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Effortful Control Moderates Bidirectional Effects Between Children's Externalizing Behavior and Their Mothers' Depressive Symptoms

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This study examined bidirectional associations between mothers' depressive symptoms and children's externalizing behavior and whether they were moderated by preschool-age effortful control and gender. Mothers and teachers reported on 224 primarily White, middle-class children at ages 3, 5, and 10. Effortful control was assessed via behavioral battery and mother ratings. Structural equation modeling indicated that maternal depressive symptoms at child age 3 predicted more externalizing behavior at age 10 among children with low effortful control and among boys. Externalizing behavior at age 3 predicted fewer depressive symptoms at the age 10 assessments among mothers of children with high effortful control. Boys with suboptimal self-regulation exposed to high levels of maternal depressive symptoms were at greatest risk for school-age behavioral problems.

Our goal was to advance understanding of bidirectional processes involving children's externalizing behavior and mothers' depressive symptoms from early to middle childhood. Current theoretical perspectives emphasize that the progression of children's adjustment problems reflects the continuous interplay between individual characteristics that children bring to their social interactions and the quality of social support and resources (Bell, 1968; Cicchetti & Toth, 1997; Sameroff, 2009). In this article we highlight a salient environmental risk to development, maternal depression, and show how multiple qualities of individual children interact with maternal depressive symptoms to influence the progression of externalizing problems across development. In what follows we briefly discuss prior literature and argue for a conceptual model that includes multiple child risk characteristics assessed across development.

Depressive disorders are common among mothers of young children and women of childbearing age (Kessler et al., 2003; Lovejoy, Graczyk, O'Hare, & Neuman, 2000). High levels of maternal depressive symptoms increase the risk that young children's disruptive behaviors grow into more serious school-age conduct problems in later childhood and adolescence (Campbell, Shaw, & Gilliom, 2000; Goodman et al., 2011; Shaw, Gilliom, Ingoldsby, & Nagin, 2003; Weinfield, Ingerski, & Moreau, 2009). However, because children's early behavior problems can elicit negative affect in caregivers, researchers have called for concerted efforts to disentangle bidirectional associations between maternal depression and child psychopathology (Connell & Goodman, 2002; Dodge, 1990; Shaw, Gross, & Moilanen, 2009).

In a study of at-risk boys, Gross, Shaw, Burwell, and Nagin (2009) found that disruptive behavior in toddlerhood was associated with persistently high levels of maternal depressive symptoms, which predicted more antisocial behavior in adolescence. Bidirectional effects between maternal depression and boys' externalizing behavior were found across development, such that high levels of one risk factor were associated with heightened levels of the other (Gross, Shaw, & Moilanen, 2008; Shaw et al.,

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2009). In a toddler-age sample that included girls, noncompliance at age 2 predicted more of mothers' depressive symptoms, which in turn predicted higher levels of externalizing behavior when children were 4 years old (Gross, Shaw, Moilanen, Dishion, & Wilson, 2008). Similarly, maternal depressive symptoms and children's behavioral problems have been shown to increase and decrease in concert with one another (Nicholson, Deboeck, Farris, Boker, & Borkowski, 2011). Although these studies illustrated bidirectional processes reinforcing adjustment problems in mothers and children, they all focused on at-risk, low-income families. Questions remain as to whether these findings generalize to middle-class families facing fewer risks and less severe pathological symptoms. Moreover, most young children who are exposed to maternal depression or demonstrate early externalizing behavior do not progress to more severe forms of maladjustment (Campbell et al., 2000; Olson, Sameroff, Lunkenheimer, & Kerr, 2009). Child self-regulation may influence this process by facilitating coping responses and reducing children's vulnerability to negative effects of maternal depression. Few studies, however, have examined whether children's self-regulation moderates child evocative effects on maternal depression, or how mothers' depressive symptoms develop over time in relation to children's externalizing behavior. As shown next, individual differences in early self-regulation may play an important moderating role in the development of bidirectional associations between maternal depressive symptoms and child externalizing behavior.

The Role of Children's Effortful Control

Child effortful control (EC), a set of temperament-based self-regulatory abilities inversely associated with externalizing problems (Posner & Rothbart, 2000), has been shown to moderate effects of contextual risk factors on child adjustment problems (e.g., Lengua, 2002). Children's EC is defined as the capacity to voluntarily inhibit a dominant response and initiate a subdominant response (Kochanska & Aksan, 2006; Rothbart & Bates, 1998). EC differs from other constituents of self-regulation (e.g., automatic regulatory processes for arousal) in that its central feature is the executive control of attention and inhibition of emotional and behavioral impulses to facilitate goal-directed behavior (Posner & Rothbart, 2000). Although children's EC emerges in late infancy and develops rapidly between the ages of 2 and 6 (Bell & Deater-Deckard, 2007; Rothbart & Bates, 2006), individual differences in EC remain moderately stable through early to middle childhood (Kochanska, Murray, & Harlan, 2000). The stability of EC, and its role in the selection, coordination, and storage of information, suggests it is a critical part of children's socialization, personality, and psychopathology (Bell & Deater-Deckard, 2007).

Consistently, young children with high levels of externalizing problems have been found to manifest low levels of EC (Eisenberg et al., 2005; Martel & Nigg, 2006; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005; Rothbart & Bates, 2006). Studies also have linked suboptimal levels of children's EC to high levels of maternal depressive symptoms (Lengua, Bush, Long, Kovacs, & Trancik, 2008; Sektnan, McClelland, Acock, & Morrison, 2010). Children with low EC have more difficulty managing their reactivity to stressors and are more likely to experience excessive levels of arousal, which may contribute to attention problems and failures inhibiting inappropriate impulses. Poorly regulated children also tend to be more dependent on parental support to manage their arousal (Sameroff, 2000; Sroufe, Duggal, Weinfield, & Carlson, 2000), which mothers with depressive symptoms are less likely to provide (Choe, Olson, & Sameroff, in press; Lovejoy et al., 2000). Mothers' frequent negative emotions and unresponsiveness may upset or anger their children, leading to further dysregulation of negative affect and associated adjustment problems, such as inattention and oppositional behavior. Therefore, children with low EC may be more prone to developing externalizing problems when their mothers experience depressive symptoms that compromise the quality of interactions with young children.

Conversely, high levels of EC in the preschool and early school years have been found to protect children from contextual risk factors for externalizing problems (Lengua, 2002; Lengua et al., 2008). Although high levels of EC alone are not sufficient to prevent behavioral problems (Olson et al., 2005), they provide children some control over their reactivity to stressful experiences. For example, adequate levels of EC have been linked with more use of active coping, less use of avoidant coping (Lengua & Long, 2002), and less intense expressions of negative emotions, such as anger and fear (Bell & Deater-Deckard, 2007). Young children, who are well regulated, therefore, utilize coping abilities and emotion regulation skills that may buffer them from some harmful consequences of maternal depression.

