



Child care subsidies and child development

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ABSTRACT

Child care subsidies are an important part of federal and state efforts to move welfare recipients into employment. One of the criticisms of the current subsidy system, however, is that it overemphasizes work and does little to encourage parents to purchase high-quality child care. Consequently, there are reasons to be concerned about the implications of child care subsidies for child development. In this paper, we provide a systematic assessment of the association between subsidy receipt and a wide range of child outcomes. Drawing on rich data from the Early Childhood Longitudinal Study, we document a negative relationship between child care subsidies and child development. In particular, our results suggest that subsidy receipt in the year before kindergarten is associated with lower reading and math test scores and greater behavior problems at kindergarten entry. Some of these negative effects persist until the end of kindergarten. A potential explanation for the poorer outcomes is that subsidized children are more likely to receive intense exposure to low-quality child care.

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1. Introduction

Child care subsidies are an important policy instrument to facilitate the transition of welfare recipients into employment. Indeed, several studies show that the cost of child care is an important constraint to helping disadvantaged mothers find employment (Anderson & Levine, 2000; Blau & Robins, 1988; Blau & Tekin, 2007; Han & Waldfogel, 2001; Kimmel, 1998; Tekin, 2005, 2007). As a result, the 1996 Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) reorganized the patchwork child care subsidy system. In particular, Congress consolidated several preexisting subsidy programs into a single block grant, the Child Care and Development Fund (CCDF). Federal and state expenditures for child care assistance increased substantially, and states were given greater authority over program design and administration. In 2005,

states spent approximately \$9.4 billion on child care subsidies and served 1.7 million children in an average month (Child Care Bureau, 2005a).

A sizable body of research examines the impact of child care subsidy receipt on mothers' employment and child care decisions (e.g., Blau & Tekin, 2007; Herbst, 2008b; Meyers, Heintze, & Wolf, 2002; Tekin, 2005, 2007). Findings from these studies indicate that subsidies are effective in moving single mothers into paid employment and shifting children from informal child care settings into the formal market. However, researchers have neglected the question of whether child care subsidies have implications for child development. The relevance of this issue is clear, given that expenditures on and recipients of child care subsidies exceed other early childhood intervention programs.¹

¹ In 2005, Head Start served 906,993 children, with expenditures of \$6.8 billion. Early Head Start serves approximately 62,000 children each year, with expenditures of \$684 million in 2005 (Office of Head Start, 2005). Finally, state pre-kindergarten programs enrolled 801,902 in 2005, with expenditures of \$2.8 billion (NIEER, 2005).

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Furthermore, research shows that developmental experiences during the first few years of a child's life have lasting effects on cognitive and behavioral well-being (Heckman & Materov, 2004; Le, Miller, Heath, & Martin, 2005; Lynch, 2004).

Since most child care subsidies are used to purchase center-based care—which has been found to promote child development in some studies—it is commonly assumed that subsidies should also have positive effects on well-being. However, it is unclear *a priori* whether subsidies are beneficial or detrimental to child outcomes. There are three primary channels through which child care assistance policies can influence child outcomes. First, mothers must be employed to be eligible for a subsidy, and recent evidence suggests that early maternal employment is negatively associated with child development (Bernal, 2008; Brooks-Gunn, Han, & Waldfogel, 2002; James-Burdumy, 2005; Liu, Mroz, & Van der Klaauw, 2003; Ruhm, 2004). Second, subsidies create incentives to purchase nonparental child care. The evidence here is mixed, with some studies finding positive effects for child care attendance (Loeb, Fuller, Kagan, & Carrol, 2004; NICHD, 2003a, 2003b) and others finding insignificant or negative effects (Baydar & Brooks-Gunn, 1991; Bernal & Keane, 2008; Desai, Chase-Lansdale, & Robert, 1989). There is more agreement, however, that high-quality center-based care has positive effects on cognitive development, particularly for low-income children (Hill, Waldfogel, & Brooks-Gunn, 2002; NICHD & Duncan, 2003; Peisner-Feinberg et al., 2001). Finally, child care subsidies free up income for parents to spend on private consumption and goods that enhance child quality. The extent to which additional income is spent on private consumption versus child quality depends on the relative size of the income elasticities.

