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The Role of Formal Child Support in Children's Academic Achievement

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1. INTRODUCTION

Children's living arrangements in the United States have become more varied during the last 50 years. In 2014, almost 24 million children lived with only one biological parent; 27 percent of all children lived with only their biological mother and 5 percent, with only their biological father (U.S. Census Bureau, 2015). Research has shown that children who grow up with only one biological parent have lower academic achievement than children who grow up with both parents (Amato and Keith, 1991; Amato, 2001, 2005; Carlson and Corcoran, 2001; Ginther and Pollak, 2004; McLanahan and Sandefur, 1994; Ribar, 2004). The negative association between being raised in a single-parent family and academic outcomes has been mainly attributed to the economic hardship faced by these families (Amato, 2005; Carlson and Corcoran, 2001; McLanahan, 1997; McLanahan and Sandefur, 1994; Sigle-Rushton and McLanahan, 2004). According to the U.S. Census Bureau (2014), 13 percent of the children who lived with both parents were in households that were below the poverty line in 2013, while the corresponding percentage for children living with only their father or mother was substantially higher, 21 percent and 45 percent, respectively. A vast literature has suggested that, theoretically and empirically, income is important for children's academic and cognitive development (e.g., Blau, 1999; Duncan et al., 2011). Low-income families lack the resources to provide their children with food, clothing, and shelter necessary for daily living, as well as the material goods and experiences that promote positive child development (Carlson and Magnuson, 2011; Duncan, Magnuson, and Votruba-Drzal, 2014; Willingham, 2012). Low-income families also experience more stress in their daily lives than wealthier families do, resulting in adverse

consequences for children's development (Carlson and Magnuson, 2011; Duncan, Morris, and Rodrigues, 2014; Willingham, 2012).

For single parents, the economic contribution from the other parent, known as child support, is a major source of income. Among custodial families who received monetary child support in 2011, the average amount received represented 16 percent of their annual income. For those below the poverty level, even after child support, these payments represented 67 percent of their annual income (Grall, 2013). Due to its relevance as an income source, child support could be a significant factor explaining the academic outcomes of children living in single-parent families.

However, child support seems to be a unique income source. Evidence suggests that it is associated with other factors explaining children's academic success, such as nonresident parents' contact with the child (e.g., Del Boca and Ribero, 2001; Nepomnyaschy, 2007; Seltzer, Schaeffer, and Charng, 1989) and conflict between parents (McLanahan et al., 1994). Furthermore, distinct types of child support—formal monetary (i.e., determined through a legal agreement); informal monetary; and informal in-kind (i.e., nonmonetary contribution provided to the children's resident family)—might have different associations with children's outcomes. Therefore, examining this relationship using a measure that combines all these types of support might conceal the diverse ways in which each type influences children's academic success. To date, few studies have examined the role of specific types of child support on children's academic success. Most of the literature has focused on studying the association between total monetary (formal plus informal) child support and academic achievement (e.g., standardized test scores, grades, cognitive development test scores), finding a positive but not necessarily causal relation (e.g., Argys et al., 1998; Baydar and Brooks-Gunn, 1994). Except for Argys and

colleagues (1998), who find a weak link between court-ordered agreements and children's verbal ability, the literature studying the role of formal child support has found that it is related neither to cognitive development nor to school achievement during early childhood (Greene and Moore, 2000; Nepomnyaschy, Magnuson, and Berger, 2012) and middle childhood (Reynolds and Wolfe, 2001).

This paper expands previous literature by examining the role of formal child support in the academic achievement of children during middle childhood. For this purpose, I take advantage of a unique longitudinal dataset that has accurate amounts of legal child support each month, and annual education data for the universe of children tested in grades 3 through 8 in Wisconsin public schools. This dataset allows me to observe 16,022 children whose nonresident father was ordered to pay child support, tested in eighth grade in school years 2012 to 2013 and 2013 to 2014. This study has two specific aims: (1) to examine the relation between the amount of formal child support received by custodial mothers over a 5-year period and their children's reading and math test scores, and (2) to test whether this association varies by economic status. The results show that formal child support is positively associated with eighth-graders' academic achievement. However, small contributions, particularly those below the median (equal to $2,316 per year) do not seem to be significantly linked to their test scores. Furthermore, the findings indicate the academic benefits associated with formal support are higher for low-income children than for their more economically advantaged peers.

2. LITERATURE REVIEW

According to economic theory, following a static model of human capital (Becker and Tomes, 1976; Becker, 1993), an increase in formal child support is assumed to be similar to an increase in labor income or any other nonlabor income (Weiss and Willis, 1985). An increase in

formal support increases the resources available to custodial mothers[1] (i.e., time and money), resulting in investments that improve their children's educational achievement (i.e., human capital). The size of this positive effect depends on the mothers' preference for their children's education relative to their own consumption and the marginal productivity of the human capital inputs they can and choose to get with the amount of support received. Children's characteristics, such as natural ability and preferences for different learning tools (i.e., endowments), also affect the level and type of inputs mothers provide, partly because they influence the marginal productivity of these inputs. In this framework, the effect of formal support will be different than that of any other income transfer depending on the set of human capital inputs associated with formal child support. If receiving formal support as opposed to receiving any other income transfer implies that the child will get more of less beneficial inputs, such as parental conflict, then formal child support contributions will have a lower effect than other income sources.

Empirical evidence, primarily for developing countries, suggests that women's income benefits children's outcomes more than men's income, apparently because women are more likely to shift marginal resources to their children (e.g., Armand et al., 2016; Behrman, 1997). Formal support's effect might differ from any other exogenous transfer because child support is specifically targeted towards children and might affect mothers' preferences to invest in their children's education. Empirical evidence suggests that divorced mothers receiving cash child support spend larger amounts on child goods than those not receiving child support (Del Boca and Flinn, 1994). This coincides with research suggesting that nonresident fathers consider how

[1] Custodial parents can be either mothers or fathers, as can noncustodial parents. However, most American children living with only one parent (85 percent) live with their mother (U.S. Census Bureau, 2015). For the purposes of this paper, I will refer to custodial parents are mothers and noncustodial parents as fathers.

well their former partners care for their children when they make child support decisions. They seem to provide child support or higher amounts of support if they observe improvements in their children's achievement (Aughinbaugh, 2001). This type of incentive might work better when noncustodial parents have more discretion regarding their payments, they provide informal support, or they work in the informal labor market and provide formal support that is not automatically collected from their paychecks. Other studies suggest that mothers' preferences to invest in their children depend in part on the cooperation between parents (Argys and Peters, 2003; Weiss and Willis, 1985). Those who are cooperative may agree on the total amount of resources to be spent on children, the share to be contributed by each parent, and an explicit requirement that all monetary support should be spent directly on children. In the non-cooperative case, however, the mother might not consider the father's preferences in her spending decisions.

Empirically, studies examining the association between family income and children's academic achievement have found that increases in income have a positive, and possibly small, causal effect on achievement. Recent experimental and quasi-experimental studies suggest that a one-thousand-dollar increase in annual family income boosts children's academic achievement by approximately 6 percent of a standard deviation (Akee et al., 2010; Dahl and Lochner, 2012; Duncan et al., 2011). This income effect seems small when compared to the influence of other family characteristics, such as mothers' education, or school characteristics, such as quality or class size (e.g., Duncan et al., 2011). The modest effect of income could be explained because parents have low preferences for the children's education or because the inputs in which the parents could inves, have a small impact on children's academic success (i.e., they are not productive). Literature explaining the latter is limited, and the results are mixed. Studies

examining whether additional parental income does influence the investment in child achievement has found that income rises increase the demand for child educational inputs, such as books or school quality (Blau, 1999; Maynard and Murnane, 1979). However, it increases more the amount spent on other household consumption and leisure of parents (Del Boca, Flinn, and Wiswall, 2014).