Children with poor EC may be more vulnerable to adverse effects of maternal depression, but even mild levels of externalizing behavior may be

sufficient to worsen mothers' depressive symptoms. Thus, we expected that child externalizing behavior would be associated with more maternal depressive symptoms regardless of levels of EC. Demonstrating that maternal depressive symptoms are exacerbated by both children's externalizing behavior and lack of self-regulation can inform understanding of risk factors for maternal depression. However, few studies have examined associations between maternal depressive symptoms, child externalizing behavior, and EC, simultaneously. As shown next, we also must attend to the gender of the child, as all of the risks we have discussed are overrepresented in boys.

The Role of Child Gender

Differences between girls and boys in the development of externalizing problems and self-regulation warrant attention to gender as a moderator of environmental risks to development (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). Girls tend to have more advanced EC and fewer externalizing problems than boys in early childhood (Deater-Deckard, Dodge, Bates, & Pettit, 1998; Olson et al., 2005). Some research suggests that boys are more adversely affected by maternal depression than girls, although the evidence is inconclusive (Connell & Goodman, 2002; Cummings & Davies, 1994; Davies & Windle, 1997). Furthermore, we know little of how the interaction between maternal depression and child self-regulation contributes to gender differences in externalizing problems. It is possible that girls' higher self-regulation relative to that of boys protects them from contextual risk factors for externalizing problems. For example, EC has been shown to mediate effects of harsh discipline on child externalizing behavior across the preschool-to-kindergarten transition for boys but not for girls (Chang, Olson, Sameroff, & Sexton, 2011). For these reasons, child gender was examined in major analyses to test for differences in the effects of maternal depression and child EC on externalizing behavior.

The Current Study

This longitudinal study of a relatively large community sample of boys and girls included data collected via multiple methods and from different informants when children were ages 3, 5, and 10. We hoped to extend prior evidence of bidirectional associations between maternal depression and child externalizing to predominantly White, middle-class families and contribute evidence of moderation by child self-regulation and gender. The first aim of this study was to test for bidirectional effects between maternal depressive symptoms and child externalizing. We hypothesized that mothers' depressive symptoms and children's externalizing behavior would predict higher levels of each other. The second aim was to test whether preschool-age levels of EC moderated bidirectional effects between maternal depressive symptoms and child externalizing behavior. We hypothesized that maternal depressive symptoms would predict high levels of externalizing behavior among children who had low levels of EC in the preschool years, but not among children who had high levels of EC. Child externalizing behavior was expected to predict more maternal depressive symptoms, regardless of preschool-age levels of EC.

Method

Participants

This study included 224 children (47% girls), mothers, and a subsample of teachers selected from a larger ongoing longitudinal study of 241 children focused on the development of school-age behavioral problems (Olson et al., 2005). Among participating children, 85% were White, 8% were biracial, 5% were Black, and 2% represented other racial–ethnic groups. During recruitment from 1999 to 2001, 44% of mothers and 30% of fathers reported a bachelor's degree as their highest level of education and another 39% of mothers and 46% of fathers reported receiving graduate or professional training. Hollingshead (1979) four-factor scores for family socioeconomic status (SES) were created with levels of occupational status and educational attainment of parents living in the household during recruitment. Family SES scores ranged from 22 to 66 (M = 54.41, SD = 10.98) representing the top four of five social strata in the Hollingshead system. Most families (87%) resided in the two highest social strata. The average annual family income was between $60,000 and $70,000 [$10,000–$100,000+]. Seventeen mother–child dyads were excluded from this study due to missing data on major study variables.

Procedure

Families with preschool-age children were recruited to represent the full range of scores for the Externalizing Problems scale of the Child Behavior Checklist for Ages 2–3 (CBCL 2/3; Achenbach,

1992) completed by the mother, and children with moderate to high levels of externalizing behavior scores were oversampled. Specifically, 66 children (30%) received ratings in the borderline clinical range (T = 60–63) and 27 children (12%) received ratings in the clinical range (T > 63). None of the families who volunteered to participate experienced extreme economic hardship defined as family income below the federally designated poverty level. This middle-class sample allowed investigators to focus on parental influences on development with minimal confounds of environmental adversity. Children with chronic health problems, physical disabilities, or severe cognitive deficits were excluded.

A female social worker interviewed mothers in their homes to collect demographic information and administer a packet of questionnaires assessing children's behavioral adjustment and mothers' psychological distress. Part of the interview focused on mothers' adjustment to parenting. Mothers who expressed strong emotional distress via ratings and/or interviews were helped to find referrals for mental health care. Home interviews were conducted during the first two assessment points. Data collection for the third assessment was carried out entirely online through electronic questionnaires. In addition, children's teachers were asked to provide ratings of child adjustment problems at all assessment points. Mothers and teachers completed questionnaires at Wave 1 (W1) when children in this study were about 3 years old (M = 3.15 years, SD = .23), at Wave 2 (W2) when children were about 5 years old (M = 5.29 years, SD = .22), and at Wave 3 (W3) when children were about 10 years old (M = 10.46 years, SD = .60). Families were paid modestly for participating. About 80% of children's preschool teachers provided ratings of child externalizing behavior at W1, 83% in the early school years at W2, and 83% in middle childhood at W3. Teachers received gift certificates for their participation.

Self-regulation was assessed by graduate student testers when children were about 3.5 years old (M = 3.45 years, SD = .17) in 3- to 4-hr behavioral assessments at a local preschool on Saturday mornings. Appointments were scheduled during home visits, so Saturday visits were a few months after mothers were initially assessed. Children participating received small gifts.

Measures

Maternal depressive symptoms. Mothers were administered the Brief Symptom Inventory (BSI) self-report measure of adult psychological distress (Derogatis, 1993). Mothers rated their levels of distress in the last week to 53 items using a 5-point scale: 0 = *not at all* to 4 = *extremely*. This study only includes the Depression scale, which consisted of six items (M_α = .81) assessing dysphoric mood, loneliness, feeling blue, lack of interest in things, suicidal ideation, and feelings of worthlessness and hopelessness. Evaluation of the BSI's Depression scale in a large psychiatric population produced high internal consistency (α = .85), test–retest reliability (r_{tt} = .84), and a correlation of .95 with the Depression scale of the Sympton Checklist–90–R (SCL–90–R), from which the BSI is derived (Derogatis & Fitzpatrick, 2004). Both scales have been well validated in research examining a range of conditions. The BSI's Depression scale has comparable levels of internal consistency, rigor, validity, sensitivity, and specificity as other widely used depression measures (Sakakibara, Miller, Orenczuk, Wolfe, & SCIRE Research Team, 2009).

