates 10 cases that are missing those instruments.

by the examiner. An age-specific basal and a performance-based ceiling establish how many of the 175 increasingly-difficult items are administered. In the present study, we use the child's age-standardized PPVT score. Both the youth and the mother also completed the Columbia Impairment Scale (CIS) with the youth as the referrent. The CIS is a thirteen item measure with questions tapping four major areas of daily functioning: (1) interpersonal relations, (2) broad psychopathological domains, like anxiety, depression, or behavior problems, (3) functioning in job or school, and (4) use of leisure time (Bird et al., 1993). Consistent with other research on the CIS, our examination of basic confirmatory factor models suggested that the 13 items of this scale are best viewed as a single measure of overall impairment; and, we analyze the simple sum of the 13 items (Cronbach's α is .82 for youth and .87 for maternal report). Finally, the Diagnostic Interview Schedule for Children (NIMH DISC 2.3), a structured instrument designed to identify clinically severe psychopathology (Shaffer et al., 1996), provides a measure of *attention-deficit/hyperactivity disorder* (ADHD). We use both the youths' and mothers' reports of the number of diagnostic symptoms of ADHD displayed by the youth.

2.1.2. Central predictor variables

Household income was reported by adult respondents in one of 24 categories ranging from none to $100,000 or more. The income categories covered intervals of $1000 below $10,000; intervals of $2000 between $10,000 and $20,000; a single interval of $5000 between $20,000 and $25,000; intervals of $10,000 between $25,000 and $75,000; a single interval between $75,000 and $100,000, and a final open-ended category for all incomes over $100,000. For our main analyses, the midpoint of the income interval was assigned based on the endpoints of the category ($0 was assigned for "none" and $150,000 was assigned for the final open-ended category). For nine cases with missing income data, the value was imputed in an OLS

regression framework using the family's recent welfare receipt (none, some, most or all of the last year's income) and AFDC participation as predictors. In our sample, family incomes covered the entire range from $0 to $150,000, with a median of $50,000. The 10th and 90th percentiles of the distribution are $15,000 and $150,000, respectively. For our main analyses, we use log family income (specifically, we first scale the income value by dividing by 10,000; we then add 1 and take the log).

Our measure of neighborhood economic resources is the median income of families residing in the study family's *census tract* at the time of the 1990 US Census. Census tracts are "small, relatively permanent geographic entities within counties...delineated by a committee of local data users... When first established, census tracts are to be as homogeneous as possible with respect to population characteristics, economic status, and living conditions" (US Department of Commerce, 1994:10-1). On average, census tracts contain about 4000 people (1500 housing units; US Department of Commerce, 1994:10-6). The study families are fairly clustered within neighborhoods. The 877 families live in 55 different census tracts; and, the median number of study families per tract is 13. The median neighborhood income in our sample is $50,000, with a minimum of $20,000 and a maximum of $125,000. The 10th and 90th percentiles of the distribution are $35,000 and $75,000, respectively. We use the same procedures to calculate log neighborhood income as described above for log family income. The correlation between logged neighborhood and logged family income is moderate ($r = .56$).

2.1.3. Control variables

We do not have measures of the social processes for the multiplicative models hypothesized above. But, we can control for three constructs that have been found to mediate the additive association between family income and youth well-being: family relationships, parental monitoring and parental psychopathology. In particular, the mother's satisfaction with aspects of the family was measured with the Family APGAR (Smilkstein et al., 1982). The mother also responded to a six-item short form of the Spanier Dyadic Adjustment Scale (DAS) as well as the DAS item on frequency of quarreling (Sharpley and Cross, 1982). Mothers and youth were asked questions about the frequency with which the youth communicated his/her whereabouts to the parent. And, each mother provided a brief psychiatric history about herself and the child's biological father in response to the Family Psychiatric History Screen for Epidemiologic Studies (Lish et al., 1995).

We also introduce several controls for selection mechanisms. One concern is that higher income families who move into or stay in lower income areas may exhibit poorer individual or family functioning than those who do not. In addition, among the highest income families living in the highest income communities, parents may possess positive attributes, such as innate ability or cultural capital, that is advantageous for their children's development. Several variables in the data set allow us to proxy these confounds. As a rough proxy of innate ability and cultural capital, we use the mother's report of her own and her child's biological father's educational attainment and the occupational prestige of his/her current or most recent job (Hauser

and Warren, 1996). Although missing data are generally minimal for these variables, we include a dummy variable to identify cases with missing data. Measures of family relationships and the parents' psychiatric history—described above—are rough proxies of poor individual and family functioning.