This relationship is further complicated by the presence of several design features embedded in the CCDF that have implications for child care quality. Arguably the most important design feature is the principle of “parental choice,” in which parents are free to use subsidies to purchase virtually any legally operating child care provider, including those operating outside states' regulatory regimes. Furthermore, conditioning eligibility for subsidies on employment and income creates challenges for maintaining stable child care arrangements. In particular, if changes in employment and income status are related to lapses in subsidy receipt, such instability could undermine child well-being by severing productive child-teacher relationships and exposing children to comparatively low-quality care during unsubsidized periods. States' reimbursement rates—or the maximum amount a state agency pays a given provider—can also influence quality. Reimbursements are usually below the federally recommended level, limiting families' access to high-quality care. This may also reduce incentives for providers to make important quality enhancements. In general, the aim of current subsidy policy is to support employment among low-income families, while placing few restrictions on child care quality (Gormley, 2007).

This paper represents the first attempt to study the implications of child care subsidy receipt for child development in the United States. Using a sample of children

living with single mothers drawn from the Kindergarten cohort of the Early Childhood Longitudinal Study (ECLS-K), we examine several measures of child well-being in the cognitive, behavioral, and psychomotor domains. Our results indicate that child care subsidy receipt in the year before kindergarten is associated with negative outcomes at kindergarten entry. For example, our best estimates suggest that subsidized children score 0.30 and 0.26 standard deviations lower on tests of reading and math ability, respectively. These negative associations generally apply to several outcomes in the behavioral domain as well. Furthermore, the impact of subsidies persists until the end of kindergarten. While the data do not permit a detailed analysis of the mechanisms through which child care subsidies influence child well-being, we present some evidence from the ECLS-K and discuss results from other studies that both point to poor child care quality as a possible explanation for the negative subsidy effects.

2. Overview of child care subsidy policy and previous research on child care

2.1. The CCDF and implications for child care quality

To be eligible for CCDF funds, families must be engaged in a state-defined acceptable work activity (e.g., employment, education, or job training), have incomes below 85 percent of the state median income (SMI), and have at least one child ages 0–12. States are given substantial flexibility in designing their subsidy systems, including the ability to transfer up to 30 percent of their TANF block grant to the CCDF, setting reimbursement and copayment rates, and defining acceptable work activities. However, states must spend no less than four percent of their CCDF allocation on quality improvement activities, and a market rate survey must be conducted every two years to ensure that subsidy families have “equal access” to high-quality providers.²

To receive subsidies, parents must complete an initial application—available at local child care or TANF offices, resource and referral agencies, via mail, or online—and must undergo eligibility screening. Once families enter the subsidy system, benefits are granted for a limited time period, usually six or 12 months, after which another round of eligibility screening is performed. Local child care agencies pay some or all of the family's child care costs through the reimbursement rate (which depends on income, the type of provider used, and the age of the child), with the reimbursements going directly to the child care provider or the family. States also require parents to cover a portion of child care costs through a copayment that varies with income, although exemptions can be applied to families below the poverty line or those receiving welfare. States utilize a number of strategies to ensure that recipients comply with subsidy rules and regulations. For example, if parents do not undergo the reauthorization process, local agencies typically terminate subsidy benefits auto-

² Results from the survey are used to set reimbursements at a level that allows subsidized families to purchase child care up to the 75th percentile of the local price distribution.

matically. Invoices are usually required to substantiate children's enrollment in child care, and school attendance registers and employer paystubs are needed to confirm parents' participation in acceptable work activities. In addition, agencies have the authority to recover child care funds provided during a period in which the parent was ineligible for assistance.

As previously stated, there are several design features associated with the CCDF that have implications for child care quality. The most important feature is the principle of "parental choice," in which parents are free to use subsidies to pay for any legally operating child care provider, including unregulated relatives and other in-home caregivers.³ To receive federal funds, providers are only required to be licensed if there is a state mandate, or they must meet basic health and safety regulations in cases where the state grants legal exemptions from licensing. The increased flexibility through "parental choice" is beneficial for working parents, but allowing providers to accept subsidized children while operating outside states' regulatory regime means that some children are exposed to low-quality care that is difficult to monitor (Adams, Tout, & Zaslow, 2007). Mandating only minimum quality standards also reduces the incentive for providers to invest in costly quality improvements that support child development.