Mothers reported a wide range of depression scores when compared to the BSI's subscale norms for nonpatient adult females (Derogatis, 1993). At each assessment, mothers reported an average depression score (M = .26) close to the 60th percentile for nonpatient women (T = 52). Across assessments, around 45% of mothers reported zero depressive symptoms, about 16% scored at the 50th percentile (T = 50), about 20% scored around the 70th percentile range (T = 54–57), and approximately 12% scored at or above the 84th percentile (T > 59). Twelve mothers (5%) did not report this information at W2, and 42 mothers (19%) did not report this at W3.

Externalizing behavior. Teacher-report raw scores for Externalizing Problems scales were used to assess children's externalizing behavior. Preschool teachers at W1 completed the Caregiver–Teacher Report Form for Ages 1½–5 (CTRF; Achenbach, 1997). The CTRF's Externalizing Problems scale (α = .96) consisted of two correlated subscales (r = .79, p < .001): 17-item Attention Problems (α = .92) and 23-item Aggressive Behavior (α = .94). Teachers at W2 and W3 completed the TRF for Ages 6–18 (Achenbach & Rescorla, 2001; Achenbach, Dumenci, & Rescorla, 2002). The TRF's Externalizing Problems scale (M_α = .94) consisted of two correlated subscales (M_r = .76, p < .001): 12-item Rule-Breaking Behavior (M_α = .65) and 20-item Aggressive Behavior (M_α = .95).

Mother-reported raw scores from Externalizing Problem scales on the CBCL 2–3 at W1 (Achenbach, 1992) and the CBCL 6–18 at W2 and W3 (Achen-

bach & Rescorla, 2001; Achenbach et al., 2002) were solely used to contrast to teacher ratings to examine overlap in perceived severity. At W1, mothers rated about 30% of children in the borderline clinical range (T = 60–63) and 12% of children in the clinical range ($T > 63$) of the Externalizing Problem scale. In contrast, teachers rated only 7% of children in the borderline clinical range and 11% of children in the clinical range. Mother and teacher ratings at W1 were only marginally correlated (r = .15, p = .052). At W2, mothers rated 6% of children in the borderline clinical range and 8% of children in the clinical range, and similarly teachers rated 6% of children in the borderline clinical range and almost 11% of children in the clinical range. Informant ratings were positively correlated at W2 (r = .51, $p < .001$). At W3, mothers rated 6% of children in the borderline clinical range and 10% of children in the clinical range, and similarly teachers rated 5% of children in the borderline clinical range and 9% of children in the clinical range. Informant ratings were positively correlated at W3 (r = .61, $p < .001$). Mother ratings were not used in main analyses to reduce both shared informant variance and potential reporting biases associated with maternal depression (Goodman & Gotlib, 1999). Although mother and teacher ratings of child externalizing behavior differed initially, ratings converged over the course of the study.

Effortful control. EC was assessed with a behavioral battery and mother report. Child temperament was assessed by mother report at W1 using an abbreviated version of the Children's Behavior Questionnaire (CBQ; Ahadi, Rothbart, & Ye, 1993). CBQ scales for inhibitory control (α = .72, 13 items) and attentional focusing (α = .85, 14 items) represented constituents of temperament most closely related to EC (Rothbart & Bates, 1998). Standardized scores for inhibitory control and attentional focusing were summed with the total score from a toddler-age behavioral battery consisting of six tasks that assessed individual differences in EC (Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996). Scores for each task (described in online Supporting Information Appendix S1) were standardized and summed into a total EC behavioral score (α = .70).

Inhibitory control and attentional focusing (r = .44, $p < .001$), inhibitory control and EC behavioral score (r = .33, $p < .001$), and attentional focusing and EC behavioral score (r = .27, $p < .001$) were all positively correlated, standardized, and summed into a composite score of preschool-age EC. Multiple assessment methods of temperament compensate for weaknesses unique to parent ratings and observational data and provide more valid and comprehensive measures of self-regulation (Rothbart & Bates, 1998). The composite score of W1 EC was dichotomized by median split to create two groups of 112 children referred to as the well-regulated children and the poorly regulated children. This dichotomous EC group variable was used in structural equation modeling (SEM) to test for moderation. The continuous composite score of W1 EC was used in an alternative test of moderation using interaction terms in SEM.

Results

Overview of Data Analysis

Preliminary analyses using SPSS 19 examined sample attrition, missing data, and descriptive statistics of study variables within the full sample and by each gender and EC group. SEM was conducted with Mplus 6 with maximum likelihood with robust standard errors, a missing data estimator for non normally distributed data (Muthén & Muthén, 2010). As shown in Figure 1, a transactional model was estimated with data on maternal depressive symptoms and child externalizing behavior across three time points. It consisted of first- and second-order lagged effects (A's and B's) that estimated stabilities of constructs, first- and second-order cross-lagged effects (C's and D's) that estimated their prediction of one another over time, and three within-time error covariances (E's) that estimated constructs' shared residual variance from same time

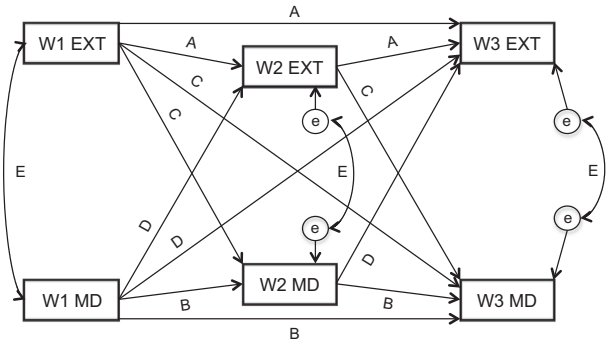

Figure 1. This structural equation model examines the continuity (A's and B's) and bidirectional effects (C's and D's) between children's externalizing behavior (EXT) and mothers' depressive symptoms (MD) across the preschool years at age 3 (W1), the early school years at age 5 (W2), and middle childhood at age 10 (W3). E's represent covariances between residual terms (e's) accounting for shared error variance from similar times of measurement.

measurement. After estimating the model with the full sample, multiple-group SEM was conducted to test for moderating effects of gender. We then included gender as a covariate in a multiple-group model comparing well-regulated to poorly regulated children, which provided a test of moderation by preschool-age EC. We then conducted an alternative test of moderation in SEM using interaction terms between EC and other W1 variables.

