Published in final edited form as:
J Marriage Fam. 2014 April 1; 76(2): 370–386.

Estimating the Effects of Parental Divorce and Death With Fixed Effects Models

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Abstract

The authors used child fixed effects models to estimate the effects of parental divorce and death on a variety of outcomes using 2 large national data sets: (a) the Early Childhood Longitudinal Study, Kindergarten Cohort (kindergarten through the 5th grade) and (b) the National Educational Longitudinal Study (8th grade to the senior year of high school). In both data sets, divorce and death were associated with multiple negative outcomes among children. Although evidence for a causal effect of divorce on children was reasonably strong, effect sizes were small in magnitude. A second analysis revealed a substantial degree of variability in children's outcomes following parental divorce, with some children declining, others improving, and most not changing at all. The estimated effects of divorce appeared to be strongest among children with the highest propensity to experience parental divorce.

Keywords

child/adolescent outcomes; death; divorce; fixed effects models

Since the mid-1960s, a large number of studies from multiple disciplines have explored the effects of parental separation and divorce on children. This research has consistently demonstrated that children with divorced parents, compared with children with two continuously married parents, score lower (on average) on a variety of measures of achievement, adjustment, and well-being (Amato, 2001; Amato & Keith, 1991; Kelly & Emery, 2003). A perennial question, however, is whether these differences are due to the causal effect of divorce or to unobserved variables that increase the risk of divorce as well as child problems. Many authors have noted the substantial difficulties of drawing causal conclusions about divorce (e.g., Amato, 2010; McLanahan, Tach, & Schneider, 2013; Ni Bhrolchain, 2001). Because parents select into divorce, the factors that lead parents to end their marriages also may affect children negatively, resulting in spurious associations between divorce and child outcomes. Indeed, some researchers have argued that the apparent "effects" of divorce on children are due entirely to selection (Ginther & Pollak, 2004; Harris, 1998; Li, 2007).

In the absence of true experiments, child fixed effects regression models provide reasonably strong evidence to decide whether divorce has causal effects on children. These models have the advantage of controlling for all time-invariant selection factors, including those that are difficult or impossible to observe. In the present study, we used child fixed effects models to estimate the effects of parental divorce on a variety of outcomes using two large national data sets: (a) the Early Childhood Longitudinal Study, Kindergarten Cohort (ECLS-K) and (b) the National Educational Longitudinal Study (NELS). To serve as a comparison, we also

estimated the effects of parental death on children—an event rarely studied in a fixed effects framework.

If divorce has negative consequences for children, the average effects are likely to be modest rather than strong, due to substantial variability in children's reactions (Amato, 2000). To put our fixed effects estimates in context, we provide a supplementary analysis of the variability in children's responses to parental divorce. We examined children's pre- and postdivorce change scores in relation to the standard error of measurement to determine the percentage of children who declined or improved significantly—an approach not used before in this literature. In a final exploratory analysis, we consider the possibility that variations in children's reactions are related to parents' propensity to dissolve their marriages.

Fixed effects Models and Parental Divorce

As noted earlier, divorced and continuously married parents exhibit many differences prior to marital disruption that may confound associations between divorce and child outcomes. Researchers working with cross-sectional data have addressed this problem by statistically controlling for a large number of potentially confounding variables. A limitation of this approach involves the impossibility of knowing whether all relevant control variables have been measured and included in the statistical models. Other researchers have used propensity score methods to match children with divorced and continuously married parents on parents' propensity to divorce (e.g., Frisco, Muller, & Frank, 2007). Because only comparable children are matched and included in the analysis, these methods yield stronger evidence of causation than do traditional regression methods. A limitation of these methods, however, is that researchers can never match children on the basis of all factors that may be causes of divorce as well as child outcomes, many of which are difficult to measure or unknown to the researcher.

Longitudinal studies make it possible to compare children before and after parental divorce, assuming that identical child outcomes are available at both times. These studies have demonstrated that many of the child problems typically associated with divorce are present years before the divorce occurs (e.g., Sun, 2001). Thus, many of the negative outcomes attributed to divorce in cross-sectional studies appear to be due to troubled family relationships (e.g., high levels of marital conflict or ineffective parenting) that precede marital disruption rather than to separation itself. An important question, therefore, is whether divorce is followed by a further increase in child problems, net of any predivorce family deficits.

To address this question, some researchers have used regression analysis to estimate the effect of divorce on an outcome after divorce, controlling for the same outcome measured prior to divorce—a lagged dependent variable approach. These studies have produced inconsistent results (Baydar, 1988; Cherlin et al., 1991; Morrison & Cherlin, 1995; Sun, 2001). Moreover, criticisms have emerged in recent years about the use of lagged dependent variables. As Johnson (2005) noted, this method is highly susceptible to omitted-variable bias. Moreover, even if a model is correctly specified, measurement error in the outcome at Time 1 (which serves as an independent variable) can lead to erroneous and unpredictable estimates of the causal effects of the independent variables at Time 2. Given that measurement error is ubiquitous in family studies, causal inferences based on lagged dependent variables may be misleading.

Fixed effects regression models are an alternative method for analyzing longitudinal data (Allison, 2009; Johnson, 1995, 2005). In a *child fixed effects model*, each child serves as his

or her own control. Fixed effects models have the advantage of controlling for all time-invariant variables. In estimating the effects of divorce, for example, these models control for factors such as race and ethnicity, parents' social class prior to separation, the quality of the parents' marriage prior to separation, parents' and children's stable personality traits, and many genetic factors. Moreover, because fixed effects models do not include the Time 1 outcome as an independent variable, they are affected less by measurement error than are models with lagged dependent variables (Johnson, 2005).

We are aware of only three studies that have used child fixed effects models to estimate the effects of divorce on child outcomes. Cherlin, Chase-Lansdale, and McRae (1998) found that parental divorce between the ages of 7 and 22 was followed by a modest but significant increase in emotional problems in the British National Child Development Study. Aughinbaugh, Pierret, and Rothstein (2005) obtained mixed results with the 1979 National Longitudinal Survey of Youth (NLSY). Table 4 in their article shows that the transition to divorce was associated with a significant increase in children's behavior problems, a marginally significant decrease in reading scores, and a significant increase in math scores. (Note that the latter finding is contrary to what most observers would have expected.) An unpublished paper by Li (2007) also used the NLSY 1979 and found no significant increase in children's behavior problems following divorce.