Formal child support is a source of nonlabor income, but as it is imposed on nonresident fathers and it possibly affects other factors associated with child achievement, one might expect that it has different effects on children's outcomes. Higher formal child support payments are positively, although weakly, linked with the quantity of father-child contact (Garasky et al., 2010; Hutson, 2007; Nepomnyaschy, 2007; Rangarajan and Gleason, 1998). One study found that this higher contact may also be associated with higher conflict between parents, after controlling for other income sources, hours worked, and child, mother, and household socio-demographic characteristics (Hutson, 2007). Empirical evidence examining the association between formal support and child achievement is limited. In the past decades, researchers have mainly studied the link between total monetary child support, combining both formal and informal contributions and children's academic outcomes. In general, this literature has found that there is a positive association (not causation) between total cash support payments and children's achievement, especially during early childhood (Baydar and Brooks-Gunn, 1994; Greene and Moore, 2000; Nepomnyaschy et al., 2012). According to Nepomnyaschy and colleagues (2012), this positive association is due to the positive role of informal support on children's outcomes because in their study informal but not formal child support resulted in statistically significant relationships. In contrast to early childhood, it is less clear whether total cash support is related to academic outcomes during middle childhood (Graham, Beller, and

Hernandez, 1994; Hernandez, Beller, and Graham, 1995) or adolescence (Argys et al., 1998; King, 1994; Knox, 1996; Reynolds and Wolfe, 2001).

Few studies have attempted to establish causality in their examination of the association between formal child support and children's cognitive development or academic achievement (Argys et al., 1998; Greene and Moore, 2000; Nepomnyaschy et al., 2012; Reynolds and Wolfe, 2001). This limited literature suggests that this association is weak and not statistically significant at different childhood stages. After controlling for father-child contact, Greene and Moore (2000) found that annual formal support receipt was not significantly associated with the school readiness of African American children aged 3 to 5, whose families applied for or were receiving welfare. Nepomnyaschy and colleagues (2012) found similar results for children of unmarried parents at age 5 after controlling for father-child contact and previous cognitive development measures using data from the Fragile Families and Children Wellbeing Study (FFCWS). Furthermore, this study found that the amount of formal support received in 2 years did not have a statistically significant association with children's verbal ability. Argys et al. (1998) studied children's ability and achievement tests during middle childhood using state or local policy and economic indicators as instrumental variables. They found that support payments that resulted from court-ordered agreements, in contrast to no child support receipt, had a positive and statistically significant link with achievement. Reynolds and Wolfe (2001) took advantage of data from a statewide randomized experiment conducted in Wisconsin in the late 1990s and examined the association between formal child support and grades during middle childhood and adolescence separately. The authors found that full pass-through, in contrast to a partial pass-through, and the amount of support received in the previous year did not have a statistically significant association with grades.

Although total monetary child support has been positively linked to children's academic achievement, the relation between formal child support and academic success is still unclear. Previous literature suggests that formal support and informal support are differently linked to children's achievement; informal child support has been associated with larger educational benefits than formal support, although no causal relationship has been established. Then, it is important to examine the relation between formal child support and children's outcomes independently. Taking advantage of administrative data from Wisconsin, this study estimates the relation between the amount of formal support received over five years and students' reading and math test scores during middle childhood. Based on the extant literature examining the association between formal child support and children's academic outcomes, it is unclear whether this association is substantively significant or not. As a source of income, one would expect to find a positive but modest association between formal child support and children's academic achievement. However, previous empirical evidence did not find a statistically significant association among children from unmarried or divorced mothers, and mothers receiving welfare (Argys et al., 1998; Greene and Moore, 2000; Nepomnyaschy et al., 2012; Reynolds and Wolfe, 2001).

Most of the previous literature studying child support and children's academic achievement uses cross-sectional data (the exceptions are Baydar and Brooks-Gunn, 1994; Knox and Bane, 1994; Peters and Mullin, 1997; Nepomnyaschy et al., 2012). In contrast to this research, the current study takes advantage of the longitudinal nature of the data and controls for

the children's test scores from 5 years before eighth grade[2] to reduce potential bias due to selection and omitted variables. Furthermore, in contrast with most of the studies exploring this topic (except for Nepomnyaschy et al., 2012), the current study explores whether there is a nonlinear association between formal support and test scores. Different specifications were tested, including the possible existence of a threshold after which child support influenced test scores. Also, the availability of detailed monthly child support data provides information to measure the irregularity of payments, not available in previous research. Prior empirical evidence has shown that formal child support payments are irregular for more than half of custodial families (Ha, Cancian, and Meyer, 2011). It is possible that child support volatility may be associated with constraints in the family's ability to plan their budget, as is the case for income volatility (e.g., Pew Charitable Trusts, 2016; Aspen Institute, 2016). Then, an increase in support volatility could be associated with negative consequences on children's outcomes due to the less consistent availability of resources for the child's education. If the irregularity of support and achievement are negatively correlated, a regression of the amount of formal support on children's academic achievement that does not control for the irregularity of payments over the same period (including null payments) could be underestimating or overestimating the association between the amount of support and achievement. This would depend on the relation between the amount and irregularity of support. A positive one would indicate a downward bias, while a negative one, an overestimation. Evidence suggests that the latter is the case, because custodial mothers with higher earnings, who tend to receive more support (e.g., Bartfeld and

[2]Ninety-eight percent of the children in the sample were tested in third grade 5 years before eighth grade; the rest, in fourth or fifth grade. For the sake of simplicity, the rest of the paper will refer to this test as the third-grade test.

Meyer, 1994), have a higher probability of receiving support regularly (Ha et al., 2011). Therefore, controlling for the irregularity of child support is expected to be accompanied with a decrease in the association between formal support and achievement.

Finally, this study explores whether child support benefits children from low-income families more than their more advantaged peers. In theory, if the inputs in which the mother invests have a constant marginal productivity, each additional unit of child support would result in a constant increase in human capital regardless of the child's initial level of those inputs. In contrast, if the human capital inputs have diminishing marginal returns, as any of the inputs increase, there will be a point at which the marginal product of an additional unit will be less than the marginal product of the previous unit. And, in this scenario, children of disadvantaged families, with lower levels of specific inputs (e.g., books and notebooks available at home), would experience larger benefits from increases in child support than children of more advantaged families, with higher levels of those inputs (above their maximum marginal productivity). Empirically, no study has explored this issue. However, evidence for income indicates that its effect on academic achievement is larger for children growing up in more disadvantaged families (e.g., Dahl and Lochner, 2012).

3. EMPIRICAL STRATEGY

3.1 Data and Sample

The study uses longitudinal linked administrative data from the Wisconsin Department of Public Instruction (DPI) and the 2014 Multi-Sample Person File (MSPF) database compiled at the Institute for Research on Poverty at the University of Wisconsin–Madison. The DPI data include information on academic performance for students in grades 3 through 8, as well as in grade 10, in Wisconsin public schools, who are tested in October of each school year using the

Wisconsin Knowledge and Concepts Examination (WKCE). DPI data also include attendance and disciplinary outcomes, and basic demographic characteristics for all children in Wisconsin public schools from the 2005 to 2006 through 2013 to 2014 school years. The MSPF database includes linked individual-level administrative data from different public social welfare programs, including Wisconsin's Kids Information Data System (KIDS), which contains monthly information about child support orders, payments, support received, and past-due amounts (arrears).