Attrition and Missing Data

Approximately 91% of the sample continued to participate in the study at W3, while 21 families stopped participating mainly due to family relocation. Families who left the study reported a lower average annual household income at recruitment (M = 7.50; \$40,000–\$50,000) than families who remained in the study (M = 9.46; \$60,000–\$70,000), $t(20) = 2.09$, $p = .049$. Teacher ratings of child externalizing behavior were missing at W1 for 44 children (20%), and 38 children (17%) at W2 and W3. Children missing teacher ratings at W2 were more likely to have lower teacher ratings of externalizing behavior at W1 (M = 6.94) than children who had these data (M = 10.78), $t(61) = -2.01$, $p = .049$. Mothers who did not report their depressive symptoms at W3 (M = 8.22) had a lower annual family income at recruitment than mothers who reported these data (M = 9.53), $t(51) = -2.14$, $p = .037$. Although some missing data and attrition were systematic, nonrandom effects were modest and did not appear to violate assumptions of our missing data estimator, maximum likelihood with robust standard errors.

Descriptive Statistics

Table A1 in the Appendix shows correlations and descriptive statistics of variables for the full sample. As reported in earlier studies of this sample, girls had higher levels of EC at W1 and lower levels of externalizing behavior than boys (Olson et al., 2005). W1 EC was negatively associated with externalizing behavior at all assessments. Supporting expectations of bidirectional effects, some assessments of maternal depressive symptoms and child externalizing behavior were positively associated with one another. Distribution values indicated potential problems of positive skewness for all assessments of maternal depressive symptoms and W2 externalizing behavior (skewness > 2.5, kurtosis > 8.0). Distributions of externalizing behavior at W1 and W3 appeared positively skewed, but their values were relatively low (skewness < 2.5, kurtosis < 6.5). EC scores were normally distributed (skewness < $\pm$.51, kurtosis < 1.08). Tables A2 and A3 in Appendix present correlation tables by gender and by EC group, respectively.

Structural Equation Modeling

Standardized values are presented in the figures and text. Reported p values are from unstandardized estimates, which account for standard errors more accurately than standardized estimates (Kline, 2005). Following Boomsma (2000), SEM results include values for model chi-square (χ^2), comparative fit index (CFI), estimated root mean square error of approximation (RMSEA), and its 90% confidence interval. RMSEA values $\leq .05$ indicate a close approximate fit. CFI values greater than .90 indicate a reasonably good fit (Kline, 2005). Overall model fit indices are only provided in the figures and not in the text, unless the model had no figure.

We first hypothesized that maternal depressive symptoms and child externalizing would have bidirectional effects in which they would predict higher levels of each other. We estimated all possible effects in the transactional model with the full sample, $\chi^2(0) = .00$, $p < .001$, CFI = 1.0, RMSEA = .00. Contrary to expectations, no cross-lagged effects between maternal depressive symptoms and externalizing behavior were found. R^2 values indicated the model explained 22% of the variance in W2 externalizing behavior, 29% in W2 maternal depressive symptoms, 44% in W3 externalizing behavior, and 40% in W3 maternal depressive symptoms.

Multiple-Group SEM

Child gender effects. After testing the transactional model with the full sample, we tested for moderating effects of child gender. Chi-square difference tests ($\Delta\chi^2$) were used to contrast fit of nested models. One by one, a structural path was constrained to be equal for boys and girls and the overall model fit was compared to a model without that constraint. If the equality constraint worsened the overall model fit, as indicated by a significant $\Delta\chi^2$ value, we eliminated it in the next nested model. If the equality constraint did not worsen the fit, it was retained in the next nested model testing an additional equality constraint and so forth until the best fitting and most parsimonious model was identified. Following these steps, we identified a model with a close approximate fit (see Figure 2). Two structural paths were estimated separately for boys and girls to achieve the closest fit. W1 maternal depressive symptoms

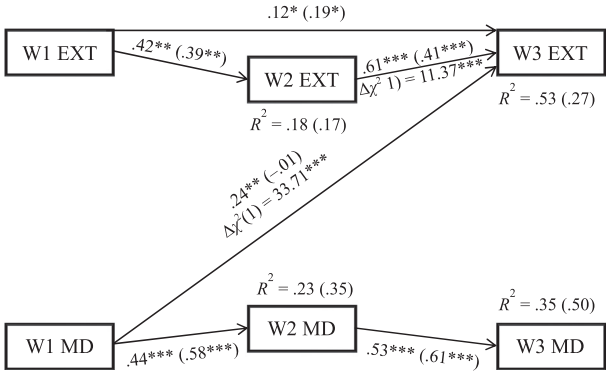

Figure 2. Multiple-group structural equation models results indicate maternal depressive symptoms (MD) at age 3 (W1) predict high levels of externalizing behavior (EXT) at age 10 (W3), only among boys (standardized estimates before parentheses, $n = 118$). Girls have less stable EXT from ages 5 (W2) to 10 (estimates in parentheses, $n = 106$). Covariances, residuals, and nonsignificant paths are not shown. Chi-square difference values ($\Delta\chi^2$) indicate paths that differ by gender, $\chi^2(13) = 10.19$, $p = .68$, comparative fit index = 1.00, root mean square error of approximation = .00 [.00, .08].
*$p < .05$. **$p < .01$. ***$p < .001$.

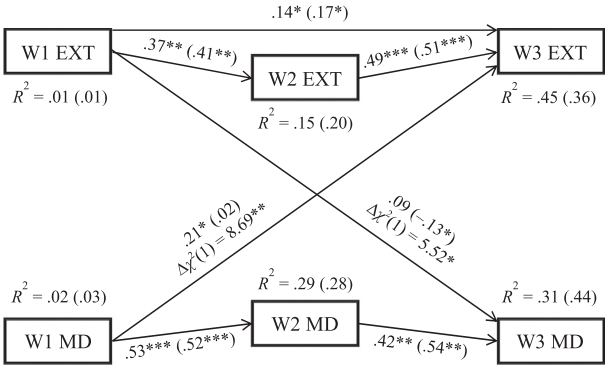

Figure 3. Multiple-group structural equation models results indicate maternal depressive symptoms (MD) at age 3 (W1) predict high levels of externalizing behavior (EXT) at age 10 (W3), only among poorly regulated children (standardized estimates before parentheses, $n = 112$). EXT at age 3 predicts low levels of MD at age 10, only among well-regulated children (estimates in parentheses, $n = 112$). Covariances, residuals, nonsignificant effects, and gender effects are not shown. Chi-square difference values ($\Delta\chi^2$) indicate paths that differ by effortful control group, $\chi^2(18) = 11.66$, $p = .86$, comparative fit index = 1.00, root mean square error of approximation = .00 [.00, .05].
*$p < .05$. **$p < .01$. ***$p < .001$.

predicted high levels of externalizing behavior at W3 among boys ($\beta = .24$, $p = .001$), but not among girls ($\beta = -.01$, $p = .935$), $\Delta\chi^2(1) = 33.71$, $p < .001$. Girls had less stable externalizing behavior from W2 to W3 ($\beta = .41$, $p < .001$) than boys ($\beta = .61$, $p < .001$), $\Delta\chi^2(1) = 11.37$, $p < .001$. Gender moderated the association between maternal depressive symptoms and child externalizing behavior, such that mothers' early depressive symptoms only predicted boys' externalizing behavior in middle childhood, which was more stable than girls' externalizing behavior.