Several other studies are pertinent because they relied on child fixed effects models to study transitions across a range of family structures (married biological parents, cohabiting biological parents, married stepparents, cohabiting stepparents, and single mothers). Dunifon and Kowaleski-Jones (2002) found that family structure changes were not related to math scores or delinquency in the NLSY 1979. They did find, however, that the number of years spent in a single-parent family was negatively associated with math scores and positively associated with delinquency among White (but not among Black) children. Burnett and Farkas (2009) also reported that transitions between various family structures in the NLSY 1979 were unrelated to children's mathematics scores. Similarly, Foster and Kalil (2007) found few significant associations between family structure changes and child outcomes among low-income families participating in the Comprehensive Child Development Project. In contrast, Hao and Xie (2002) found that the number of family structure transitions was positively and significantly associated with children's behavior problems in the National Survey of Families and Households. Finally, Cooper, Osborne, Beck, and McLanahan (2011) found that the mother's total number of coresidential transitions was associated with lower verbal ability among children in the Fragile Families Study, but only at a marginal level of significance. Overall, it is difficult to interpret these inconsistent results—a conclusion also reached in a recent review of this literature by McLanahan et al. (2013).

Before continuing, we want to note that several other studies have relied on a related approach: *sibling fixed effect models*. Using this approach, researchers have compared siblings exposed to single parenthood for different lengths of time prior to the age of 18 (Björklund, Ginther, & Sundström; 2007; Björklund & Sundström, 2006; Ermisch & Francesconi, 2000). This approach removes unobserved family characteristics that both siblings hold in common (e.g., all stable maternal traits). Nevertheless, siblings experience many aspects of family life differently, and these are not controlled in this type of analysis. Moreover, these designs require the dual assumptions (a) that the effects of divorce (or single parenthood) depend on how long children lived with a single or remarried parent prior to reaching adulthood and (b) that parental separation has no effects on children after they reach the age of 18. If these assumptions are incorrect, then one might erroneously conclude that changes in family structure have no consequences for children. For these reasons, child fixed effects models, in which children serve as their own controls, provide a stronger basis

for reaching causal inferences about the effects of parental divorce than do sibling fixed effects models.

Parental Death

Some researchers have argued that parental death can be treated as a natural experiment to study the effects of parental absence (e.g., Corak, 2001; Lang & Zagorsky, 2001). This argument is weakened if parents "self-select" into death, for example, through substance abuse or other risky behavior. In these cases, unmeasured variables (parents' personalities or mental health) could be responsible not only for premature death but also child problems. Nevertheless, it is reasonable to assume that most deaths among parents with dependent children are due to unexpected and unpredictable circumstances. After all, accidents (unintentional injuries) are the main cause of death for people between the ages of 25 and 44—the age group most likely to be raising children (U.S. Census Bureau, 2012). Because parental death involves less self-selection than does parental divorce, it can provide additional insights into the causal effects of parental absence.

Does it make sense to compare parental death with parental divorce? Unlike most parental deaths, divorces are often preceded by a period of disturbed marital relations and general family disorganization. Nevertheless, many divorces are preceded by relatively little overt conflict between parents (Amato & Hohmann-Marriott, 2007). Indeed, many children report having had no idea that their parents were thinking about divorce prior to separation (Hetherington & Kelly, 2002). Correspondingly, many stable, long-term marriages involve high levels of chronic conflict (Hawkins & Booth, 2005). Although *some* divorces are preceded by conflict, what *all* divorces have in common is the transition from a two-parent to a single-parent household—a characteristic shared with parental death. Although comparing the impact of parental divorce and parental death is not without limitations, such a comparison can potentially strengthen causal inferences about the effects of parental divorce. Of course, even if researchers are uncomfortable comparing death with divorce, the effect of bereavement on children is of interest in its own right.

In an early literature review, Amato (1993) located 24 studies that compared children who experienced parental death with children living with two biological parents. Of these studies, 15 found that children who experienced parental death scored lower on measures of adjustment and achievement and nine found no differences. Most studies conducted since then have continued to report significant associations between parental death and problematic offspring outcomes (Corak, 2001; Frostin, Greenbert, & Robins, 2001; Gertler, Levine, & Ames, 2004; Steele, Sigle-Rushton, & Kravdal, 2009), although a few studies have reported mostly null results (e.g., Biblarz & Gottainer, 2000; Lang & Zagorsky, 2001). Few of these studies, however, have relied on fixed effects models to estimate the effects of parental death.

Goals of the Present Study

Given the impossibility of conducting true experiments, child fixed effects models are one of the best available methods for estimating the causal effects of divorce on children. Only a handful of relevant studies are available, however, and these studies yielded contradictory results. Additional studies may help to shift the weight of the accumulated findings in one direction or another. In reviews of the research literature on family structure and child well-being, Amato (2010), McLanahan et al. (2013), and Sweeney (2010) all recommended that researchers working in this area conduct new studies with fixed effects models and related methods for dealing with omitted-variable bias.

The first goal of the current study was to use child fixed effects models to estimate the effects of divorce on children in two national data sets: (a) the ECLS-K Class of 1998–1999 and (b) the NELS of 1988. We examined a wide range of outcomes, including mathematics and reading scores, emotional and behavioral problems, classroom behavior, peer relationships, self-control, self-esteem, internal locus of control, smoking, and educational aspirations. The second goal was to use child fixed effects models to estimate the effects of parental death on children. As noted earlier, although some observers view parental death as a natural experiment, some degree of self-selection may be involved. Thus, a child fixed effects approach is useful to adjust for stable, unobserved parental traits that may increase the risk of death. To the extent that parental death and divorce share an essential feature (the shift from a two-parent to a single-parent household), comparing the two forms of family disruption may yield further information about the causal status of parental divorce.

Even if significant links are observed between divorce and child outcomes, they are likely to be modest be in magnitude (Amato, 2001; Amato & Keith, 1991). Presumably, this is because children respond to family disruption in varied ways. We know of only one study, however, that directly investigated this assumption. Morrison and Cherlin (1995) calculated the percentage of children who changed positively (+0.5 *SD*) and negatively (−.5 *SD*) on several outcomes following parental divorce. They found that mean levels of well-being tended to decline following divorce, but a sizable group of children also shifted in positive directions. Given the general absence of inquiry along these lines, our third goal was to examine variations in child outcomes following divorce. Instead of relying on arbitrary cutoff points, however, we used the standard error of measurement to distinguish between children who improved, declined, and remained unchanged following divorce, relative to the amount of measurement error.