This linked dataset provides unique longitudinal information of formal support received and standardized test scores for the universe of children studying in public schools in Wisconsin whose fathers were ordered to pay formal child support. The results are generalizable for all children with a child support order who were enrolled in a public school in Wisconsin. Previous studies examining this topic (except for Nepomnyaschy et al., 2012) have used sub-samples of secondary datasets, which were not designed for the population under study, resulting in small sample sizes and, consequently, low statistical power to find an effect and to get an accurate effect size. This dataset also provides information about monthly formal child support orders, payments, and amounts received by custodial mothers, which tend to be more precise than similar information collected through surveys (Edin, Tach, and Mincy, 2009; Schaeffer, Seltzer, and Klawitter, 1991).

This study examines whether the amount of child support received in 5 years is associated with reading and math test scores of two cohorts of students who were tested for the first time in eighth grade in 2012 to 2013 and 2013 to 2014. The sample is restricted to those students residing with their mother, regardless of whether she is repartnered, and whose nonresident father was ordered to pay formal child support the month of the test in eighth grade

and the month of the test 5 years before that, when students were in third, fourth, or fifth grade (both in October). Most of these students' fathers (96 percent) had a child support order for each of the 59 months between both tests. Restricting the sample to children whose father owes formal child support provides a more homogeneous sample because they are probably different from those who are not involved in a child support case. Those not involved in a formal case may have parents who follow a private agreement and do not need (or want) a formal agreement or they might belong to disadvantaged families, not having access to information or not being able to follow the requirements to request child support through the court. This resulted in a sample of 17,376 students. I then excluded 1,323 students (8 percent) who did not have a third-grade test score (on October of school years 2007 to 2008 and 2008 to 2009), which from now on will also be referred to as the initial test. From this sample, I dropped 31 children because the sample did not include other students from the school in which they were enrolled for the initial test.[3] The analysis considers only children with nonresident fathers, because most American children living with only one parent (85 percent) live with their mother (U.S. Census Bureau, 2015). Students who experienced a change in guardianship (e.g., from mother to another relative or foster care) were excluded from the sample. The final sample of consisted of 16,022 students in eighth grade: 15,964 with a reading test score and 16,000 with a math test score.

3.2 Methods

For researchers studying the association between child support and children's educational outcomes, the primary concern has been to reduce the biases that have not allowed them to establish causation. Children who receive child support or receive more support tend to be

[3]The regression analyses include school fixed effects. For this reason, the sample should include only children from schools with at least two students.

different from those who do not receive it or receive less support. The results will be biased if the regressions do not control for the variables that are associated with child support (receipt and amount) and also with children's outcomes. For instance, not controlling for custodial and noncustodial parents' earnings, which have been associated with higher child support payments and better academic performance, will result in biased results. In some cases, the unobserved variable's link to child support and the outcome is not very clear, such as for other types of fathers' involvement, parental conflict, and mothers' preference to invest in their children (e.g., Del Boca and Flinn, 1994; Del Boca and Ribero, 2001; McLanahan et al., 1994; Nepomnyaschy, 2007; Seltzer et al., 1989). Another potential source of bias could arise if fathers choose to give child support on the basis of expectations about children's academic outcomes, as some theoretical and empirical evidence suggests (Aughinbaugh, 2001). Researchers have used different methodological strategies to reduce these biases. Among the studies examining formal support, researchers have used state or local policy variables and economic indicators as instrumental variables (Argys et al., 1998). They have also considered the potential confounding effect of other variables, such as the quantity of father-child contact (Argys et al., 1998; Nepomnyaschy et al., 2012). However, child contact has not been found to have a statistically significant relation with achievement in any of these studies.

In this study, I take advantage of the longitudinal nature of the dataset and the information available in it to minimize the potential sources of bias. The main analysis is based on regressions that control for the initial test scores, from third grade (i.e., lagged dependent variable model). This method controls for persistent child characteristics that have consistent effects on both lagged and concurrent dependent variables (across different amounts or

categories of formal child support).[4] Including a previous test as a control variable allows me to compare children with the same third-grade test score, who probably have more (time-invariant or variant) characteristics in common than children with different third-grade scores.

For the sake of simplicity, instead of analyzing annual data, the analysis is based on the test scores of students in eighth grade and the amount of support they received over the 59 months between the third- and eighth-grade tests. The regressions for each subject, reading and math, add sequentially a rich set of control variables. To reduce potential biases, I control for variables that influence eighth-grade test scores and the amount of child support received between tests, but that are neither jointly determined with nor a consequence of child support.

First, I control for sociodemographic characteristics that include basic characteristics that are time-invariant: cohort, gender, race, mother's age at birth, and family structure at birth. This set of sociodemographic control variables also includes variables measured prior to the initial test (by September of school years 2007 to2008 and 2008 to 2009): the grade level, disability status, and English proficiency when the initial test was taken, whether the child had any school disciplinary incident the year prior to the initial test, whether the child was reported as possibly experiencing child abuse and neglect the year prior to the first test, whether any parent was ever incarcerated 15 years prior to the initial test, and the number of years the child's parents have

[4]Due to the availability of longitudinal data (with a maximum of 6 years of annual data by child), an alternative method could be to control for child fixed effects. Child fixed effects models control for all time-invariant characteristics, such as the child's predisposition to learn. These models are based on the presumption that the most important omitted variables are time-invariant, which might not be the case for the current study. The most important unobserved variables under analysis are other types of fathers' involvement, such as the quantity and quality of contact between the noncustodial father and the child, informal child support payments, and the conflict between parents. Evidence suggests, for example, that children born to unmarried parents are likely to be exposed to considerable relationship instability and to decreasing involvement from their nonresident fathers over time (Carlson and McLanahan, 2010). Because fixed effects estimators typically remove both good and bad variation, even small unobserved time-variation in the individual effects could be responsible for substantial bias. Therefore, the main regressions in this study use the lagged dependent variable approach.

been involved in the child support system together, measured in the year of the third-grade test. Some of these variables not only influence eighth-grade test scores, but they could also be jointly determined with formal support or could be a consequence of it. For instance, the indicator of a disciplinary incident is measured the year prior to third grade, because the child's behavior at school could be the result of formal support payments. Finally, the sociodemographic characteristics for which we control in the basic regression also include variables measured between the initial and eighth-grade tests. These variables might determine father's monetary and nonmonetary involvement with his child and/or also affect test scores: whether all child support cases in which the student is involved receive enforcement services (IV-D), only some of them, or none; whether the father was also ordered alimony for the child's family; the number of the child's half-siblings to whom the father owed child support; an indicator of other fathers who owed support to the child's family; and whether the child is the only child involved in the support cases (no full-siblings).

In a second specification, I include the initial economic characteristics of the custodial family and noncustodial father as control variables measured before the initial test: whether the student was eligible for school lunch, whether the child's mother ever received Temporary Assistance for Needy Families (TANF) or Supplemental Nutrition Assistance Program (SNAP), and the logarithm of the mother's and father's earnings. These variables are important determinants of test scores, but if measured between tests they could also be affected by the amount of formal support received during that period. For this reason, these variables are measured prior to the initial test.

A third specification adds the third-grade test score (i.e., lagged dependent variable) to control for time-invariant child characteristics that have consistent effects on both lagged and

concurrent test scores. A fourth specification adds indicators of the school in which the student was enrolled in third grade to control for unobserved school heterogeneity. This might control for some unobserved initial socioeconomic differences across children but not for differences in children's early-years upbringing or their natural ability. I do not use eighth-grade school fixed effects because they might be associated with the amount of formal support the custodial family received in the previous months. Finally, a fifth specification adds a measure of irregularity of the monthly amount of child support received over the 59-month period to isolate the influence of the amount received from the consistency of its receipt.