High and low effortful control. Next, we entered gender as a covariate in a multiple-group model that tested for moderation by child EC. Boys and girls were coded, respectively, as 0 and 1. Our second hypothesis was that mothers' depressive symptoms would predict high levels of externalizing behavior only among children with low levels of EC. We expected the externalizing behavior of children in both EC groups to predict more of their mothers' depressive symptoms. Findings partially supported our hypothesis. The same nested model approach as the gender analysis produced a close-fitting model comparing children by their EC at W1 (see Figure 3). The closest fitting model included two unconstrained paths estimated separately for well-regulated and poorly regulated children. As hypothesized, W1 maternal depressive symptoms predicted high levels of child externalizing behavior at W3 among poorly regulated children ($\beta = .21$, $p = .01$), but not among well-regulated children ($\beta = .02$, $p = .881$), $\Delta\chi^2(1) = 8.69$, $p < .01$. Contrary to expectations for child evocative effects, well-regulated children's W1 externalizing behavior predicted low levels of mothers' depressive symptoms at W3 ($\beta = -.13$, $p < .05$), but these variables were unrelated for poorly regulated children ($\beta = .09$, $p = .314$), $\Delta\chi^2(1) = 5.52$, $p < .05$. This finding was explored in a post hoc analysis reported at the end of the results.

Although not shown in Figure 3, W1 EC also moderated a gender effect on externalizing behavior at W3. Male gender predicted higher levels of externalizing behavior at W3 among poorly regulated children ($\beta = -.28$, $p < .001$), but not among well-regulated children ($\beta = .02$, $p = .826$), $\Delta\chi^2(1) = 15.34$, $p < .001$. Thus, boys with low levels of self-regulation had higher levels of externalizing behavior than girls and well-regulated boys. This extends our previous finding that maternal depressive symptoms predict more behavioral problems in middle childhood among boys and poorly regulated children by illustrating that low self-regulation is in itself a predictor of boys' continuing behavioral problems. R^2 values indicated that for poorly regulated and well-regulated children, respectively, this model explained 15% and 20% of the variance in W2 externalizing behavior, 29% and 28% in W2 maternal depressive symptoms, 45% and 36% in W3 externalizing behavior, and 31% and 44% in W3 maternal depressive symptoms.

Moderating effects of child effortful control and gender. We conducted an alternative test of moderation within a SEM framework that did not dichotomize EC scores. Dichotomizing continuous variables has been criticized for losing information about individual differences and contributing to spurious statistical significance and overestimation of effect sizes (MacCallum, Zhang, Preacher, & Rucker, 2002). Centered continuous scores of EC, externalizing behavior, and maternal depressive symptoms at W1, and their interactions were entered in a transactional model with externalizing behavior and maternal depressive symptoms at W2 and W3. Given the significance of gender in previous models, we tested for moderation by EC in a transactional multiple-group model comparing boys and girls, thus also testing for moderation by gender.

As shown in Figure 4, no interactions between W1 variables were significant. Interactive effects between W1 EC and W1 maternal depressive symptoms on W3 maternal depressive symptoms (M_β = .17, p = .061), and between W1 EC and W1 maternal depressive symptoms on W2 externalizing behavior (M_β = .15, p = .079) only trended to significance and were not examined further or shown in Figure 4. A multiple-group model that estimated all effects equally for boys and girls provided an acceptable fit, $\chi^2(24) = 41.24$, $p = .016$, CFI = .91, RMSEA = .08 [.04, .12]. The overall fit was improved when we estimated three effects separately by gender (see Figure 4). Consistent with previous results, boys' externalizing behavior (β = .58, $p < .001$) was more stable than girls' from W2 to W3 (β = .43, $p < .001$), $\Delta\chi^2(1) = 14.83$, $p < .001$. W1 maternal depressive symptoms predicted high levels of externalizing behavior at W3 among boys (β = .19, p = .013), but not among girls (β = –.01, p = .968), $\Delta\chi^2(1) = 5.69$, p = .044. We found that W1 EC predicted low levels of boys' externalizing behavior at W3 (β = –.15, p = .047), but was unrelated to girls' externalizing (β = .11, p = .372), $\Delta\chi^2(1) = 4.50$, p = .025. Consistent with previous analyses, an alternative test of moderation showed direct effects of maternal depressive symptoms on boys' more stable externalizing problems. In contrast to initial tests of moderation, no interactive effects were found, although there were direct effects of child EC and maternal depressive symptoms on boys' externalizing behavior. Collectively, findings suggested that high EC protected boys from the adverse effects of maternal depression and directly reduced boys' externalizing behavior.

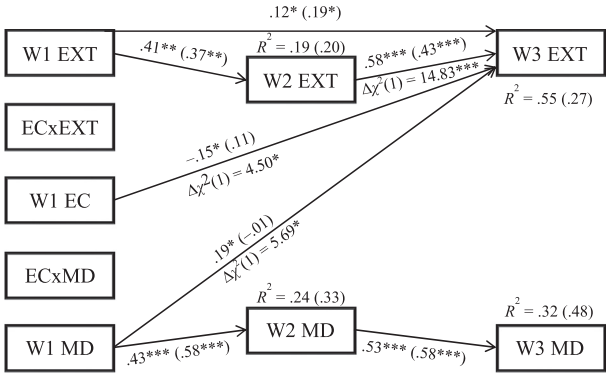

Figure 4. Multiple-group structural equation models results indicate maternal depressive symptoms (MD) and child effortful control at age 3 (W1) predict high levels of externalizing behavior (EXT) at age 10 (W3) only among boys (standardized estimates before parentheses, n = 118). Boys' externalizing behavior is more stable from ages 5 (W2) to 10 than girls' externalizing behavior (estimates in parentheses, n = 106). Covariances, residuals, and nonsignificant effects are not shown. Chi-square difference values ($\Delta\chi^2$) indicate paths that differ by gender. $\chi^2(21) = 16.23$, p = .757, comparative fit index = 1.0, root mean square error of approximation = .00 [.00, .06].
*$p < .05$. **$p < .01$. ***$p < .001$.