We also made an exploratory attempt to understand some of the variability in children's responses by considering whether adjustment depends on parents' propensity to divorce. Marital disruption may be especially harmful when the probability of divorce is high. Parents at high risk of divorce tend to have low socioeconomic status and may have personality or mental health problems that make it difficult to sustain long-term committed relationships (Amato, 2000; Karney & Bradbury, 1995). The lack of social, economic, and personal resources may limit parents' ability to help their children adjust to family transitions like divorce. Moreover, children's long-term exposure to multiple stressors in disadvantaged families may increase their vulnerability to the additional burden of family disruption. A contrary possibility is that divorce is more problematic when parents have a low probability of marital dissolution. Family disruption may be particularly stressful when it occurs in social groups in which divorce is relatively uncommon (e.g., families with White, well-educated, middle-class parents). Following divorce, children with affluent, well-educated parents may feel stigmatized or "different" from their peers because they know few other children in comparable circumstances. Correspondingly, children in high-divorce populations may find it easier to adjust to events that are relatively common and perceived as normal. In the present study we tested these contrasting hypotheses by (a) estimating the probability of experiencing divorce for children in two-parent families and (b) examining interactions between subsequent divorce and the probability of divorce in predicting child outcomes.

Method

Data Set 1

Sample—The ECLS-K was designed by the National Center for Education Statistics and involved a nationally representative sample of 21,387 kindergarten students selected from 1,280 schools. The sample was first studied in 1998–1999 and followed through the eighth

grade (Tourangeau, Nord, Lê, Sorongon, & Najarian, 2009). In each wave, researchers collected data from children, parents, and teachers. Data for the current study were drawn from the first two waves (collected in the fall and spring of the kindergarten year) and from the fourth, fifth, and sixth waves (collected in the spring of the first, third, and fifth grade). We did not include the third wave (collected in the fall of the first grade) because only a subsample of children participated. We did not use later waves because most of the dependent variables in our analysis were not included in those years. Because of our focus on parental divorce, children were omitted from the analysis if their biological parents did not report being married in the first wave of data collection. These restrictions resulted in a sample size of 11,003 participants. The demographic characteristics from the first wave (weighted to be nationally representative) appear in Table 1.

Measures—Marital status questions from the ECLS-K parent questionnaires were used to measure the timing of parental divorce and death. If parents reported being "divorced" or "separated" in a particular wave, the child was coded as having experienced divorce in that wave and all subsequent waves (0 = parents still married, 1 = parents separated or divorced). We combined divorce and separation because the great majority of separations either result in quick reconciliations (and are missed in longitudinal surveys) or eventually end in divorce (Bumpass, Martin, & Sweet, 1991). Moreover, from a child's perspective separation is more consequential than legal divorce, so it makes sense to start counting in the wave in which the separation occurred. In most cases, separations and divorces occurred between the same waves and are indistinguishable in the data set. Similarly, if a parent died between waves, the child was coded as having experienced parental death in that wave and all subsequent waves (0 = both parents still alive and married, 1 = parent died). A total of 972 children (9%) experienced parental divorce between kindergarten and the fifth grade. Only 80 children (slightly less than 1%) experienced the death of a parent.

Scores on reading and mathematics tests were used to measure academic achievement. Reading assessments in the first two waves focused on basic skills such as print familiarity, letter recognition, rhyming words, and word recognition. Starting in the third grade, reading assessment expanded to include items focused on phonemic awareness, vocabulary, and passage comprehension. In the kindergarten and first-grade mathematics tests, items focused on identifying one-digit numbers, shape recognition, and counting. In subsequent years, assessments focused on number sense, data analysis, statistics, and algebra. Although the content of these assessments differed across waves, item response theory was used to calculate scores that were comparable over time (Tourangeau et al., 2009). Reliability coefficients (θ) ranged from .91 to .96 for reading and from .89 to .94 for mathematics across waves (Pollack, Atkins-Burnett, Najarian, & Rock, 2005).

To assess nonacademic outcomes, teachers rated the frequency with which children exhibited various social skills and behaviors. All ratings were made on 4-point scales (1 = never, 2 = sometimes, 3 = often, 4 = very often), with the mean of the relevant items serving as the scale score. *Positive approach to learning* measured six classroom behaviors that promote children's learning: (a) "keeps belongings organized," (b) "shows eagerness to learn new things," (c) "works independently," (d) "easily adapts to changes in routine," (e) "persists in completing tasks," and (f) "pays attention well." The reliability coefficient (split–half reliability averaged across all waves) was .90. *Self-control* referred to the child's ability to control attention, emotions, and behavior. The scale included four items dealing with respect for the property rights of others, controlling one's temper, accepting peer ideas, and responding appropriately to peer pressure (mean reliability = .79). *Interpersonal skills* included five items dealing with forming friendships, getting along with people who are different, comforting or helping other children, expressing views in positive ways, and showing sensitivity to the feelings of others (mean reliability = .88). *Externalizing problems*

was based on five items dealing with arguing, fighting, getting angry, acting impulsively, and disturbing ongoing activities (mean reliability = .89). *Internalizing problems* was based on four items dealing with anxiety, loneliness, low self-esteem, and sadness (mean reliability = .77). (For additional details, see Pollack et al., 2005.)

Data Set 2

Sample—The NELS (like the ECLS-K) was designed by the National Center for Education Statistics. The data set involved a nationally representative sample of 24,599 eighth-grade students from 1,032 schools. These students were initially studied in the spring of 1988 and were followed into early adulthood (Curtin, Ingels, Wu, & Heuer, 2002). Data for the current study were drawn from the first three waves collected in 1988 (eighth grade), 1990 (when most students were high school sophomores), and 1992 (when most students were high school seniors). Students who dropped out of school after the first assessment were contacted and included in the study. Because of our focus on parental divorce, adolescents were omitted from the analysis if they reported not living with both married biological parents in the eighth grade. This reduced the available sample size to 10,380 participants. The demographic characteristics from the first wave (weighted to be nationally representative) appear in Table 1.