To summarize, for each test subject, reading and math, the analysis includes five ordinary least squares (OLS) regressions with increasing levels of controls. The first one controls for children's and parents' sociodemographic characteristics. The second, adds the custodial family's and noncustodial father's initial economic characteristics. The third adds the lagged dependent variable. The fourth adds initial school fixed effects, and the fifth, a measure of irregularity of the support received. I estimate all regressions with robust standard errors clustered by the child's school in third grade. These regressions were estimated using a continuous linear and a categorical measure of child support received between tests.[5]

Another aim of this paper is to examine whether the role of formal support in test scores varies across initial economic status. The measure of initial economic status combines the

[5]Tests of different specifications for child support, including polynomial equations (with quadratic and cubic terms), suggested that a linear relation between the amount of formal support received and the test scores provided a better fit for the data. However, a linear regression assumes that the strength of the relation is the same across different amounts of child support received (i.e., every dollar of formal support received has the same influence on children's test scores). For this reason, regressions were also estimated using a categorical measure of formal support, although it is well-known that creating categories out of continuous variables could result in lower statistical power to detect a relation because of the information that is lost in the transformation (Altman and Royston, 2006). Different categorical measures of child support were tested with different cut-off-points (e.g., quintiles, deciles); using any of those measures does not alter the main results.

indicators of initial school lunch eligibility and initial participation in SNAP or TANF, all measured in the year before the third-grade tests. Low-income children are those eligible for school lunch (family income less than 185 percent of the official poverty line) or those whose family participated in SNAP (generally family income less than 130 percent of poverty) or TANF. To test whether the coefficient of formal support varies between low-income and the rest of children, the regressions include an interaction of the corresponding child support measure and this measure of initial economic status. In these regressions, the set of control variables is also like the fifth specification described before. It includes sociodemographic characteristics, the lagged test scores, initial school fixed effects, and the measure of monthly child support variability. An additional specification also controls for the logarithm of mothers' and fathers' initial earnings.

3.3 Measures

Academic Achievement: Third- and eighth-grade academic achievement is measured using children's reading and math scores on the WKCE. These test scores measure how well students have mastered grade-level content and skills, as specified by the Wisconsin Model Academic Standards. For the analysis, raw test scores were standardized according to the state's mean by grade and year to have a mean of zero and a standard deviation of one. Then, each child's standardized score represents the difference, in standard deviation units, of that child's raw score from the average child taking the test in the same grade and school year in Wisconsin. Students take the test in both subjects in October every academic year. To reduce the potential

measurement bias linked with test scores, I run sensitivity analyses averaging two consecutive years of test scores to measure outcomes and lagged outcomes.[6]

Formal Child Support: The annual amount of formal support received is measured by adding up the amount received over the 59 months between the initial and eighth-grade tests. I use the amount of child support received and not child support payments, because part of these payments may correspond to payments to the state (e.g., reimbursements for state medical expenses) that custodial mothers do not receive. Also, in a tiny handful of child support cases, there is a time lag between the payment of child support and disbursement (or custodial mothers' receipt).

The amount of child support received includes payments from child support or alimony. I divided this amount by the number of children with the same resident mother and nonresident father who are listed in cases during the 5-year period. Before adding up the amount of support received in different years, I adjusted the amounts to 2014 prices. Then, I annualize the amount of support received over the 59-month period. In the regressions described in the previous subsection, I use two measures of child support, both measured over the period in between the third- and eighth-grade test scores: the amount received per year and a categorical measure based on the annual amount received. The latter groups the amount received into quartiles: support per year (1) below the 25th percentile, equivalent to $820; (2) between the 25th and 50th percentile ($820 and $2,315); (3) between the 50th and 75th percentile ($2,316 and $4,028); and (4) above

[6]Initial and eighth-grade test scores might have some idiosyncratic measurement errors, which I try to reduce by averaging them with the immediate test score available. Therefore, eighth-grade scores were averaged with seventh-grade test scores, and initial test scores were averaged with test scores from the next school year. This reduced the period of analysis from 59 to 35 months (approximately 3 years), and a new measure of child support for only this period is included in the regressions. The control variables, except for the monthly child support variability, which is also calculated for the 35-month period, are the same as the ones described in the first four specifications above.

the 75th percentile, equivalent to $4,028. Although this measure ignores detailed information about the distribution of the monthly amount of support received, it allows me to test whether there is an absolute threshold after which child support amounts become important for children's academic success.

In addition, the study controls for the irregularity of child support received by each child over the 5-year period. To measure this, I use the standard deviation of the monthly amount of support received over the 59 months between tests (in monthly dollars). Then, I adjust this standard deviation by the monthly mean of support received, dividing the standard deviation by the mean, because higher means are more prone to have bigger standard deviations. A high ratio of the standard deviation to the mean indicates that the monthly support received between tests is widely spread; a low ratio indicates that the monthly amounts are clustered closely around the mean.[7]

Control Variables: As described in the previous subsection, the main analysis includes a rich set of sociodemographic characteristics and initial economic characteristics. Table A1 in the Appendix describes in detail how these variables were measured for the analyses.

4. RESULTS

4.1 Descriptive Analysis

Table 1 presents the summary statistics of child support, test scores, and control variables for all children and for two groups of children: those receiving less than the median amount of

[7]I also ran robustness checks using a different measure of child support irregularity as used in a previous study (Ha et al., 2011). The alternative measure of irregularity calculates the number of months in which the formal support received was not within the 25 percent of the modal amount received over the 59-month period, including null amounts. This alternate measure explains less of the variation of test scores than the measure based on the monthly support standard deviation. Therefore, the latter is presented in the results section. The results controlling for the alternative measure of irregularity of formal support received are available upon request.

formal support, equivalent to $2,316 per year, and those receiving at least the median. Less than 7 percent of the sample did not receive formal support over the 5-year period, they are included among those who received less than the median. On average, children received $2,828 per year of formal support; the standard deviation of monthly formal support is $146 per month. For the average child, the standard deviation was equivalent to 98 percent of her monthly support. Regarding test scores, children in the sample have lower initial and eighth-grade test scores (between 0.2 and 0.3 standard deviations less) than the average Wisconsin student. Students had lower tests scores when they were in eighth grade than in third grade. Children receiving support below the median had significantly lower eighth-grade and initial test scores in both subjects than those receiving at least the median.

Table 1 also reflects how children differ depending on the amount of support they received. These two groups of children differed before the initial test. A significantly larger proportion of children receiving monthly support below the median were black or Hispanic, had a disability, were born from unmarried parents, were not fully proficient English learners, had a disciplinary incident, or had a parent in prison than children receiving more formal support. In addition, children receiving formal support below the median had older child support cases, with more full-siblings that are beneficiaries of the support, and fewer enforced cases than their more advantaged peers. Children receiving less support seem to have more half-siblings from both their mother’s and father’s sides. Furthermore, low-child support recipients had more economically disadvantaged parents than the rest of children in the sample.