In addition, we adjust for some alternative hypotheses. In particular, family structure, welfare receipt, and employment status are all correlated with income and, in some cases, might be associated with child outcomes in ways beyond the multiplicative mechanisms described above. In particular, families with low incomes who live in low income neighborhoods may differ from other families by being more likely to participate in public welfare programs and to experience unemployment. The stigma of welfare receipt or unemployment, the lack of savings, and the lack of an employed adult role model in these families might lead to poorer socioemotional or academic outcomes for youth. And, high income families living in high income communities may be most likely to contain two parents. In these families, on average, parents may be better able to find time for activities such as supervising children, helping children with homework, and taking children for enriching outings than is the case in single parent households. We include dummy indicators in our models for the absence of a second parent from the household, for recent welfare receipt in the family, and for there not being at least one employed parent in the household.

Finally, we control for the child's grade in school (dummy indicator of high school [grades 9–12] and of middle school [6–8] with the omitted category being grade school [< 6]), the child's gender (dummy indicator of female), and the child's race/ethnicity (dummy indicator of white race/ethnicity).

2.2. Results

2.2.1. Overview of models

The models we have outlined have a natural hierarchical structure (families clustered within neighborhoods). Standard statistical techniques are not appropriate for such data because of the potential non-independence of observations within clusters (in our case, families that live within the same neighborhood may be more similar than those that live in different neighborhoods). Currently, several statistical approaches are available for estimating models based on such data. Two of the most popular are: (1) using standard estimation approaches with robust standard errors (e.g., Rogers, 1993) and (2) applying hierarchical linear models (also known as multi-level linear models or mixed-effects models; e.g., Bryk and Raudenbush, 1992). There may a slight advantage to the former approach. Because it involves an adjustment to standard statistical techniques and can be readily calculated in several general purpose software packages, the first approach may be somewhat easier for the novice to apply. And, the conceptualization of the hierarchical linear model tends to focus more on how the Level 2 (neighborhood) constructs moderate the effect of Level 1 (family) constructs, rather than the symmetrical moderation that we emphasize in our conceptual models. Below, we rely on the first approach. Appendix A makes clear that the conceptualization of the multiplicative models that

we outlined above can also be naturally applied within the hierarchical linear models framework.

Sampling weights were developed to produce estimates representative of youth living in the areas covered by each of the three mainland MECA sites. Although experts generally agree that weights should be used to obtain unbiased estimates of descriptive statistics (e.g., means, frequencies), weighting may not always be advisable in regression models due to the tradeoff between reducing bias and increasing variance (e.g., DuMouchel and Duncan, 1983; Korn and Graubard, 1995; Pfeffermann, 1993). We present weighted estimates in the tables and comment in the text regarding the consistency of unweighted models.

Table 3 presents a summary of the coefficients for the two income variables and their interaction. Depending on the properties of the outcome variable, the regression models we estimate are either OLS (PPVT), ordered logit (CIS), or poisson (symptom count). Table 4 presents the conditional effects underlying these multiplicative models. We calculate these conditional effects at income levels between

Table 3
Summary of multiplicative regression models

	Without controls			With controls[a]		
	Family income	Neigh. income	FI × NI interaction	Family income	Neigh. income	FI × NI interaction
PPVT	23.01**	32.68**	−8.22*	15.20	21.14**	−6.29
	(8.32)	(5.49)	(3.99)	(9.67)	(6.13)	(4.25)
ADHD symptom count						
Youth report	.79	.59	−.37	1.40+	1.25	−0.56
	(.48)	(.56)	(.25)	(0.79)	(0.78)	(0.38)
Mother report	1.43*	1.26+	−.85**	2.01**	1.41+	−0.96**
	(.56)	(.64)	(.32)	(0.66)	(0.77)	(0.33)
Columbia Impairment Scale						
Youth report	1.23**	1.13*	−.71**	2.02+	1.97+	−0.99*
	(.37)	(.42)	(.18)	(1.02)	(1.05)	(0.47)
Mother report	.81	1.11+	−.57*	0.78	0.80	−0.48
	(.58)	(.59)	(.27)	(0.93)	(0.86)	(0.45)

Note. Number of youth = 877. Number of census tracts = 55. Values are coefficients from fitted regression models (OLS for PPVT; Poisson for ADHD symptom counts; Ordered Logit for Columbia Impairment Scale). Standard errors are in parentheses. Neigh. = neighborhood. FI = family income. NI = neighborhood income.