Measures—Marital status items from the NELS student questionnaires were used to measure the timing of parental divorce and death. If students reported that their parents had separated or divorced between waves, they were coded as having experienced divorce in that wave and all subsequent waves (0 = parents still married, 1 = parents separated or divorced). Similarly, if a parent died between waves, the student was coded as having experienced parental death in that wave and all subsequent waves (0 = both parents still alive and married, 1 = parent died). A total of 869 children (8%) experienced parental divorce during the study, and 221 children (2%) experienced the death of a parent.

Academic achievement was assessed in each wave with tests of reading and mathematics. The reading test required students to read five short passages and answer questions about word meaning, figures of speech, the author's perspective, and the passage as a whole. The mathematics test included word problems, graphs, equations, quantitative comparisons, and geometric figures. Although the content of these assessments differed across waves, item response theory was used to calculate scores that were comparable over time.

Reliability (θ) coefficients ranged from .80 to .85 for reading and from .89 to .94 for mathematics, depending on the wave (Rock & Pollack, 1995).

In each wave, students responded to 13 questionnaire items using a 4-point response scale (1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree). A principal-components analysis (conducted by the authors of the current study) revealed two components that accounted for 45% of the total item variance. The first component appeared to reflect self-esteem and was defined by items such as "I feel good about myself"; "I feel I am a person of worth, the equal of other people"; and "On the whole, I am satisfied with myself." The second component appeared to reflect internal locus of control and was defined by items such as "I don't have enough control over the direction my life is taking"; "Good luck is more important than hard work for success"; and "My plans hardly ever work out, so planning only makes me unhappy." With items scored in the direction of high self-esteem and internal locus of control, mean alpha reliability coefficients across waves were .77 and .71, respectively.

Two additional single-item variables were available in each wave. To assess educational expectations, students were asked, "As things stand now, how far in school do you think you

will get?" Response options included 1 = won't finish high school, 2 = will finish high school, 3 = will attend vocational, trade, or business school after high school, 4 = will attend a four-year college, 5 = will finish college, 6 = will attend a higher level of school after graduating from college. Finally, students were asked, "How many cigarettes do you usually smoke a day?" Response options were 1 = don't smoke, 2 = 1 to 5 cigarettes a day, 3 = about ½ pack a day, 4 = more than ½ pack but less than 2 packs a day, 5 = two packs a day or more.

Analysis

Although all time-invariant variables (e.g., race/ethnicity) are controlled implicitly in child fixed effects models, it is necessary to control for variables that change over time that might be causes of child outcomes as well as parental divorce. The current analysis controlled for child age and age squared (to account for nonlinearity)—the approach used in most prior studies with child fixed effects models (e.g., Cherlin et al., 1998). Because divorce changes so many aspects a child's life, it is difficult to identify time-varying factors not affected by divorce. Controlling for changes in household income, parent–child relationships, or interparental conflict, for example, would lead to underestimates of the true divorce effect—a point we return to in the Discussion section. We used the *xtreg* procedure in Stata 12 to estimate the models, with robust standard errors to adjust for clustering in the ECLS-K and NELS sample designs.

Both data sets revealed a good deal of attrition, with the decline in sample size from the first to the final wave approaching 50% for some outcomes. A common approach to adjusting for attrition bias is to (a) use probit or logistic regression to estimate the propensity to drop out of the sample and (b) include the propensity score as a weight or control variable in the final analysis (Miller & Wright, 1995). These propensity scores, however, are usually estimated from stable characteristics such as race, and these variables were controlled in the fixed effects analysis. Indeed, one of the advantages of this method is that it allows cases to contribute all of their observations to the analysis, even if participants skipped a wave or dropped out of the sample in later waves (Johnson, 1995).

To facilitate comparisons across dependent variables with different units of measurement, all dependent variables were standardized to have means of 0 and standard deviations of 1. Standardizing within waves, however, would have masked change over time in the mean levels of some variables. Thus, for each data set, standardization was based on (a) the overall mean of the variable across all waves and (b) the average within-wave standard deviation of the variable. (Standardization affects the effect sizes from the regression analysis but has no effect on significance tests.)

Table 1 shows the mean values of the standardized dependent variables in Wave 1. Note that the means for reading and math scores in the ECLS-K seem unusually low in Wave 1. This is because reading and math scores increased substantially between kindergarten and the sixth grade. In the NELS data, the corresponding Wave 1 means also were low, but not as low as in the ECLS-K. Presumably, academic achievement does not increase as much between eighth grade and the senior year of high school as it does between kindergarten and the fifth grade.

Results

Fixed Effects Regression Analyses

The results of seven fixed effects regression analyses from the ECLS-K are shown in Table 2. Divorce was associated significantly with all outcomes, including declines in reading

scores, mathematics scores, positive approach to learning, interpersonal skills, and self-control, and increases in internalizing problems and externalizing problems. Most of these estimated effects were modest in magnitude, with effect sizes of less than 0.2 or 1 *SD*. The main exception was internalizing problems, which yielded an effect size of almost 0.3 *SD*. These values are in the lower range of effects sizes reported in meta-analyses of this literature (Amato, 2001; Amato & Keith, 1991). Presumably, the modest magnitude of effects sizes in the present study reflects the ability of fixed effects models to control for many sources of unmeasured heterogeneity.

The results for parental death also are consistent with the assumption that the loss of a parent affects children negatively. Only two outcomes were statistically significant, however: (a) a decline in mathematics scores and (b) an increase in internalizing problems. Despite the lack of statistical significance, the effect sizes for parental death were about as strong as (or stronger than) the effect sizes for parental divorce. This pattern suggests that the general lack of statistical significance was due primarily to the small number of children who experienced this event ($n = 80$). Indeed, a power analysis using the *sampsi* procedure in Stata indicated that statistical power to detect a modest effect size of 0.2 in the population was only .43 (StataCorp, 2005, pp. 173–183). Additional tests (not shown) revealed that none of the *b* coefficients for parental divorce and death differed significantly ($p > .1$) within the same equation.

The coefficients for age, as well as for age squared, were generally significant. Plots of regression lines (not shown) revealed that children's reading and math scores tended to increase substantially in the early school years and more modestly in the later years. Because age increases the risk that children will be exposed to parental divorce or death, and because age reflects developmental trends in the outcomes, controlling for age was necessary to estimate the divorce effects.