Post hoc analyses. To investigate why well-regulated children's W1 externalizing behavior predicted low levels of mothers' depressive symptoms at W3 (see Figure 3), we examined associations between W1 externalizing behavior and the developmental trajectory of maternal depressive symptoms in latent growth curve (LGC) models. We report unstandardized estimates of LGC models to retain the BSI Depression scale metric, except for correlations among growth parameters and regression coefficients, which are standardized for interpretability. First, we estimated an unconditional LGC model of maternal depressive symptoms across three assessments and found that they decreased linearly over time. Second, we regressed the intercept and slope of mothers' depressive symptoms on W1 externalizing behavior in a conditional LGC model and found that they were unrelated. Third, we estimated a multiple-group LGC model to identify EC group differences in growth of mothers' depressive symptoms and established invariant growth across EC groups. Fourth, we tested whether effects of W1 externalizing behavior on the intercept and slope of maternal depressive symptoms differed between EC groups. Only results of this last LGC model are reported, but all models produced a close fit.

We identified the best fitting model as one in which effects of W1 child externalizing behavior on the slope of maternal depressive symptoms were estimated separately for each EC group, $\chi^2(12) = 6.86$, p = .867, CFI = 1.0, RMSEA = .00 [.00, .06]. Mothers' initial levels of depressive symptoms (intercept = .28, $p < .001$) and their linear decrease

over time (slope = −.07, p = .052) were negatively associated (r = −.56, p < .001). Mothers with greater initial depressive symptoms demonstrated a steeper decrease in symptoms over time. Constraining effects of W1 child externalizing behavior on the slope of maternal depressive symptoms worsened the overall fit, $\Delta\chi^2(1) = 7.79$, p = .005. Well-regulated children's W1 externalizing behavior was not related to the slope (b = −.12, p = .238), but poorly regulated children's W1 externalizing behavior was positively associated with the slope of mothers' depressive symptoms (b = .26, p = .053). Thus, the externalizing behavior of preschoolers with low self-regulation predicted slower decreases in maternal depressive symptoms from the age 3 to 10 assessments. In contrast, our transactional multiple-group model indicated that well-regulated preschoolers' externalizing predicted low levels of mothers' depressive symptoms at age 10. Both analyses suggest that children's externalizing behavior predicted later levels of maternal depressive symptoms, and mothers of children with high levels of EC fared better than mothers of children with low EC.

Discussion

Following a transactional framework, our goal was to elucidate bidirectional processes involving children's externalizing behavior and mothers' depressive symptoms from early to middle childhood. Prior research has consistently demonstrated adverse effects of maternal depression on child externalizing problems (e.g., Goodman et al., 2011); however, many studies have not included tests of bidirectional effects, control of children's previous problem behaviors, multiple informants, or a middle-class sample—all were included in this study. In addition, we contributed unique findings that associations between maternal depression and child behavior problems were moderated by individual differences in child self-regulation and gender. We found long-term effects in both directions between children's externalizing behavior and maternal depressive symptoms that were moderated by preschool-age levels of EC.

Controlling for gender and earlier externalizing behavior, maternal depressive symptoms at age 3 predicted higher levels of externalizing behavior at age 10 among children with low EC. This was consistent with Lengua et al.'s (2008) findings that cumulative risk, including maternal depression, only predicted future adjustment problems of preschool-age children with low self-regulation—also designated as children scoring below the median on EC tasks. Furthermore, our results supported meta-analyses indicating that early exposure to maternal depression is more detrimental to development than later exposure (Goodman et al., 2011; Lovejoy et al., 2000). Preschool-age children who had suboptimal levels of self-regulation appeared to be more vulnerable to adverse effects of their mothers' depressive symptoms and, consequently, more likely to continue showing behavioral problems in middle childhood. Early childhood is a period of heightened vulnerability that may be related to the development of children's self-regulation.

Children's EC develops rapidly during preschool years, allowing them to increasingly behave in socially appropriate ways (Bell & Deater-Deckard, 2007; Kochanska & Aksan, 2006; Rothbart & Bates, 2006). Compared to children who had higher levels of preschool-age EC, children with low EC had double the externalizing problems at all assessments. Low levels of self-regulation may predispose young children to developing externalizing problems that persist through childhood, particularly when they are exposed to risk factors like maternal depression. Because moderately stable individual differences in EC emerge in late infancy (Kochanska & Aksan, 2006; Kochanska et al., 2000; Posner & Rothbart, 2000), early levels of EC may have enduring implications for children's adjustment problems and their vulnerability to stressors.

Regardless of children's EC, we expected their externalizing behavior to predict more of mothers' depressive symptoms. Although researchers have found that boys' conduct problems predict high levels of maternal depressive symptoms in low-income families (Gross, Shaw, & Moilanen, 2008; Shaw et al., 2009), we did not find this in middle-class families. The externalizing behavior of children with high self-regulation predicted lower levels of mothers' depressive symptoms when children were 10 years old. This child evocative effect was the opposite sign than we expected, and from children who in general had low levels of externalizing behavior.

We emphasize that it is common for young children to show elevated levels of externalizing behavior, and well-regulated children's externalizing symptoms fell within a normal range of adjustment. Research has shown that young children of mothers with few depressive symptoms demonstrate more defiant noncompliance and less passive noncompliance than children of mothers with many depressive symptoms (Dix, Stewart, Gershoff, & Day, 2007). Modest levels of early externalizing behavior are normative and reflect healthy attempts at autonomous

behavior, which could explain why well-regulated children's behavioral problems predicted lower levels of mothers' depressive symptoms. Well-regulated children's early externalizing behavior (which at the mean level was lower than girls' externalizing) may have engaged mothers in ways that helped reduce their depressive symptoms. To partly explore this possibility, we examined whether children's EC moderated effects of their externalizing behavior on the developmental growth of maternal depressive symptoms.

Although maternal depressive symptoms decreased at the same rate for children with low and high levels of EC, poorly regulated children's early externalizing behavior predicted smaller decreases in mothers' depressive symptoms. Thus, child evocative effects on maternal depressive symptoms were found for both well-regulated and poorly regulated children, but these effects were of a different nature. One was a time-specific effect, and the other was an effect on growth. In both cases, interactions of child self-regulation and externalizing behavior predicted later levels of maternal depressive symptoms with mothers of poorly regulated children faring unfavorably. Whereas well-regulated children's early behavioral problems were mild and benign to mothers' mental health, poorly regulated children's early behavioral problems were more severe and predicted slower decreases in their mothers' depressive symptoms through childhood.