[a] *Controls include*: maternal report on the family APGAR and of marital adjustment and discord; youth and maternal report of parental monitoring; maternal report of her own and the child's father's psychiatric history; the biological parents' educational level and occupational prestige; indicators of whether a second parent was absent from the household, whether the family had received welfare in the last year and whether at least one parent was unemployed; and the child's grade in school, gender, and race/ethnicity.

+ $p < .10$.

* $p < .05$.

** $p < .01$.

Table 4
Conditional effects for family and neighborhood income within multiplicative models with controls

	Conditional effect of neighborhood income when family income is							Conditional effect of family income when neighborhood income is						
	25,000	35,000	45,000	55,000	65,000	75,000	85,000	25,000	35,000	45,000	55,000	65,000	75,000	85,000
PPVT	13.25**	11.67**	10.41**	9.36*	8.46*	7.67+	6.97	7.32	5.74	4.48	3.43	2.53	1.74	1.04
	(2.67)	(2.80)	(3.17)	(3.61)	(4.04)	(4.46)	(4.85)	(4.47)	(3.47)	(2.72)	(2.15)	(1.74)	(1.51)	(1.43)
ADHD symptom count														
Youth report	0.55	0.41	0.30	0.21	0.13	0.06	−0.01	0.70+	0.56+	0.45+	0.36	0.28	0.21	0.14
	(0.41)	(0.36)	(0.34)	(0.34)	(0.34)	(0.35)	(0.37)	(0.35)	(0.28)	(0.24)	(0.21)	(0.21)	(0.21)	(0.23)
Mother report	0.20	−0.04	−0.23	−0.39	−0.53+	−0.65*	−0.76**	0.81**	0.56*	0.37+	0.21	0.07	−0.05	−0.16
	(0.41)	(0.36)	(0.32)	(0.29)	(0.28)	(0.27)	(0.27)	(0.29)	(0.23)	(0.20)	(0.18)	(0.18)	(0.19)	(0.21)
Columbia Impairment Scale														
Youth report	0.73	0.49	0.29	0.12	−0.02	−0.14	−0.25	0.78+	0.54	0.34	0.17	0.03	−0.09	−0.20
	(0.50)	(0.41)	(0.34)	(0.30)	(0.28)	(0.27)	(0.27)	(0.45)	(0.34)	(0.27)	(0.21)	(0.18)	(0.17)	(0.17)
Mother report	0.20	0.08	−0.02	−0.10	−0.16	−0.22	−0.28	0.17	0.05	−0.04	−0.12	−0.19	−0.25	−0.31
	(0.33)	(0.25)	(0.20)	(0.19)	(0.20)	(0.22)	(0.25)	(0.40)	(0.31)	(0.25)	(0.22)	(0.21)	(0.22)	(0.24)

Note. Values are conditional effects for neighborhood or family income at the listed level of the other income variable (family or neighborhood) based on the fitted "with controls" regression models reported in Table 3. Standard errors are in parentheses. The coefficients can be calculated by hand. For example, based on the "with control" coefficients for PPVT in Table 3, the formula for the effect of neighborhood income, conditional on family income, is $21.14 - 6.29 \times$ family income. Based on the way we transform the income variables as described in the text, the value of $25,000 on Family income translates to $\ln(2.5 + 1) = 1.25$. Thus, when family income is $25,000, the conditional effect of neighborhood income is $21.14 - 6.29 \times 1.25 = 13.28$. This value differs slightly from the value in the upper left cell of Table 4 due to rounding error. The coefficients, and standard errors, in Table 4 are calculated exactly by the computer via manipulation of the regression equations (for example see Aiken and West, 1996).

$^{+}p < .10$.
$^{*}p < .05$.
$^{**}p < .01$.

$25,000 and $85,000, well within the income range of the sample (see the footnote to Table 4 for details about these calculations).