The results of six fixed effects regression analyses using the NELS data are shown in Table 3. Divorce was associated significantly with declines in reading achievement, math achievement, self-esteem, internal locus of control, and educational expectations, as well as an increase in smoking. Comparable to the results for the ECLS-K data, effect sizes were generally modest, with most being between 0.1 and 0.2 *SD*. The one exception was smoking, which produced an effect size of a little more than 0.3 *SD*. Once again, most of these effect sizes are within the lower range of those found in meta-analyses of this literature (Amato, 2001; Amato & Keith, 1991).

Table 3 also shows that parental death was associated with a significant decline in math scores, a significant decline in internal locus of control, and a significant increase in smoking. Even the coefficients that failed to attain significance, however, were comparable in magnitude to those of divorce. As in the ECLS-K, the absence of statistical significance for parental death for some outcomes probably reflects low statistical power. (Although the power of the analysis was .83 to detect differences as large as 0.2 *SD* in the population, statistical power was only .31 to detect differences as low as 0.1 *SD*.) As in Table 2, none of the *b* coefficients for parental divorce and death differed significantly (all *p*s > .1) within the same equation. Also comparable to Table 2, most of the age and age-squared terms in Table 3 were statistically significant. For most outcomes, these coefficients indicated improvements in outcomes during the early years of high school that slowed down in later years.

One of the assumptions of fixed effects models is that the effects of the predictors do not change over time. We tested this assumption by creating multiplicative interaction terms for divorce and age (and age squared) and entering these into the regression models shown in

Tables 2 and 3 (results not shown). In the ECLS-K data, significant age interactions emerged only for reading scores. Plotting values from the regression equation revealed that the estimated effect of divorce on reading scores declined from kindergarten to the third grade but increased again in the fifth grade. This trend was weak, with differences between ages reflecting less than 0.10 *SD*. Stronger evidence of age interactions emerged from the NELS data (results not shown). With respect to math scores and internal locus of control, effect sizes associated with divorce declined significantly from the first year of high school to the senior year. Similarly, the effect size associated with parental death and cigarette smoking was stronger in the first year of high school than in later years. Despite these variations, divorce was associated consistently with negative outcomes at all ages in both data sets.

Diversity in Divorce Outcomes

Given the modest effect sizes in Tables 2 and 3, the next part of the analysis focused on variability in children's outcomes following divorce. For each outcome, we calculated the standard error of measurement and the corresponding standard error of the difference between scores (see Anastasi, 1988, Chapter 5). This procedure made it possible to see whether an individual child's scores before and after parental divorce differed "significantly." In traditional hypothesis testing, *significance* refers to the magnitude of the difference between two sample means relative to sampling error (or the standard error of the difference between means). In the current context, *significance* refers to the magnitude of the difference between two individual scores relative to measurement error. In other words, two scores differed significantly if the gap between them was unlikely (with a probability of .05 or less) to have occurred by chance alone.

Given strong developmental trends (especially for reading and math scores), we used regression methods to remove the effects of age from the data (i.e., we calculated residual scores) for these outcomes. For children who experienced divorce, we calculated change scores as the score in the wave following divorce minus the score in the wave before divorce. We then determined how many children changed significantly (relative to the standard error of the difference) between waves in both directions (positively and negatively). With respect to the ECLS-K data, 24% of children experienced decreases in reading scores following divorce, 19% experienced increases in reading scores, and the remaining 57% of children stayed the same. Similarly, following divorce, mathematics scores decreased for 22% of children and increased for 16% of children, positive approach to learning declined for 21% of children and improved for 13% of children, interpersonal skills declined for 26% of children and increased for 19% of children, self-control increased for 14% of children and declined for 15% of children, internalizing problems increased for 24% of children and decreased for 10% of children, and externalizing problems increased for 18% of children and declined for 14% of children. Consistent with the regression results in Tables 2 and 3, these results show that problematic changes were more common than were beneficial changes. These results highlight two additional trends, however. First, for many outcomes, improvements were nearly as common as were decrements. And second, across all outcomes, the most common response to divorce was no change at all. (We do not discuss the results for NELS outcomes because they revealed a similar pattern.)

To illustrate these trends more clearly, we present figures for three representative variables from the ECLS-K: (a) internalizing problems, (b) externalizing problems, and (c) interpersonal problems. Figure 1 shows the distribution of change scores for children who experienced divorce. To provide a comparison, we also calculated change scores for children who did not experience a parental divorce. (These were randomly selected from all the change scores available.) The results for internalizing problems show that the two

distributions overlapped a great deal. On the left side of the distribution in Figure 1 (which indicates improvements in internalizing problems), the two distributions were similar. On the right side of the distribution (which indicates increases in internalizing problems), the distribution for children who experienced divorce shows an elevated number of cases. The figure also shows the values of 1.96 times the standard error of the difference, which is the point in the distributions at which the change scores become "significant" relative to measurement error. The figure indicates that children with divorced parents were overrepresented among children who showed increases in problems, despite a substantial degree of overlap in distributions. The figures for externalizing problems and interpersonal skills revealed similar trends, albeit less pronounced.

The final step in the analysis attempted to explain some of the variability in children's reactions to divorce. Rather than examining background variables individually, however, we looked at parents' general propensity to divorce. With respect to the ECLS-K data, we used logistic regression to predict divorce between the first semester of kindergarten and the sixth grade from the sociodemographic variables listed in Table 1, along with the log of household income and a series of dummy variables reflecting region of the country. All predictors were measured in the first wave. The results (not shown) revealed that the odds of divorce were positively associated with being Black and negatively associated with parents' education, being in the "other non-White" racial group, and attending a private school (other than a Catholic school)—results that are generally consistent with other studies. From the regression equation we calculated the predicted probability of experiencing divorce for each child. These predicted probabilities (propensities) ranged from 0 to .30.

We then added a multiplicative interaction term between divorce and the predicted probability of divorce to each of the fixed effects models in Table 2 (results not shown). We could not include the predicted probability score on its own because it did not vary over time. Including the interaction term was allowable, however (Allison, 2009). The interactions were significant for reading scores ($p < .001$), mathematics scores ($p < .001$), self-control ($p < .05$), and externalizing behavior ($p < .05$). In addition, the interactions were marginally significant for positive approach to learning and interpersonal behavior (both *p*s < .1). For all six outcomes, the estimated effect of divorce was stronger when the probability of divorce was high. (Tables describing these regression results are available on request.)