As we have shown child self-regulation to moderate the influence of early externalizing behavior on growth of mothers' depressive symptoms, so too may the interaction of maternal depression and child self-regulation alter the growth of adjustment problems. The early combination of maternal depression and child regulatory problems may place children on difficult trajectories in which they repeatedly struggle with stage-salient tasks. Children's adaptive failures may exacerbate mothers' depressive symptoms, which in turn may spill over into mother–child interactions, increasing risk for age-aberrant conduct problems. Although we did not find bidirectional effects within a single group of children, we demonstrated effects in both directions between maternal depressive symptoms and children's externalizing that spanned approximately 7 years. Possible explanations for not identifying bidirectional influences include the length of time separating waves of assessments and the low-risk nature of our sample. Annual assessments, moment-to-moment data on mother–child interactions, and high-risk families with severe mental illnesses might have provided more robust evidence of bidirectionality. As it stands, studies that have documented transactions or bidirectional effects between maternal depression and child externalizing behavior have utilized one or more of these approaches (Gross, Shaw, & Moilanen, 2008; Gross, Shaw, Moilanen, & Dishion, 2008; Gross et al., 2009; Nicholson et al., 2011; Shaw et al., 2009).

A unique contribution of this study was our analysis of gender differences. Consistent with previous studies, boys had lower levels of self-regulation and higher levels of externalizing behavior than girls (Deater-Deckard et al., 1998; Else-Quest et al., 2006; Olson et al., 2005). Anticipating gender differences in children's behavioral adjustment, we compared boys and girls in a transactional model and found two moderating effects of gender. First, maternal depressive symptoms at child age 3 predicted higher levels of boys' externalizing behavior at age 10. Second, boys had more stable externalizing behavior than girls from ages 5 to 10. Compared to girls, boys in this study showed externalizing problems that persisted through childhood and were associated with their exposure to maternal depressive symptoms in the preschool years.

These findings extended evidence of elevated externalizing problems in boys' exposed to maternal depression from low income families to White, middle-class boys and their mothers (Gross et al., 2009; Shaw et al., 2003; Shaw et al., 2009). In showing no relation between girls' behavior and mothers' depressive symptoms, results were consistent with other findings suggesting that boys are more vulnerable than girls in early childhood to contextual risk factors for externalizing problems (Cummings & Davies, 1994; Davies & Windle, 1997; Dodge & Pettit, 2003; Goodman & Gotlib, 1999; Yates, Obradović, & Egeland, 2010). We note that only one child outcome was examined in this study and it is possible that there are no gender differences or worse outcomes for girls when examining other domains. Some research, for example, suggests that girls are more likely to develop internalizing problems than boys when exposed to maternal depression, particularly during adolescence (e.g., Davies & Windle, 1997).

In further analyses we determined whether the moderating role of early self-regulation differed for boys and girls. First, we found that male gender predicted higher levels of externalizing behavior at age 10 among children who had low levels of EC at age 3. Boys' increased risk was associated with their lower relative levels of self-regulation and greater negative response to mothers' depressive symptoms. Again, this is consistent with theories that suggest that boys are more vul-

nerable to contextual risk factors in early childhood than girls.

However, an alternative test of moderation that did not use dichotomized EC scores showed no interactive effects between child EC and maternal depressive symptoms on boys' or girls' externalizing behavior. Our initial test of EC as a moderator was within a multiple-group SEM framework, and therefore, no main effects of EC were examined. Contrary to our previous moderation results, both child EC and maternal depressive symptoms at age 3 directly predicted higher levels of boys' externalizing behavior at age 10. The main effect of child EC may have accounted for all the variance in externalizing behavior that could be explained by the interaction between EC and maternal depressive symptoms. Nonetheless, this analysis demonstrated unique contributions of child EC and maternal depressive symptoms during the preschool years on the continuity of boys' externalizing behavior, and their relatively modest roles, at least in this low-risk sample, in the development of girls' problem behavior.

Despite inconsistent findings with EC as a moderator, we have shown that high levels of self-regulation in the preschool years have an impact on externalizing behavior in middle childhood. Moreover, boys' early self-regulatory vulnerabilities may help explain why boys typically display more externalizing problems than girls. Supporting previous research, boys' EC at age 3 was inversely related to their externalizing behavior at age 10 (Eisenberg et al., 2005; Martel & Nigg, 2006; Olson et al., 2005). Boys' EC was negatively correlated with externalizing behavior at each assessment, whereas for girls they were only correlated at age 3. Gender differences in self-regulation may explain why the gender gap in externalizing behavior grows after the preschool years (Deater-Deckard et al., 1998; Farrington, 2009). Early gender differences in reactivity to stress and self-regulation favor girls in reducing their risk of externalizing problems. For example, infants who focus on stressors are shown to be more aggressive as toddlers; however, shifting attention away from stressors, a regulatory skill related to EC, is associated with less aggressive behavior in girls, but not in boys, who generally develop this skill later on (Crockenberg, Leerkes, & Bárrig Jó, 2008). Boys show a stronger impulse to continue attending to stressors than girls, and inhibition of this response requires greater EC. Thus, boys' temperamental vulnerabilities appear to increase their risk of externalizing problems, particularly when exposed to maternal depressive symptoms in the preschool years.

Few studies have addressed child factors that explain why boys show more externalizing problems than girls. Our findings indicate that low self-regulation in early childhood, a time of critical self-regulatory development, elevates boys' vulnerability to maternal depression and their risk of continuing to manifest externalizing problems. As both child self-regulation and gender moderated relations between maternal depression and child externalizing, we can assert broadly that transactional models are needed. Irrespective of empirical associations showing reciprocal effects, a transactional framework informs knowledge of how individual child characteristics and environmental factors provide stronger predictions about development than either alone.

Limitations and Future Directions

Several caveats of this study warrant future investigation of our research questions. Although our analytic models delineated effects between maternal depressive symptoms and child externalizing behavior, they did not clarify proximal mechanisms or how the development of self-regulation was affected by maternal depression and child behavioral problems. Parenting deficits have been linked to maternal depression (Goodman & Gotlib, 1999; Lovejoy et al., 2000), child externalizing behavior (Campbell et al., 2000; Deater-Deckard et al., 1998), and EC (Chang et al., 2011; Choe et al., in press). Mothers with depression who demonstrate disengaged or actively negative parenting may contribute to suboptimal gains in children's EC and, consequently, more persistent externalizing problems. Behavioral problems in early childhood are normative, reflecting children's attempts at behavioral autonomy; when successful, children may help improve mothers' depressive symptoms (Dix et al., 2007). Children with age-aberrant behavioral problems, however, may evoke disrupted parenting from mothers, which can worsen maternal depression and interfere with their attempts to socialize children. Therefore, parenting deficits may mediate bidirectional associations between maternal depressive symptoms and child externalizing. Longitudinal studies integrating these factors with self-regulation are needed.