We do not have measures of the social processes hypothesized above for *multiplicative* models (i.e., positive or negative social comparisons, participation in social networks, access to enriching resources). Thus, in interpreting the findings, we look to see if the revealed patterns are consistent with some of these hypothesized unmeasured mechanisms. We present simple associations in models that include only family income, neighborhood income, and their interaction as well as coefficients adjusted for controls for the additive income effect mechanisms, selection mechanisms, and alternative hypotheses described above. We feature the latter "with controls" models in Table 4 and as we present the results.

2.2.2. Receptive vocabulary

The results for PPVT are consistent with the lessening model of Table 1. PPVT shows negative interactions in Table 3. And, in Table 4, the conditional effects for family and neighborhood income are larger in magnitude at lower values of the other income variable. The 23% drop in size of the interaction coefficient with controls versus without controls is attributable to the dummy indicator of the child being white versus other ethnicities that is highly significant in predicting higher PPVT scores. When the dummy indicator for whites is omitted from the "with controls" model, the interaction is slightly larger than in the "no controls" model and significant ($b = -8.38$, $se = 4.12$, $p < .05$). Although white and non-white children in our sample can be found across all kinds of communities, this finding reflects the fact that white children are concentrated in the settings high on both neighborhood and family income and in the settings of relative advantage, while children of other ethnicities are more likely to live in contexts of low family and neighborhood income. To further understand these results, we estimated the PPVT models restricted to the sample of 609 white children and found that the interaction between family and neighborhood income was significant in models with and without controls (with controls: $b = -11.85$, $se = 3.69$, $p < .01$; without controls: $b = -10.18$, $se = 3.29$, $p < .01$). Indeed, the evidence of a multiplicative effect is clearer for whites only, with the conditional effects for *both* family income and neighborhood income being positive and significant when income is $45,000 or less in the other context but insignificant when income is higher in the other context (details available from the authors).

Fig. 2 plots the values predicted from the fitted "with controls" model for the full sample and whites, making evident the greater impact of an increment of income in one context (family or neighborhood) in settings of lower income in the other context (neighborhood or family). The figure also highlights the stronger multiplicative effect for whites than the full sample. Indeed, while the full sample figure has the shape of the lessening effect, the whites-only figure is more consistent with the eliminating model and visualizes the greater symmetry in the family and neighborhood income conditional effects for whites. The predicted values for PPVT range between 96 and 110 for the full sample, with the difference being close to three quarters of the standard deviation of 19 in our sample. For whites, the range is 101–113, approaching two-thirds of a standard deviation.

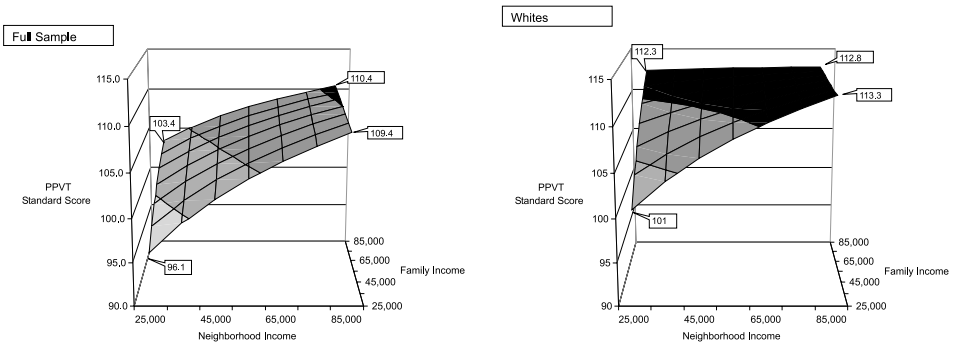

Fig. 2. Illustration of emprical findings consistent with the lessening multiplicative model: PPVT. *Note:* Plotted values in the left graph are predicted scores based on the model with controls in Table 3. The right graph presents predicted values from the "with controls" model described in the text that is restricted to whites.

The finding of a lessening model for the child's receptive vocabulary might fit well with the conceptual framework we posited earlier. Youth with limited resources in one context might gain substantially in this verbal area by more abundant resources in another context. This effect appears stronger for whites, although sample size did not allow us to estimate the models within other ethnicities. Better understanding these results would require a sample with less confounding of race/ethnicity and income as well as measures of cognitive capabilities designed to be culturally valid within ethnicity.