Figure 2 shows the interpretations for the four fully significant interaction terms. This figure was based on the average change scores for children before and after parental divorce for families with low (0–.07), medium (.08–.15), and high (.15–.30) predicted divorce probabilities. (Note that "high" in this sense is not absolute but relative to other families in the sample.) With respect to reading achievement, children with low divorce probabilities tended to show modest improvements in reading, whereas children with high divorce probabilities tended to decline. Self-control revealed a similar pattern. With respect to mathematics achievement, children with low divorce probabilities showed modest declines, whereas children with high divorce probabilities showed more substantial declines. Correspondingly, all three groups of children showed increases in externalizing behavior following divorce, but the increase was especially marked for children with high divorce probabilities. Note that children with low divorce probabilities came from relatively advantaged families, whereas children with high divorce probabilities came from relatively disadvantaged families. Presumably, parents with more social and economic resources were better able to cushion their children from the potentially disruptive effects of marital dissolution than were parents with few resources.

We conducted a comparable analysis predicting divorce in the NELS data set (not shown). Fixed effects models (comparable to those shown in Table 3) with interaction terms (divorce

× divorce probability) revealed significant results for three outcomes: (a) reading scores, (b) math scores, and (c) educational expectations (all *p*s < .01). In each case, more problematic outcomes followed divorce when parents had high a high propensity to divorce. Overall, these results were entirely consistent with the results from the ECLS-K. (Detailed tables are available on request.)

Discussion

A number of scholars have argued that new research on divorce, family structure, and child outcomes should rely on fixed effects models and other methods that adjust for unobserved heterogeneity (Amato, 2010; McLanahan et al., 2013; Sweeney, 2010). Our analysis, based on child fixed effects models, found that divorce was associated with consistent declines in children's achievement and adjustment. Moreover, these results held for adolescents (the NELS) as well as younger children (the ECLS-K). With respect to previous studies with child fixed effects models, our results are consistent with those of Cherlin et al. (1998), Cooper et al. (2011), and Hao and Xie (2002) and partly consistent with Aughinbaugh et al. (2005) and Dunifon and Kowaleski-Jones (2002). Our results clash with the studies by Burnett and Farkas (2009), Foster and Kalil (2007), and Li (2007). It is not uncommon for researchers to obtain divergent results when using different data sets and model specifications. Nevertheless, with the current results (based on two data sets) included in the mix, the weight of the evidence from child fixed effects models supports the notion that divorce has a negative mean effect on children.

One might argue that our results *underestimate* the effect of divorce because they did not account for the "early effects" of divorce, that is, declines in children's well-being due to marital conflict or other disturbed family relationships that precede (and may be causes of) marital disruption. Because the predivorce measures of outcomes absorbed the effects of these early family problems, they were implicitly controlled in our analysis. This is not a limitation in our view, however. If children have an elevated number of problems *prior to* divorce, then this outcome cannot be attributed to divorce. Virtually every formulation of causation assumes that the cause must precede the effect in time. The models in our study estimated the effects of parental separation—not of conflict or other disturbed relationships that precedes separation. Many divorces are preceded by little overt conflict (Amato & Hohmann-Marriott, 2007), and many long-term, stable marriages involve chronic conflict (Hawkins & Booth, 2005). What all divorces have in common is the departure of one parent from the household, and this is the effect captured in our statistical models.

One also might argue that our models *overestimate* the effects of divorce because they include too few time-varying controls. By definition, however, control variables must be probable causes of the independent and the dependent variables and cannot be caused by the independent variable. In the present case, time-varying covariates that are affected by divorce cannot function as control variables (although they can serve as mediating variables). Divorce changes an extraordinary number of things in children's lives, including residences, relationships with parents, exposure to interparental conflict, and standard of living. Because these variables are affected by divorce, they should not be controlled if one's goal is to estimate the total effect of divorce. For example, adding changes in social class to the models would have been inappropriate, given that divorce typically brings about changes in social class—household income in particular. Nevertheless, our models may have omitted some relevant time-varying covariates and, for this reason, the estimated effects in Tables 2 and 3 may overstate the associations between divorce and child outcomes. (Recall that the effect sizes for some outcomes varied with children's ages, so the values reported in Tables 2 and 3 should be interpreted as average effects across multiple age groups. By

presenting the data in this fashion, we sacrificed some precision to tell the more general story of how divorce is related to a large number of outcomes.)

Our study also shows that parental death, like parental divorce, is followed by declines in children's well-being. These results are consistent with Amato's (1993) early literature review, as well as most studies published since then (e.g., Corak, 2001; Gertler et al., 2004; Steele et al., 2009). Unlike most previous studies, however, the current study has the advantage of being based on child fixed effects models, which allow for stronger inferences about causality.

Two-parent households can be disrupted for reasons other than parental divorce and death. Some studies have found that the international migration of one parent to obtain employment is associated with lower academic achievement among children left in the home country (e.g., Creighton, Park, & Teruel, 2009; Jampaklay, 2006). Similarly, studies of military families have found that the overseas deployment of one parent is associated with increased behavioral and psychological problems among children (Gorman, Eide, & Hisle-Gorman, 2010; Paris, DeVoe, Ross, & Acker, 2010). Another route to a single-parent household involves parental incarceration, which also is associated with poorer child adjustment (Wildeman, Wakefield, & Runey, 2013). Parental divorce, death, migration, deployment, and incarceration all involve selection factors. Nevertheless, the specific selection factors involved in these disparate scenarios vary considerably. Yet it is striking that each cause of single parenthood is associated with similar outcomes for children. In other words, whenever the presumed cause is present (the departure of one parent from a child's household), the presumed effect is present (a reduction in child achievement and well-being). These consistent observations provide additional support for the assumption that parental divorce has a causal effect on children.

As many authors have pointed out, reaching causal conclusions requires the specification of plausible explanatory mechanisms (Goldthorpe, 2001; Ni Bhrolchain, 2001). Previous reviews of this literature have repeatedly pointed to plausible and well-documented explanations for the presumed effects of divorce and single parenthood (Amato, 1993, 2000, 2010; Brown, 2010; Kelly & Emery, 2003). These mechanisms include (a) a decline in children's standard of living, (b) impaired caregiving from stressed parents, (c) a decrease in parental supervision and time with children, (d) being caught in the middle between conflicted parents in the postdivorce years, (e) relocating to new neighborhoods and schools, and (f) the introduction of parents' new partners into children's households and lives. Indeed, there is an abundance of good theoretical reasons for assuming that divorce is a risk factor for a variety of child problems.