Table 1. Summary Statistics by Amount of Child Support Received

	All Children	Received CS below the Median	Received CS at or above the Median
N of students	16,022	8,011	8,011
Child Support			
Annual CS received between 3rd and 8th grade	$2,828 (2,876)	$907 (756)	$4,750 (2,931)
Annual CS excluding top 2%	$2,588 (2,115)	$907 (756)	$4,339 (1,590)
Annual CS excluding top 1%	$2,667 (2,249)	$907 (756)	$4,464 (1,801)
Monthly CS, mean (59 months)	$236 (239)	$76 (63)	$396 (244)
Monthly CS, standard deviation (59 months)	$146 (196)	$88 (101)	$205 (244)
Monthly CS, ratio of std. dev. to mean	0.98 (1.13)	1.40 (1.37)	0.57 (0.58)
Outcomes in 8th Grade			
Reading score	-0.277 (0.97)	-0.468 (1.00)	-0.087 (0.89)
Math score	-0.308 (0.97)	-0.527 (1.00)	-0.089 (0.88)
Lagged Outcomes (3th grade, initial)			
Reading score	-0.222 (0.99)	-0.395 (1.02)	-0.049 (0.93)
Math score	-0.251 (0.96)	-0.439 (0.99)	-0.063 (0.90)
Sociodemographic Characteristics			
School year: 2013–14	50%	51%	49%
Grade, initial test: Third	98%	97%	99%
Female	50%	49%	50%
Race:			
White	67%	51%	83%
Black	21%	34%	8%
Hispanic	9%	11%	6%
Other	4%	4%	3%
Child has a disability	18%	20%	16%
Mother's age at birth (mean)	24 (5.74)	23 (5.53)	25 (5.80)
Family structure at birth:			
Married parents	38%	27%	48%
Unmarried parents	55%	65%	45%
Missing	8%	8%	7%
Never an English learner or fully proficient in 3rd grade	96%	95%	98%
Any disciplinary incident, year before 3rd grade	5%	8%	2%
Involvement with CPS before 3rd grade	12%	15%	9%
Parent in prison over 15 years before 3rd grade	14%	24%	5%
Years in WI CS system, 3rd grade (mean)	6.2 (2.61)	6.5 (2.55)	6.0 (2.66)
Alimony ordered between 3rd and 8th grade	2%	1%	3%
Only child in CS case between tests (no full-siblings)	50%	43%	56%
CS case type between tests:			
Only non-IV-D	9%	6%	11%
Only IV-D	81%	81%	80%
Mixed	11%	13%	8%
N of half-siblings to whom father owes CS between tests:			
Zero	87%	81%	93%
One	9%	12%	5%
Two or more	4%	7%	2%
Other fathers who owe CS to child's mother between tests	8%	10%	6%

(table continues)

Table 1, continued

	All Children	Received CS below the Median	Received CS at or above the Median
Economic Characteristics			
Eligible for school lunch before initial test (a)	71%	84%	58%
Student's family participated in W-2 or SNAP before initial test (b)	64%	79%	49%
Mother's annual earnings before initial test (thousands)	$17 (16)	$15 (14)	$19 (17)
Father's annual earnings before initial test (thousands)	$24 (28)	$14 (18)	$35 (32)
Low-income children (a or b)	77%	89%	65%

Note: Except for the proportion of only IV-D child support cases, all variables' means or proportions differ statistically significantly (at $p < 0.01$) between children who receive a formal support of less than $2,316 per year (i.e., median value) and those who receive that amount or more. Standard deviations of continuous variables are presented within parentheses.

As Table 1 shows, children receiving different amounts of formal support differ in several ways. Therefore, it is unclear whether the differences observed in test scores between low- and high-support recipients can be attributed to the receipt of formal support, or are instead a result of these other characteristics. The regression analyses, presented in the next subsection, controls for all these differences to have a better measure of the association between formal support and children's test scores.

4.2 Regression Analyses

Table 2 presents the regressions of eighth-grade reading and math test scores as described in the previous section. Panel A presents the coefficients for continuous measure of formal support (i.e., the linear models), and Panel B, the categorical measure, defined in quartiles. There are five columns for each test subject, representing the five models, as described above and as identified in the bottom panel of the table.

The first column in Panel A shows that each thousand dollars of formal support is associated with an increase of reading test scores in 0.022 standard deviation units. Adding control variables in columns 2, 3, and 4 reduces this coefficient but it remains statistically

significant. In column 5, the regression controls for the irregularity of support, every thousand dollars in annual formal support increases reading scores in 0.006 standard deviation units. The results for the first five columns in Panel B show the results for the categorical measure of formal support on reading. The base category in these regressions is comprised of children whose father made formal support contributions under $820 per year (the first quartile); 26 percent of these children did not receive any support over the 59 months.

Column 1 shows that children receiving formal support of at least $820 have higher test scores than their peers in the base category. The larger the amount of formal support received by each quartile, the higher the reading scores (i.e., the relation seems to be monotonic). However, only the coefficient of the top quartile is statistically significantly different from the coefficients of the second and third quartiles. Controlling for initial economic characteristics gives equivalent results, but with smaller coefficients than in column 1. Adding the initial reading scores and then the school fixed effects eliminates the statistical significance of some categories. According to the results in column 4, only children receiving formal support above the top quartile have statistically significantly higher scores than children receiving less than $820. Adding the irregularity measure as a control variable does not significantly change the results.

Table 2. Regressions of Test Scores on Child Support

	Reading					Math				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A										
CS received per year	0.023***	0.016***	0.008***	0.006**	0.006*	0.029***	0.022***	0.011***	0.009***	0.008**
($ thousands)	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]
Panel B										
CS received per year (base = Q1: Under $820)										
Q2: $820–$2,315	0.085***	0.068**	0.024	0.023	0.022	0.088***	0.066**	0.040*	0.024	0.019
	[0.021]	[0.022]	[0.017]	[0.019]	[0.019]	[0.022]	[0.022]	[0.018]	[0.019]	[0.019]
Q3: $2,316–$4,028	0.118***	0.085***	0.040*	0.032	0.029	0.131***[a]	0.088***	0.066***	0.051**	0.043*
	[0.023]	[0.024]	[0.019]	[0.020]	[0.020]	[0.022]	[0.023]	[0.018]	[0.019]	[0.020]
Q4: $4,028–$82,534	0.191***[ab]	0.132***[ab]	0.062**[a]	0.060**[a]	0.057*[a]	0.243***[ab]	0.171***[ab]	0.105***[ab]	0.089***[ab]	0.079***[ab]
	[0.024]	[0.025]	[0.020]	[0.021]	[0.022]	[0.023]	[0.024]	[0.019]	[0.021]	[0.022]
Sociodemographic characteristics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Initial economic characteristics		Y	Y	Y	Y		Y	Y	Y	Y
Initial test score (LDV)			Y	Y	Y			Y	Y	Y
Initial school FE				Y	Y				Y	Y
Irregularity of CS received					Y					Y

Notes: The table presents the coefficients and robust standard errors, clustered by initial school. Coefficients' statistical significance: *p < 0.05, **p < 0.01, ***p < 0.001.
Sample: 15,964 students for reading and 16,000 students for mathematics (from 1,127 schools). The coefficients of all control variables are available upon request.
[a]Coefficient is significantly different from the second quartile coefficient at p < 0.05.
[b]Coefficient is significantly different from the third quartile coefficient at p < 0.05.

Columns 6 to 10 present the results for math test scores. The first four columns in Panel A show that the coefficient of child support decreases as more control variables are added in the regressions. Column 9 shows that every thousand dollars in annual formal support is associated with 0.009 standard deviations higher math test scores. After controlling for the irregularity of support received, the size of the coefficient decreases, as expected (see section 2.2).[8] The same columns in Panel B present the results where the categorical measure of formal support is the main independent variable explaining math test scores. The inclusion of control variables reduces the size and statistical significance of the coefficient of the second quartile. After controlling for the initial school fixed effects (column 9), only formal support received above the median ($2,315 per year) matters. As with reading, a larger amount of formal support received above this threshold is associated with a better performance in math in comparison to their peers who receive less than $820 per year (the first quartile). In contrast with the results for reading, the coefficients of the fourth quartile (columns 8 through 10) for math are significantly different from the coefficients of the other two quartiles. Overall, the association between formal support and children's test scores is noticeably stronger for math than for reading.

As can be appreciated in Table 2, the distribution of child support in the top quartile is very disperse; it ranges from $4,028 to $82,534 per year. It is possible that some of the observations in one extreme of the distribution are outliers. For this reason, I ran the same specifications as in Table 2, excluding the top 2 percent of the child support distribution (above

[8]Panels A and B in Table A2 in the Appendix present the results of both the amount and irregularity of the support for the specifications presented in columns 5 and 10. For exploratory purposes, because the topic exceeds the aims of this study, Panel C presents the results of a similar specification but instead of including the amount and irregularity of support separately, it combines them in one variable. This variable is measured based on the interaction between the child support quartiles and a binary variable that indicates whether the student's support is regular (below the median) or irregular (above the median).