2.2.3. Attention-deficit/hyperactivity disorder and Columbia Impairment Scale

For both youth and mother reported ADHD symptoms and CIS impairment, the fitted models reflect the relative disadvantage and relative advantage as risky situations model of Table 1. (Recall that since ADHD and impairment are risky rather than healthy outcomes, the directions must be reversed in Table 1 by switching the word positive with negative and negative with positive throughout.) As expected for this model, each outcome has a negative interaction between family and neighborhood income in Table 3; in the models with controls, these coefficients are significant for mother reported ADHD and youth reported CIS scores. In Table 4, the conditional effects show the expected reversal from positive at low levels of the other income variable to negative at high levels on the other income variable (Although, with the exception of mother reported ADHD, most conditional coefficients are not significant making it difficult to statistically distinguish among the set of risky non-monotonic multiplicative models).

Fig. 3 plots the predicted values from the fitted "with controls" models. The expected elevated levels of symptoms and impairment in contexts of relative deprivation and/or relative advantage is evident for all outcomes, except youth ADHD. The lack of findings for youth ADHD may be explained, in part, by past research suggesting that parents may be better reporters of clinically valid ADHD symptoms in children than the children themselves (Jensen et al., 1999; Rubio-Stipec et al., 1994). Indeed, mother reported ADHD symptoms and youth reported CIS impair-

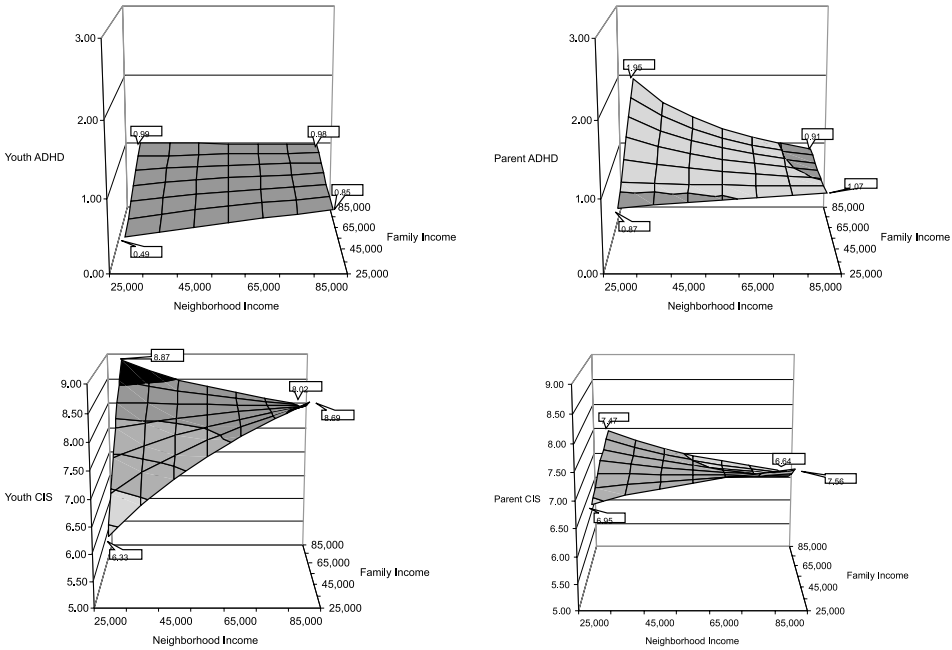

Fig. 3. Illustration of empirical findings consistent with the relative deprivation and relative advantage as risky multiplicative model: ADHD and Columbia Impairment Scale. *Note:* The plotted values are predicted values based on the models with controls in Table 3.

ment reveal the greatest differential between the highest and lowest predicted values: Both differences are over one-third of the standard deviation for that outcome in our data. For mother reported CIS impairment the differential is over one-tenth of a standard deviation. Although elevated maternal ADHD symptom reports are evident primarily in contexts of relative advantage, CIS impairment is higher both in contexts where the family's income exceeds that of the average neighbor and where the average neighborhood income exceeds the family's income. [2]

We would speculate that some of the concepts of access to resources and social distance described above might be pursued by future research to understand this constellation of findings. If relatively advantaged youth are not sufficiently challenged intellectually at school due to person–environment mismatch, then the social context may elicit symptoms like those of ADHD. These symptoms may then relate