Although the available evidence supports the notion that divorce has negative effects on children, the average effects are modest in magnitude. Indeed, most of the effect sizes from our analysis were below 0.2 *SD*, with the mean effect size across all outcomes being 0.16 in the ECLS-K and 0.17 in the NELS. Moreover, our analysis of change scores revealed that many children exhibited improved in functioning following divorce, and the most common outcome was no change at all. These results are consistent with those of Morrison and Cherlin (1995), who also reported a substantial degree of variation in children's change scores following divorce. The substantial diversity in children's reactions to family disruption clarifies why the average effect sizes are modest rather than large.

Many variables are likely to moderate (either exacerbate or lessen) the effects of marital disruption on children. Our analysis suggests that divorce tends to be most harmful when parents have a relatively high propensity to divorce. Given that we estimated propensities from sociodemographic variables, families with the highest propensities also tended to be

the most disadvantaged. Presumably, parents with many social and economic resources are better able than other parents to buffer their children from the negative effects of family disruption. Because this finding has not been reported previously, readers should treat it cautiously. Moreover, our divorce propensity measure might have yielded different results if it had been based on a broader set of initial predictors. Nevertheless, this would be a fruitful topic for future research.

Our study casts no light on how divorce affects trajectories of child well-being. For some children, problems may start to increase as divorce becomes imminent, peak at the time of separation, and decline in subsequent years. In other cases, problems may emerge at the time of separation and stabilize at high level or increase further in subsequent years. Although these considerations are beyond the scope of the current study, other studies have made useful progress in modeling trajectories of well-being for children from divorced families (Cherlin et al., 1998; Kim, 2011; Strohschein, 2005; Sun & Li, 2011).

Although the evidence that divorce has negative effects on children (on average) seems reasonably strong, additional studies using child fixed effects models with previously unexamined data sets would help confirm this conclusion. Given the substantial degree of diversity in children's responses, we suggest that future research focus primarily on the factors that account for this diversity—a suggestion echoed by other scholars (e.g., Demo & Fine, 2010).

Acknowledgments

This research was supported by a grant from the National Institute of Child Health and Human Development to the Population Research Institute at Pennsylvania State University (HD041025). We thank David Johnson and Wayne Osgood for valuable advice on statistical analysis.

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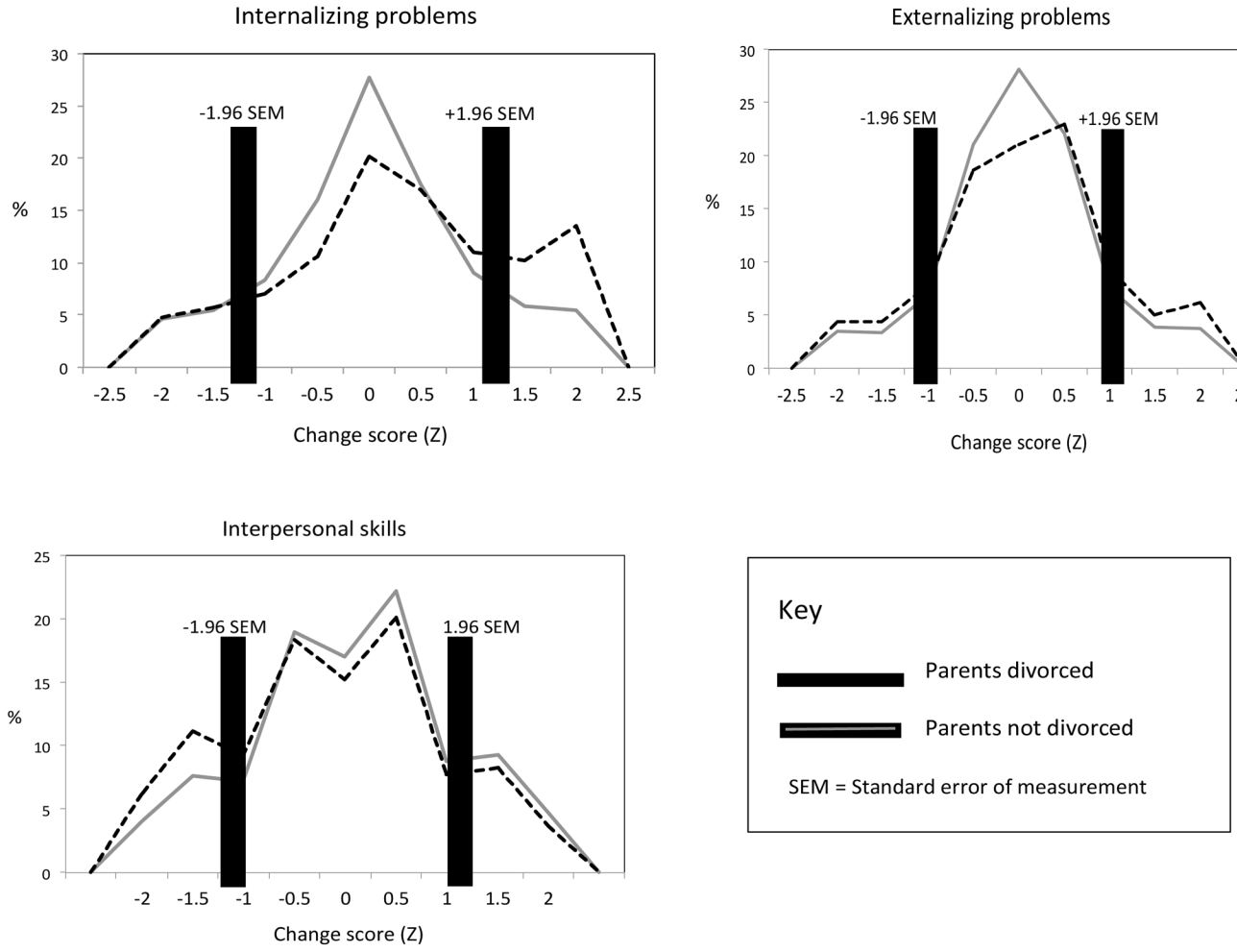

Figure 1.
Distribution of Change Scores for Children With Divorced and Continuously Married Parents (Early Childhood Longitudinal Study Kindergarten Cohort).