$9,490 per year). Table A3 in the Appendix shows the results of these regressions. The results are very similar. The only difference is that child support does not appear to be as relevant for math scores as with the complete sample, particularly after controlling for the irregularity of child support.

In another sensitivity test, I ran the regressions presented in Table 2 using different measures of test scores and formal child support. The outcomes and lagged outcomes are calculated using the average of two consecutive years to reduce the potential measurement bias associated with standardized test scores. As described in the previous section, the outcome variable in these regressions is the average of eighth-grade and seventh-grade test scores, and the lagged outcome is the average of initial test scores and the test scores from the following consecutive year. After doing this, the period between tests is reduced to 35 months (approximately 3 years) and the sample of children with reading or math test scores with available information to calculate the average test scores of two consecutive years is reduced to 15,430 observations. The results of the regressions on the amount of formal support received over 3 years are presented in Table A4 in the Appendix. Panel A shows that the coefficients of formal support and their standard deviations are in general quite similar (though a little smaller) than those from the regressions in Table 2. Panel B shows the results where formal support quartiles are the main independent variable. The cut-off points of the quartiles are slightly different, but this difference does not exceed eight dollars. The coefficients are also very similar to those in Table 2. As in Panel A, most of them are smaller, especially the coefficients of the top quartile in the math regressions. The exceptions are the coefficients of the second quartile, which are slightly larger and more likely to be statistically significant (see columns 3, 4, 5, 9, and 10).

Overall, Tables 2, A2.3, and A2.4 show consistent results. Receiving larger amounts of formal support are associated with higher reading and math test scores. The results also suggest that formal support in the top quartile, above $4,050 per year, is more important for children's test scores than smaller amounts. Furthermore, the association is stronger for math than for reading test scores, when the whole sample is considered. If we exclude the top 2 percent of the child support distribution, there does not seem to be substantial differences between both subjects.

Another aim of this study is to test whether the association of formal support on test scores varies across initial economic status, measured before third grade. To do this, I defined as low-income children those eligible for school lunch or whose mother participated in SNAP or TANF (Table A1 in the Appendices presents a detailed description of how I defined these indicators). In total, they represent 77 percent of the sample (see Table 1). The results of the regressions controlling for this indicator and its interaction with formal support are presented in Table 3. Panel A presents the results for the continuous measure of support, and Panel B, for the categorical one. There are two columns per subject. In one, the set of control variables does not include initial parental earnings; in the other one, it does.

Table 3. Regressions of Test Scores on Child Support and Initial Economic Status

	Reading		Math	
	(1)	(2)	(3)	(4)
Panel A				
CS received per year	-0.001	-0.0001	0.001	0.002
($ thousands)	[0.002]	[0.002]	[0.003]	[0.003]
Initial economic status:	-0.136***	-0.129***	-0.140***	-0.130***
Low income	[0.022]	[0.022]	[0.022]	[0.022]
CS * Low income	0.017***	0.017***	0.019***	0.019***
	[0.004]	[0.004]	[0.004]	[0.004]
Panel B				
CS received per year (base = Q1: Under $820)				
Q2: $820–$2,315	-0.019	-0.014	-0.023	-0.019
	[0.050]	[0.050]	[0.045]	[0.045]
Q3: $2,316–$4,028	-0.089	-0.083+	-0.058	-0.052
	[0.049]	[0.048]	[0.043]	[0.044]
Q4: $4,028–$82,534	-0.050	-0.040	-0.038	-0.030
	[0.045]	[0.045]	[0.041]	[0.041]
Initial economic status:	-0.179***	-0.169***	-0.183***	-0.170***
Low income	[0.045]	[0.045]	[0.042]	[0.042]
CS * Economic status				
Q2 * Low income	0.039	0.038	0.048	0.045
	[0.053]	[0.053]	[0.049]	[0.049]
Q3 * Low income	0.140**	0.138**	0.125**	0.122**
	[0.052]	[0.052]	[0.047]	[0.047]
Q4 * Low income	0.133**	0.131**	0.162***	0.159***
	[0.049]	[0.049]	[0.045]	[0.045]
Sociodemographic characteristics	Y	Y	Y	Y
Mother's and father's initial earnings		Y		Y
Initial test score (LDV)	Y	Y	Y	Y
Initial school FE	Y	Y	Y	Y
Irregularity of CS received	Y	Y	Y	Y

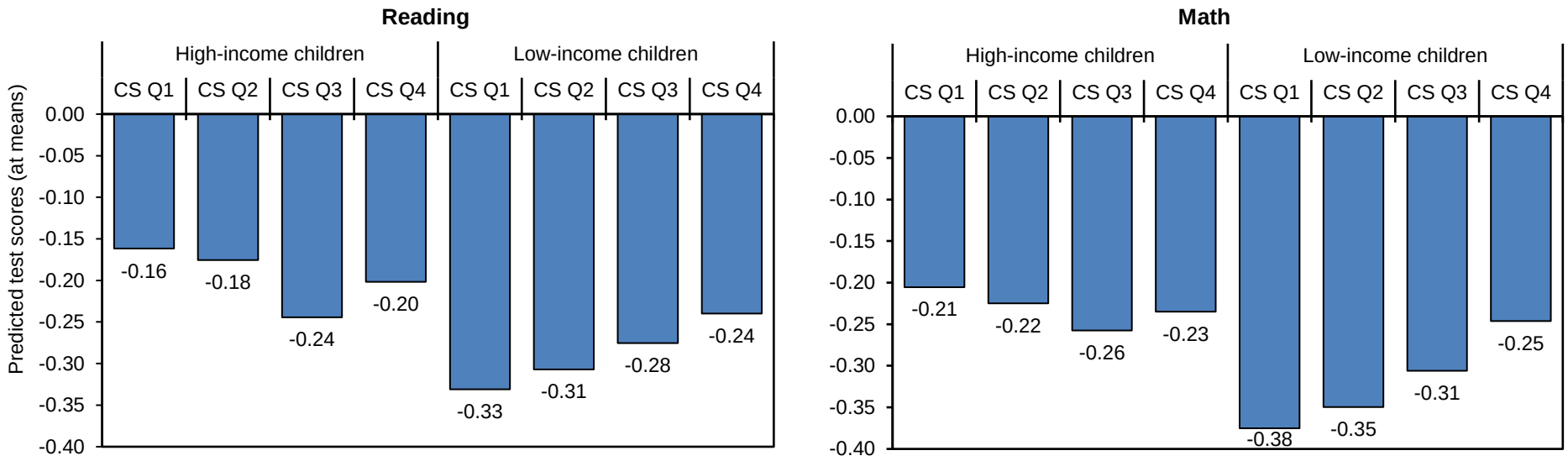
Notes: The table presents the coefficients and robust standard errors, clustered by initial school. Coefficients' statistical significance: *p < 0.05, **p < 0.01, ***p < 0.001. Sample: 15,964 students for reading and 16,000 students for math (from 1,127 schools). Students with low initial economic status, are SNAP beneficiaries, or W-2 beneficiaries are eligible for school lunch. The coefficients of all control variables are available upon request.

The results in Panel A show that each thousand dollars of formal support is associated with 0.017 to 0.019 standard deviations higher scores for low-income children than for wealthier children (see columns 1 through 4). Panel B also suggests that receiving formal support payments in the third and fourth quartiles compared to receiving less than $820 is associated with higher scores for low-income children than for their more economically advantaged peers: in fact, there is not a large or consistent relationship between child support and test scores for high-income children.