[2] Indeed, the elevation in mismatch neighborhoods is more similar by informant for the CIS impairment outcomes than for the ADHD outcomes (back/left and front/right corners of the graphs). But, levels of CIS impairment differ by informant in the match neighborhoods (front/left and back/right corners of the graphs). Most strikingly, youth reported CIS impairment is predicted to be lowest when their family incomes are low and they live in low income contexts. Although this finding is unexpected, it is in contrast to predictions from the models which do not include controls. The "no controls" models also reveal relative disadvantage and relative advantage as risky situations, but youth report the highest levels of impairment in shared low income contexts (details available from the authors).

to problematic interactions with parents, siblings, peers, and other adults, such as those assessed by the CIS. The youth's lack of involvement in the kinds of age-appropriate activities measured by the CIS may also relate to the social distance mechanism we speculated about above related to situations of relative advantage and disadvantage. In pursuing these findings, it would also be important to consider variation across socioeconomic strata in the ways in which the symptoms of ADHD are known, recognized and interpreted.

2.2.4. Sensitivity of findings

We examined the sensitivity of the findings to alternative model specifications.

For ADHD, in addition to the models of symptom counts reported in the tables, we also estimated models that predicted a dummy indicator of whether the youth met all of the criteria for an ADHD diagnosis, with and without impairment. For the mother report, negative interactions were significant for both diagnostic variables in models with and without controls, consistent with the symptom count. For the youth report, although the signs of the interactions were all negative, only one was significant (diagnosis without impairment as the outcome in the model with controls).

We also estimated four variants of the models presented in the text: (1) *unweighted* models that do not adjust for the sampling weights, (2) models based on *non-logged income*, (3) models in which we estimate family income between the income intervals in a *non-midpoint* manner (randomly assigning a value in the interval based on a uniform or normal distribution), and (4) models in which we *upcode and downcode* both family and neighborhood income to match the extremes used in Table 4 and our illustrative figures ($25,000 minimum and $85,000 maximum). The findings for both mother reported ADHD and youth reported CIS were quite consistent across these alternative specifications. The interactions were significant across all four alternative specifications, with and without controls (although the significance falls to the $p < .06$ level for youth reported CIS in the unweighted model with controls). As might be expected, given their weaker findings reported in Table 3, although the youth reported ADHD and mother reported CIS show negative interactions across the alternative specifications they are sometimes more significant and sometimes less significant than those reported in Table 3. The findings for PPVT also reveal negative interactions across all of the alternative specifications. For the full sample, the coefficients predicting PPVT across the alternative specifications are sometimes more significant and sometimes less significant than those reported in Table 3. But, for white youth, the coefficients are consistently negative and significant across all model specifications, with and without controls.

The purpose of this paper has been to test for interactions between continuous income measures. However, categorized income variables provide an additional sensitivity check and relate our findings to those of prior research that has relied on categorical variables. Analyses with categorical variables replicate the above pattern of findings, although the associations are generally less statistically significant suggesting greater power for the models with continuous income variables. In particular, we created three sets of dummy variables, using the sample quartiles, thirds, and

medians for family and neighborhood income (details available from the authors). The same lessening pattern of results is evident for PPVT for all three of these categorical models, although the interaction is statistically significant only in the models that are restricted to whites (both with controls and without controls). The categorical income variables also mirror the continuous income variables in revealing the relative disadvantage and relative advantage as risky situations models for the ADHD and CIS impairment outcomes. As was the case for the continuous measures, the situation of relative advantage is associated with significantly higher maternal reports of ADHD than situations of shared low or high income, although the associations are statistically significant only in the models without controls. Youth reported ADHD also shows some evidence of relative advantage as risky, although primarily in the quartiles categorical model. And, levels of CIS impairment are elevated in the categorized situations of both relative advantage and relative disadvantage, although in the three sets of categorical models these differences are statistically significant primarily in the mother reported models without controls.

3. Discussion

This study encourages researchers to employ samples and tests consistent with conceptual frameworks regarding the interaction between family and neighborhood income. We have demonstrated the ways in which such models can be comprehensively considered with continuous income measures and the interconnections among various models that might otherwise seem at odds.