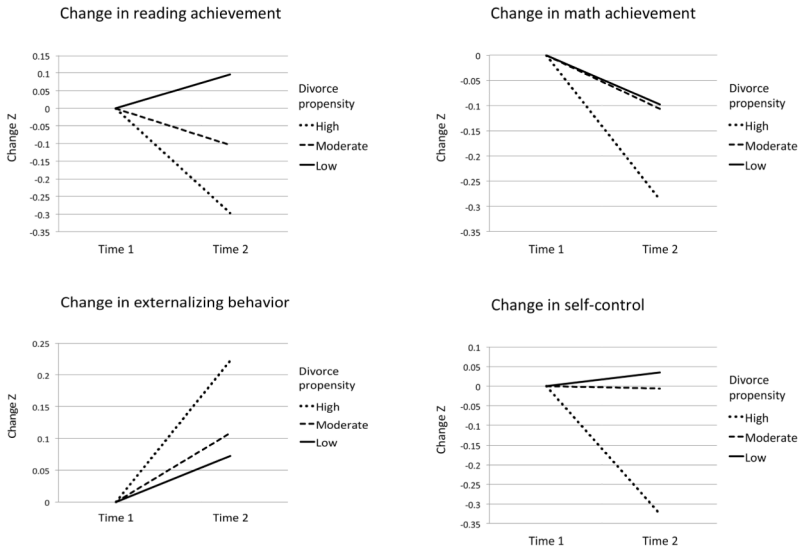

Figure 2.
Change in child outcomes following divorce by propensity to divorce (Early Childhood Longitudinal Study Kindergarten Cohort).

Table 1

Descriptive Statistics for Two Samples

Variables	ECLS-K 1998–1999 (*n* = 11,003)		NELS 1988 (*n* = 10,380)	
	Proportion or mean	*SE*	Proportion or mean	*SE*
Female	.49	.01	.50	.01
Race/ethnicity				
Hispanic	.17	0.02	.10	.01
Black non-Hispanic	.07	0.01	.07	.01
White non-Hispanic	.70	0.03	.75	.01
Other	.07	< .01	.09	.01
School type				
Public	.81	.06	.85	.02
Catholic	.08	.02	.09	.01
Other private	.12	.02	.06	< .01
Location				
Urban	.33	.04	.22	.02
Suburban	.46	.04	.47	.02
Rural	.21	.05	.32	.02
Parent highest education				
Not finish high school	.06	.01	.08	.01
High school graduate or GED	.20	.01	.18	.01
Post high school	.33	.01	.40	.01
College graduate	.26	.01	.17	.01
Graduate degree	.16	.01	.17	.01
Age	5.70	0.01	14.34	0.01
Number siblings	0.52	0.02	1.15	0.03
Cumulative parental divorce	.09	.01	.09	< .01
Cumulative parental death	.01	< .01	.02	< .01
Dependent variables				
Reading Z	−0.97	0.02	−0.34	0.02
Mathematics Z	−0.96	0.02	−0.51	0.02
Positive approach to learning Z	−0.12	0.02		
Interpersonal skills Z	−0.16	0.02		
Self-control Z	−0.14	0.02		
Internalizing problems Z	−0.08	0.02		
Externalizing problems Z	−0.04	0.04		
Self-esteem Z			0.04	0.02
Internal locus of control Z			0.04	0.02
Smoking Z			−0.25	0.01
Educational expectations Z			−0.04	0.02

Note: Data are weighted values from the first wave of each survey. ECLS-K = Early Childhood Longitudinal Study, Kindergarten Cohort; NELS = National Educational Longitudinal Study.

Table 2

Fixed Effects Regression Analyses of Parental Divorce, Parental Death, and Seven Child Outcomes From the Early Childhood Education Study Kindergarten Cohort 1998–1999

Predictor	Reading Z	Math Z	Positive approach to learning Z	Interpersonal skills Z	Self-control Z	Internalizing Z	Externalizing Z
Divorce	−.061*** (.010)	−.045*** (.001)	−.187*** (.033)	−.14*** (.037)	−.107* (.041)	.309*** (.044)	.118*** (.027)
Death	−.044 (.033)	−.099** (.031)	−.119 (.095)	−.112 (.148)	−.232 (.155)	.309* (.152)	0.183 (.108)
Age	.200*** (.001)	.086*** (.001)	.015*** (.003)	.026*** (.003)	.016*** (.003)	.008** (.003)	.009** (.002)
Age^2	< −.001*** (< .001)	< −.001*** (< .001)	−.001*** (< .001)	−.001*** (< .001)	−.001*** (< .001)	−.001 (< .001)	−.001** (< .001)
Constant	−6.4334***	−5.728***	−0.717***	−1.256***	−0.837***	−0.521**	−0.475***
N students	10,756	10,846	10,851	10,812	10,823	10,828	10,845
N observations	41,976	42,988	40,630	39,792	39,998	40,141	40,378

Note: Table values are unstandardized *B* coefficients, with robust clustered standard errors in parentheses.

* $p < .05$.

** $p < .01$.

*** $p < .001$ (two-tailed).

Table 3

Fixed Effects Regression Analyses of Parental Divorce, Parental Death, and Six Child Outcomes From the National Educational Longitudinal Study of 1988

Predictor	Reading Z	Math Z	Self-Esteem Z	Internal locus of control Z	Educational expectations Z	Smoking Z
Divorce	−.145*** (.038)	−.126*** (.030)	−.106** (.038)	−.155*** (.038)	−.111*** (.030)	.359*** (.048)
Death	−.144 (.081)	−.159** (.056)	−.098 (.077)	−.223* (.087)	−.086 (.059)	.255** (.097)
Age	.171*** (.003)	.263*** (.003)	.012** (.004)	.003 (.004)	.011*** (.003)	.146*** (.005)
Age^2	−.056*** (.003)	−.064*** (.002)	.028*** (.002)	.013*** (.003)	.005* (.002)	−.001 (.003)
Constant	0.137	0.167	−0.050	−0.010	0.013	−0.002
N students	10,380	10,380	10,361	10,361	10,380	10,312
N observations	28,551	28,548	28,135	28,135	29,839	29,542

Note: Table values are unstandardized *B* coefficients, with robust clustered standard errors in parentheses.

* $p < .05$.

** $p < .01$.

*** $p < .001$ (two-tailed).