Figure 1 below presents the linear predictions of the test scores that result from regressions in columns 2 and 4 of Table 3. The predicted test scores are shown by quartile of support received and initial economic status. High-income children receiving support in the first two quartiles (6 percent of the total sample) tend to have better scores than the rest of the children in the sample in both reading and math tests. Surprisingly, high-income children receiving amounts of support above the median (18 percent of the sample) score slightly worse than other wealthy children ($p < .10$). On average, low-income children tend to have worse test scores than their wealthier peers. For low-income children, their pattern across quartiles of support received is clear: low-income children receiving higher amounts of economic support from their nonresident father have better test scores than other low-income children.

.

Figure 1. Linear Predictions of Test Scores by Child Support Received and Initial Economic Status



Notes: The linear predictions presented in this table correspond to the regression results presented in columns 2 and 4 in Table 3, Panel B

5. CONCLUSIONS

Even though improving the well-being of children living in single-parent families is one of the primary intended aims of the U.S. child support system, there is still a wide gap in the literature examining the importance of nonresident fathers' court-ordered economic contribution to children's outcomes. Most of the extant literature examining children's cognitive development and academic achievement have not analyzed the role of formal support independently (e.g., Baydar and Brooks-Gunn, 1994; Knox and Bane, 1994). The few studies that have done this lack detailed information about the child support orders and payments or study a small sample of children (Argys et al., 1998; Greene and Moore, 2000; Nepomnyaschy et al., 2012; Reynolds and Wolfe, 2001).

The current study contributes to this literature by examining (1) the association between formal child support received over a 5-year period and eighth-graders' reading and math test scores, and (2) whether this relation varies across custodial families' economic status. To do this, I take advantage of a unique longitudinal administrative dataset with detailed monthly information on formal support and annual test scores from third through eighth grade for two-cohorts of students enrolled in Wisconsin public schools. The results show that higher amounts of formal support received are positively associated with reading and math test scores. After controlling for various sociodemographic and economic differences—lagged test scores, school fixed effects, and the irregularity of support received over a 5-year period—linear regressions show that each thousand dollars of formal support is associated with a 0.006 standard deviation increase in reading test scores and a 0.008 standard deviation increase in math. The results also suggest that formal support above the median (at or above $2,316 per year) matters more for math test scores than contributions in the bottom quartile (under $820). For reading test scores,

only support contributions in the top quartile (at or above $4,028) are associated with higher test scores in comparison with contributions in the bottom quartile. The literature is not clear about why the influence of child support or other income sources could be higher on math than reading, but evidence suggests that it is much harder for teachers to improve students' achievement in English than in math (e.g., Hanushek and Rivkin, 2010; Kane et al., 2013).

When comparing the association between formal support and test scores across economic status, the results suggest that formal support is associated with larger increases for low-income children than for their wealthier peers. This is similar to what previous research has found for labor income (e.g., Dahl and Lochner, 2012). Economically disadvantaged children have fewer basic educational resources than richer children, such as books or school materials. Therefore, any increase in the amount of formal child support received benefits their test scores more than those of advantaged children, who probably would need a bigger investment to improve their outcomes (e.g., move to a better school district).

The positive link between formal support and academic achievement found in this study confirms the weak association found between court-ordered awards and academic achievement for younger children, between 5 and 8 years old (Argys et al., 1998). Although these results contrast with non-significant associations found for children under 5 (Greene and Moore, 2000; Nepomnyaschy et al., 2012) and for school-age children (Reynolds and Wolfe, 2001), the associations found in this study are smaller than those of Nepomnyaschy and colleagues (2012). They found that an increase of a thousand dollars in formal support over a 2-year period is associated with an increase of 1.2 percent of a standard deviation in a vocabulary cognitive test, while in this study a similar increase results in an increase of 0.8 percent of a standard deviation or less in the outcomes. These contrasting results could be related to the different samples

considered in the studies. In particular, this study analyzes children with nonresident fathers who have a formal support order; other studies considered all children (with or without a support order) of never-married mothers (Nepomnyaschy et al., 2012) or African American single mothers who applied for or were receiving welfare (Greene and Moore, 2000). It is possible that formal support has a stronger association with achievement among children in the child support system, not among all children who live with only one parent. Another potential explanation is that the academic benefits of formal support become stronger over time (at least when comparing young children with eighth-graders). These findings seem to differ from what the literature suggests for family income (Duncan et al., 1998; Levy and Duncan, 2000; Votruba-Drzal, 2006). Future research should test the evolution of this association across different childhood stages for the same sample of children and should test whether the association differs between those who are in the formal child support system and those who are not (who may still receive informal support).

Consistent with previous studies examining this topic, the results show a positive association between formal support and academic achievement but cannot establish causation. The dataset used in this study, although rich and detailed in terms of formal child support and academic outcomes, lacks information that could reduce the potential bias in the results, such as measures of father-child contact or other types of child support. The positive association found between formal support and academic achievement might be due to other factors for which I cannot control. For instance, some studies have found that fathers who pay higher amounts of formal support are also more likely to provide informal cash contributions or in-kind support (Garasky et al., 2010; Meyer and Cancian, 2012; Rangarajan and Gleason, 1998). Future data

collection efforts and research should particularly focus on the association between formal child support and any of these potential confounding variables.

The results from this study provide valuable information for policymaking as child support's intended aim is to improve the well-being of children living in single-parent families. Formal support has a positive and statistically significant relationship with the academic achievement of children whose fathers have been ordered formal support, especially for low-income children. These findings add to other evidence on the potential benefits of formal support contributions for children's outcomes in the United States, which becomes more relevant for children as they grow older because their mothers prefer formal support over informal support in the long run (Nepomnyaschy and Garfinkel, 2010). Future research efforts should compare its academic benefits with those of other types of parental involvement to get a better understanding of the ways in which nonresident fathers improve their children's well-being.

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APPENDIX

Appendix Table A1. Measurement of Control Variables

Variable	Measurement
Sociodemographic Characteristics	
School year: 2013–14	Indicator of whether the child took the eighth-grade test (reading or mathematics) in 2013–14 and not in school year 2012–13.
Grade, initial test: Third	Indicator of whether the child took the initial test in third grade and not in fourth or fifth grade.
Female	Indicator of whether the child is a female.
Race	Categorical variable indicating whether the child is (1) White (base category), (2) Black, (3) Hispanic, or (4) Other.
Has a disability, third-grade test	Indicator of whether the school ever registered the student as having a disability in the school year prior to the third-grade test or on September prior to the third-grade test. The disabilities considered include any learning, cognitive, noncognitive, and emotional behavioral disability, as well as any other health impairment, traumatic brain injury, speech or language disability, and autism.
Mother's age at birth	Continuous variable indicating the mother's age at the time of the child's birth.
Family structure at birth	Categorical variable indicating whether the child's parents were (1) unmarried or (2) married (base category) at the time of her birth, or (3) the information is missing.
Never an English learner or fully proficient before third-grade test	Indicator of whether the child has never been an English language learner or was fully proficient by the month prior to the third-grade test. The indicator equals zero if the child had a beginner, intermediate, or advanced English learner.
Any disciplinary incident, year before third-grade test	Indicator of whether the student was involved in a disciplinary incident the school year prior to the third-grade test. Disciplinary incidents include expulsion, out-of-school suspension, and placement in an interim alternative educational setting (IAES, removal option for students with disabilities).
Experience of child abuse or neglect before third-grade test	Indicator of whether the child was reported as possibly experiencing child abuse and neglect in the 12 months prior to the third-grade test (i.e., the student was screened-in by the Child Protective Services, CPS).
Parent in prison 15 years before third-grade test	Indicator of whether any of the child's parents were ever in prison over the 15 years prior to the third-grade test.
Years in Wisconsin CS system, third-grade test	Years the child support cases, in which the student has been involved, have been active (measured the calendar year when the third-grade test was taken).
Alimony ordered between tests	Indicator of whether the father was ordered to pay alimony to the custodial family at least once during the 59 months between tests.
Only child in CS case between tests (no full-siblings)	Indicator of whether the child is the only one (i.e., no other full-siblings) involved in the support order cases over the 59-month period.
CS cases between tests received enforcement services (IV-D):	Categorical variable indicating whether (1) all child support cases in which the student is involved receive enforcement services (IV-D), (2) only some of them, or (3) none (base category).
N of half-siblings to whom father owes CS between tests	Categorical variable indicating the number of half-siblings to whom the father owed child support: (1) zero (base category), (2) one, or (3) two or more.
Other fathers who owe CS to child's mother between tests	Indicator of whether other fathers that owed formal support to the custodial family.