In our empirical illustration, we find evidence of both monotonic and non-monotonic multiplicative models. We find that youths' receptive vocabulary is more strongly positively related to income in one context (family or neighborhood) when income is low in the other context (neighborhood or family), particularly for white youth. And, our findings reveal that attention-deficit/hyperactivity disorder and impairment are highest among youth who live in contexts where their families' financial circumstances are advantaged or deprived in relation to their neighbors.

Although within our data these findings are quite consistent, they should be replicated in other samples before strong conclusions about policy and practice are made. If replicated, the findings affirm the complexity of addressing the consequences of income inequality for youth. Our findings reveal clear benefits to youths' receptive vocabularies when they live in one low income context and income is higher in the other context. Yet, these findings are somewhat at odds with the results for youths' social and emotional well-being since situations of relative advantage and relative disadvantage appear problematic for youths' daily functioning and symptoms of ADHD. Thus, policies and programs would need to be sensitive to the social and emotional challenges that youth face when embedded in a milieu where they have appreciably more or less family financial resources than their peers.

This study is limited. Our sample size is fairly small, and restricted to three geographic areas of the US. In our empirical illustration, sample size did not permit an examination of important issues such as trajectories associated with age, schooling

levels, and pubertal status or variations in associations by gender and ethnicity, all of which may be central determinants of the studied outcomes. We also lack measures of the social processes that we posit for the multiplicative models as well as other determinants of children's academic and social behavior (e.g., parental goals for their children). And, especially given our cross-sectional design and limited set of controls, it is possible that factors we did not measure here, including additional selection mechanisms or covariates of income, explain the findings, rather than the mechanisms we posit. Ultimately, we would encourage the collection of data that better supports the test of multiplicative models through: (1) measurement of potential mediating variables to look at hypothesized mechanisms and (2) sampling plans designed within demographic groups to obtain substantial variation of family income within neighborhood income and vice versa.

3.1. Mechanisms underlying multiplicative models

In our empirical illustration, we were able to control for the mechanisms that have been revealed in prior research of additive income effects (i.e., family relationships, parental monitoring and parental psychopathology) as well as proxies for confounds related to parents' selection into neighborhoods (i.e., parents' education and occupation, family relationships, and parental psychopathology) and other correlates of family income (family structure, welfare receipt, and parental unemployment). However, we did not have measures of the mechanisms that we speculate underlie the multiplicative models that we conceptualized and estimated here.

For example, we posited two potential mechanisms for the kind of lessening effect seen when we predict children's receptive vocabularies. One simply suggested that the marginal effect of additional family (neighborhood) income would be smaller when neighborhood (family) income is higher. This hypothesis is a simple extension of economic concepts of diminishing marginal returns, thus in one sense the empirical finding is not surprising. However, understanding why additional income "matters more" in lower income than higher income contexts for particular aspects of child well-being may aid in the design of interventions (for example, is there some level of exposure to grammatically correct spoken language that can come either from parents or from other adults in the community and is needed to achieve a particular level of vocabulary?). The other mechanism we suggest is that parents may respond to the relative level of resources in their family and neighborhood, spending private family income or accessing public neighborhood resources to compensate when one setting is relatively deficient. At a minimum, researchers would require information about families' expenditures and their use of community resources to test this mechanism. Ideally, they would also have information about parents' perceptions of their own and their neighborhoods' resources and their strategic decision making about their children's learning opportunities.

As noted above, we anticipate that mechanisms of resource targeting and social distance may underlie the findings for symptoms of ADHD and impairment of daily functioning. Studies that measure the social networks of children and their parents would allow for an examination of the proposition that social distance restricts a

youth's involvement in age-appropriate activities when he or she lives among neighbors who on average have larger or smaller incomes than his or her family. Connecting sociometric measures with these social network studies would also allow researchers to examine the extent to which, on average, youth who live in these contexts of income mismatch experience social rejection. To the extent that a youth's behavior appears inattentive due to the failure of the social context to appropriately target his or her learning needs, studies might also attempt to measure the range of opportunities for remedial and gifted instruction in the local schools, libraries, and parks and the extent to which the youth would benefit from such instruction. More generally, these findings reinforce the need to move beyond the structural level and examine processes that occur at the individual, family and community levels (e.g., see Coulton et al., 1996 and Sampson et al., 1999 for measures of certain neighborhood mechanisms).