Relatedly, we examined moderating effects of children's preschool-age EC, but growth in EC occurs across development (Kochanska et al., 2000; Lengua, 2006). Children's EC at ages 5 and 10 may have had different moderating effects on relations between maternal depression, child externalizing, and gender. However, as we have emphasized, indi-

vidual differences in levels of EC are moderately stable through childhood (Kochanska & Aksan, 2006; Posner & Rothbart, 2000), suggesting that preschoolers who performed poorly on self-regulatory tasks would likely perform poorly on age-appropriate tasks in later childhood. Furthermore, identifying child factors in early development that influence their vulnerability to contextual risk factors is more likely to inform prevention efforts to reduce future problem behaviors.

Another methodological limitation was the different versions of the TRF used to assess child externalizing problems. Our measure of externalizing problems at age 3 included scales of attention problems and aggressive behavior, whereas the measure at ages 5 and 10 consisted of scales for rule-breaking and aggressive behavior. Use of only consistent items from these measures might have altered our findings as attention problems and rule-breaking behavior could be related to child EC and maternal depression differently. Moreover, specifying the exact symptoms of mothers and children that reciprocally influence each other is needed to clarify bidirectional processes underlying negative mother–child interactions.

Finally, the external validity of our findings is limited to mainly White, middle-class families. Bidirectional effects in the maternal depression literature have been found mostly in at-risk, low-income families (Gross, Shaw, Moilanen, & Dishion, 2008; Nicholson et al., 2011). Racially and ethnically diverse samples should be examined to replicate and determine the generalizability of our results.

Conclusion

In this prospective longitudinal study, low levels of child self-regulation increased boys' vulnerability to harmful effects of maternal depressive symptoms, increased their risk of school-age externalizing problems, and hindered improvements in mothers' depressive symptoms. In addition to conceptualizing poor self-regulation as a vulnerability factor, we also may consider self-regulatory competence as a protective factor that buffers young children from risk factors like maternal depression. This alternative perspective supports researchers who posit that children's self-regulatory competence facilitates resilience processes, such as effective coping responses (Buckner, Mezzacappa, & Beardslee, 2003; Lengua, 2002; Lengua & Long, 2002). Teasing apart the dynamic interplay between maternal depression and child externalizing can elucidate their etiologies and prevention, as well as the intergenerational transmission of psychopathology. Prevention efforts targeting mothers' depressive symptoms and toddlers' disruptive behavior and emerging self-regulatory skills, especially in boys, may help prevent more stable and severe mental health problems in mothers and their children.

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Appendix
Correlations, Means, and Standard Deviations of Variables in Structural Equation Models (SEM)

Table A1
*Full Sample SEM (*N = *224)*

Variables	1	2	3	4	5	6	7	8
1. Gender (0 = *boys*, 1 = *girls*)	—							
2. W1 effortful control	.19**	—						
3. W1 maternal depressive symptoms	.15*	−.12	—					
4. W1 externalizing behavior	−.17*	−.30***	.06	—				
5. W2 maternal depressive symptoms	−.02	−.07	.51***	.17*	—			
6. W2 externalizing behavior	−.16*	−.23**	.08	.43***	.08	—		
7. W3 maternal depressive symptoms	−.02	−.05	.36***	.12	.52***	.12	—	
8. W3 externalizing behavior	−.26***	−.31***	.17*	.44***	.17*	.63***	.10	—
M	0.47	−0.03	0.29	10.11	0.27	4.40	0.22	3.39
SD	0.50	2.24	0.42	12.56	0.48	8.16	0.38	6.07

Note. W1 = Wave 1 at age 3; W2 = Wave 2 at age 5; W3 = Wave 3 at age 10.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table A2
Multiple Group SEM Comparing Boys (Below Diagonal, n = *118) and Girls (Above Diagonal,* n = *106)*

Variables	1	2	3	4	5	6	7	*M* (*SD*)
1. W1 effortful control	—	−.06	−.23*	.03	−.11	.04	.01	0.42 (2.21)
2. W1 maternal depressive symptoms	−.28**	—	.01	.50***	.13	.48***	.07	0.35 (0.50)
3. W1 externalizing behavior	−.31**	.17	—	.04	.30*	.05	.32**	7.95 (10.66)
4. W2 maternal depressive symptoms	−.15	.55***	.25*	—	.11	.63***	.04	0.26 (0.48)
5. W2 externalizing behavior	−.28**	.11	.51***	.06	—	.11	.48***	3.08 (6.70)
6. W3 maternal depressive symptoms	−.12	.19	.18	.41***	.12	—	.19	0.21 (0.40)
7. W3 externalizing behavior	−.41***	.34**	.45***	.23*	.69***	.06	—	1.75 (3.33)
M	−0.44	0.23	12.09	0.28	5.61	0.23	4.87	
SD	2.19	0.32	13.83	0.48	9.17	0.35	7.46	

Note. W1 = Wave 1 at age 3; W2 = Wave 2 at age 5; W3 = Wave 3 at age 10.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table A3
Multiple Group SEM Comparing Poorly Regulated (Below Diagonal, n = *112) and Well-Regulated Groups (Above Diagonal,* n = *112)*

Variables	1	2	3	4	5	6	7	8	*M* (*SD*)
1. Gender (0 = *boys*, 1 = *girls*)	—	−.02	.24*	−.04	.11	−.11	.02	−.03	0.60 (0.49)
2. W1 effortful control	−.03	—	−.06	−.12	.02	.02	.09	−.11	1.80 (1.21)
3. W1 maternal depressive symptoms	.08	−.28**	—	.03	.50***	.13	.52***	.13	0.28 (0.41)
4. W1 externalizing behavior	−.15	−.13	.09	—	.00	.42***	−.17	.33**	6.65 (9.69)
5. W2 maternal depressive symptoms	−.10	.02	.53***	.26*	—	.05	.59***	.03	0.23 (0.46)
6. W2 externalizing behavior	−.08	−.13	.07	.37**	.08	—	.13	.48***	2.49 (5.67)
7. W3 maternal depressive symptoms	−.03	.00	.23*	.24*	.48***	.11	—	.07	0.19 (0.32)
8. W3 externalizing behavior	−.30**	−.25*	.22*	.43***	.21*	.65***	.08	—	1.83 (3.75)
M	0.35	−1.87	0.29	13.82	0.32	6.30	0.25	4.85	
SD	0.48	1.33	0.43	14.18	0.50	9.72	0.42	7.36	

Note. W1 = Wave 1 at age 3; W2 = Wave 2 at age 5; W3 = Wave 3 at age 10.
*$p < .05$. **$p < .01$. ***$p < .001$.

Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Appendix S1. Behavioral Tasks for Assessing Preschool-Age Effortful Control.