(table continues)

Appendix Table A1, continued

Variable	Measurement
Initial Economic Characteristics	
Eligible for school lunch	Indicator of whether the student was eligible for school lunch at the beginning or the end of the school year prior to the third-grade test or on September prior to the third-grade test.
Student's family participated in TANF or SNAP	Indicator of whether the child's mother ever received TANF or SNAP over a 5-year period before the third-grade test (by October the year prior the third-grade test).
Mother's earnings before third-grade test	Custodial mother's earnings reported to the Unemployment Insurance system over a 5-year period before the third-grade test (by October the year prior the third-grade test). In the regressions, this variable was included in logarithms (plus one, to include the null amounts).
Father's earnings before third-grade test	Noncustodial father's earnings reported to the Unemployment Insurance system over a 5-year period before the third-grade test (by October the year prior the third-grade test). In the regressions, this variable was included in logarithms (plus one, to include the null amounts).

Appendix Table A2. Regressions of Test Scores on Child Support (Amount and Irregularity of Payments)

	Reading	Math
	(1)	(2)
Panel A		
CS received per year	0.006**	0.008***
($ thousands)	[0.002]	[0.002]
CS irregularity	-0.004	-0.011+
(ratio of std. dev. and monthly $CS)	[0.006]	[0.006]
Panel B		
CS received per year (base = Q1: Under $820)		
Q2: $820–$2,315	0.022	0.019
	[0.019]	[0.019]
Q3: $2,316–$4,028	0.029	0.043*
	[0.020]	[0.020]
Q4: $4,028–$82,534	0.057*	0.079***
	[0.022]	[0.022]
CS irregularity	-0.003	-0.008
(ratio of std. dev. and monthly $CS)	[0.006]	[0.006]
Panel C		
CS amount and irregularity (base = Q1, irregular)		
Q1, regular	0.003	-0.006
	[0.027]	[0.026]
Q2, regular	-0.003	0.022
	[0.027]	[0.026]
Q2, irregular	0.035	0.022
	[0.022]	[0.021]
Q3, regular	0.027	0.045*
	[0.025]	[0.022]
Q3, irregular	0.034	0.055**
	[0.025]	[0.024]
Q4, regular	0.054*	0.089***
	[0.024]	[0.022]
Q4, irregular	0.071*	0.079**
	[0.029]	[0.028]

Notes: The table presents the coefficients and robust standard errors, clustered by initial school. Coefficients' statistical significance: +p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001. Sample: 15,964 students for reading and 16,000 students for math (from 1,127 schools). All regressions control for sociodemographic characteristics, economic characteristics, initial test score (LDV), and initial school fixed effects. The coefficients of all control variables are available upon request.

Appendix Table A3. Regressions of Test Scores on Child Support Excluding Top 2% of the Child Support Distribution

	Reading					Math				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A										
CS received per year	0.029***	0.018***	0.008*	0.008*	0.007*	0.039***	0.027***	0.017***	0.015***	0.013***
($ thousands)	[0.004]	[0.004]	[0.003]	[0.003]	[0.004]	[0.004]	[0.004]	[0.003]	[0.003]	[0.003]
Panel B										
CS received per year (base = Q1: Under $820)										
Q2: $820–$2,315	0.080***	0.066**	0.022	0.023	0.022	0.087***	0.067**	0.041*	0.025	0.020
	[0.021]	[0.021]	[0.017]	[0.019]	[0.019]	[0.022]	[0.022]	[0.018]	[0.019]	[0.019]
Q3: $2,316–$4,028	0.112***	0.082***	0.038*	0.031	0.028	0.130***[a]	0.090***	0.066***	0.052**	0.044*
	[0.023]	[0.024]	[0.019]	[0.020]	[0.020]	[0.022]	[0.023]	[0.018]	[0.019]	[0.020]
Q4: $4,028–$9,490	0.174***[ab]	0.119***[ab]	0.054**[a]	0.055*	0.052*	0.229***[ab]	0.161***[ab]	0.102***[ab]	0.089***[ab]	0.079***[ab]
	[0.023]	[0.025]	[0.020]	[0.021]	[0.022]	[0.023]	[0.024]	[0.020]	[0.021]	[0.022]
Sociodemographic characteristics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Initial economic characteristics		Y	Y	Y	Y		Y	Y	Y	Y
Initial test score (LDV)			Y	Y	Y			Y	Y	Y
Initial school FE				Y	Y				Y	Y
Irregularity of CS received					Y					Y

Notes: The table presents the coefficients and robust standard errors, clustered by initial school. Coefficients' statistical significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Sample: 15,645 students for reading and 15,803 students for math (from 1,127 schools). The coefficients of all control variables are available upon request.
[a]Coefficient is significantly different from the second quartile coefficient at $p < 0.05$.
[b]Coefficient is significantly different from the third quartile coefficient at $p < 0.05$.

Appendix Table A4. Regressions of Test Scores (7th and 8th Grade Averages) on Child Support Received over Three Years

	Reading					Math				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A										
CS received per year	0.022***	0.016***	0.006***	0.006**	0.005**	0.026***	0.020***	0.008***	0.008***	0.007***
($ thousands)	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Panel B										
CS received per year (base = Q1: Under $722)										
Q2: $722–$2,282	0.080***	0.066**	0.028	0.028	0.026	0.074***	0.053*	0.032*	0.026	0.025
	[0.020]	[0.021]	[0.014]	[0.015]	[0.015]	[0.020]	[0.020]	[0.013]	[0.014]	[0.014]
Q3: $2,282–$4,049	0.092***	0.064**	0.032*	0.029	0.025	0.099***	0.060**	0.036*	0.028	0.025
	[0.022]	[0.023]	[0.015]	[0.016]	[0.016]	[0.021]	[0.022]	[0.014]	[0.014]	[0.015]
Q4: $4,050–$72,424	0.179***[ab]	0.127***[ab]	0.053***	0.057***[ab]	0.053**[b]	0.210***[ab]	0.142***[ab]	0.071***[ab]	0.067***[ab]	0.064***[ab]
	[0.022]	[0.023]	[0.016]	[0.017]	[0.017]	[0.021]	[0.022]	[0.014]	[0.015]	[0.015]
Sociodemographic characteristics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Economic characteristics		Y	Y	Y	Y		Y	Y	Y	Y
Initial test score (LDV)			Y	Y	Y			Y	Y	Y
Initial school FE				Y	Y				Y	Y
Irregularity of CS received					Y					Y

Notes: The table presents the coefficients and robust standard errors, clustered by initial school. Statistical significance: *p < 0.05, **p < 0.01, ***p < 0.001.
Sample: 15,403 students for reading and 15,420 students for math (from 1,126 schools). The coefficients of all control variables are available upon request. Initial test score is the average of third- and fourth-grade scores.
[a]Coefficient is significantly different from the second quartile coefficient at p < 0.05.
[b]Coefficient is significantly different from the third quartile coefficient at p < 0.05.