3.2. Sampling designs

Samples have often limited the ability of past studies to estimate interactions between family and neighborhood income. Sometimes limited variation in family and neighborhood income has resulted from an interest in studying communities that follows the collection of data. When such a sample of families was initially restricted to a particular locale, then there is typically limited variation in neighborhood income. The sampling designs for national population studies can also limit researchers interested in studying family and neighborhood income. Often, sampling plans use census data to target fairly homogenous communities on various demographic characteristics (race, income). This reduces the financial costs of locating the targeted sample sizes in various demographic categories. However, it also means that more heterogenous communities are less likely to be included, as are contexts important to multiplicative models—such as poorer youth embedded in wealthier communities and wealthier youth embedded in poorer communities. Studies of the multiplicative models outlined here instead require sufficient numbers of these groups, and thus alternative sampling strategies.

We have focused on socioeconomic resources in families and neighborhoods, although some of the mechanisms we discuss may occur within schools. In some areas, socioeconomic resources will be more similar in a child's neighborhood and school than others. For example, non-metropolitan schools that serve an entire city may have wider variation in students' economic backgrounds than suburban or urban schools that draw from a community area in which family incomes are more homogenous. Studies of educational contexts often use multi-stage sampling strategies to study multi-level contexts, and researchers are increasingly doing so in studies of neighborhood contexts. These designs would allow the models and mechanisms laid out here to be studied across family, school, and neighborhood contexts.

Ideally, future studies will combine strategic sampling designs, longitudinal follow up, and measurement of relevant mechanisms to continue to advance research regarding how youth fare when situated in differing economic circumstances in the family, school, and neighborhood.

Appendix A. Approaches to accounting for clustering of families within neighborhoods

Assuming some familiarity with these models (or consulting of the cited references), we demonstrate here how the models we outline in the text can be estimated by either the standard interaction model with robust standard errors or the hierarchical linear models (HLM) approach.

The standard interaction model that might be estimated in OLS is

$$\mathrm{READ}_i = b_0 + b_1\mathrm{NEIGINC}_i + b_2\mathrm{FAMINC}_i + b_3\mathrm{NEIGINC}_i \times \mathrm{FAMINC}_i + e_i,$$

where READ is reading comprehension, as an example outcome variable, NEIGINC is the median income in the neighborhood, FAMINC is the family's income level, and *i* denotes each individual. With robust standard errors, the model is identical, but the standard errors of the coefficients are adjusted for non-independence within neighborhoods and heterogeneity of unspecified form (see Rogers, 1993).

Applying HLM to our models, Level 1 is the family/youth and Level 2 is the neighborhood. Following Bryk and Raudenbush (1992), the Level 1 HLM model with reading comprehension as the outcome is

$$\mathrm{READ}_{ij} = \beta_{0j} + \beta_{1j}\mathrm{FAMINC}_{ij} + r_{ij}$$

where *i* indicates individuals and *j* indicates neighborhoods. The Level 2 HLM models are

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\mathrm{NEIGINC}_j + u_{0j},$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}\mathrm{NEIGINC}_j + u_{1j}.$$

This specification highlights the typical conceptualization of cross-level effects–neighborhood income may be used to predict the size of the effect of family income on reading comprehension. This is clearly one form of moderation described in our conceptual models. The parallel moderation of the effect of neighborhood income on reading comprehension by the level of family income is made clear by substituting the Level 2 equations into the Level 1 equation to yield the single equation form of the model

$$\mathrm{READ}_{ij} = (\gamma_{00} + \gamma_{01}\mathrm{NEIGINC}_j + u_{0j}) + (\gamma_{10} + \gamma_{11}\mathrm{NEIGINC}_j + u_{1j}) \times \mathrm{FAMINC}_{ij} + r_{ij},$$

$$\mathrm{READ}_{ij} = \gamma_{00} + \gamma_{01}\mathrm{NEIGINC}_j + \gamma_{10}\mathrm{FAMINC}_{ij} + \gamma_{11}\mathrm{NEIGINC}_j \times \mathrm{FAMINC}_{ij} + u_{0j} + u_{1j}\mathrm{FAMINC}_{ij} + r_{ij}.$$

Note that this model is identical to our standard interaction model, except for the structure of the error term. In the HLM model, the error variance is partitioned to include family/youth-level random effects, neighborhood-level random effects, and heterogeneity associated with levels of family income.

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