The CCDF's emphasis on supporting employment may also influence the stability and quality of care received by low-income children. As noted above, parental eligibility for subsidies is conditioned on employment and income, which means that parents lose eligibility if they become separated from a job, have earnings that exceed the threshold, or fail to comply with states' recertification rules. These eligibility rules can be at odds with children's developmental needs. Recent evidence suggests that the median subsidy spell lasts only 3–7 months (Meyers, Peck, et al., 2002). If lapses in subsidy receipt prompt frequent changes in child care arrangements when parents lose eligibility, such instability could have negative effects on child outcomes (Loeb et al., 2004; Shonkoff & Phillips, 2000; Tran & Weinraub, 2006).

Linking subsidy eligibility to employment and income creates challenges for providers to increase quality. Child care providers that rely heavily on subsidized children as a source of revenue may experience severe fiscal shortfalls when parents lose eligibility or use their subsidy to pay another provider. States' use of rationing, waiting lists, and other tools to navigate the CCDF funding structure can be a further source of financial instability for child care providers. Given the volatility associated with serving large numbers of subsidized children, providers have few incentives to make substantial quality improvements, especially those requiring a long-term commitment of sustained funding (e.g., higher wages, additional and high-skilled staff, and educational materials) (Adams & Rohacek, 2002).

Finally, states' CCDF regimes influence child care quality through reimbursement rates. Child care subsidies

increase purchasing power by enabling low-income parents to afford a level of quality provided in the larger child care market.⁴ The CCDF attempts to surmount the problem of low average quality by setting reimbursement rates at a level high enough to cover at least 75 percent of the prices charged in the local market. Setting reimbursement rates at the 75th percentile is a federal recommendation, however, leaving states with substantial flexibility to set lower benefit levels. As of 2007, only nine states established reimbursement rates at the 75th percentile of the local price distribution, compared to 22 states in 2001 (Schulman & Blank, 2007). Low reimbursement rates limit parental access to high-quality providers, thereby decreasing demand for such services and weakening incentives for providers to raise quality.⁵

2.2. Previous research

Several strands of empirical research are relevant to the current study. Our review begins with the finding that investments in early childhood programs can have high returns, especially for low-income children (Karoly, Kilburn, & Cannon, 2005; Knudsen, Heckman, Cameron, & Shonkoff, 2006). Research from neurobiology suggests that receptivity to new information is substantially stronger early in life (Shonkoff & Phillips, 2000), while recent work in economics stresses the dynamic complementarities inherent in early childhood investments that make them particularly cost-effective (Barnett, 1995; Carneiro & Heckman, 2004).

There is a small literature analyzing the impact of publicly subsidized educational programs, and much of the evidence to date is inconsistent. Results from intensive early childhood interventions, including the Perry Preschool and Abecedarian programs, offer promising impacts on short- and long-term outcomes (Barnett, 1995; Karoly et al., 2005). These results are mirrored by recent evaluations of states' pre-kindergarten programs, all of which find substantial positive impacts on low-income children's cognitive ability test scores (Berlinski, Galiani, & Manacorda, 2008; Berlinski, Galiani, & Manacorda, 2009; Fitzpatrick, 2008; Gormley & Gayer, 2005; Loeb, Bridges, Bassock, Fuller, & Rumberger, 2007; Magnuson, Ruhm, & Waldfogel, 2007). A sizeable body of research evaluates the short- and long-term impact of Head Start, a federally subsidized preschool program targeted at poor children and their families. For example, a recent randomized evaluation by the U.S. Department of Health and Human Services estimates test score impacts of around 0.1–0.2 standard deviations one year after Head Start entry (U.S. DHHS,

³ Indeed, fully 25 percent of subsidized children participate in unregulated daycare settings (Child Care Bureau, 2005b).

⁴ Recent studies suggest, however, that average quality in U.S. child care settings tends to be mediocre and highly variable (Helburn et al., 1995; NICHD, 2000a; Phillips & Adams, 2001; Vandell & Wolfe, 2000). For an example of the effects of quality inputs in another early childhood education environment (Head Start), see Currie and Neidell (2007).

⁵ States have addressed these incentive problems through tiered reimbursement rates, which provide higher rates to providers meeting more stringent quality standards. One problem with this approach, however, is that states will only pay the higher rates after providers make the quality improvements, and therefore does not help low-quality providers make the initial financial investments.

2005). The best evidence to date on the long-term impact of Head Start comes from within-family comparisons of siblings (Currie & Thomas, 1995; Deming, 2009; Garces, Thomas, & Currie, 2002) and discontinuities across counties in Head Start funding (Ludwig & Miller, 2007). Results from this body of work point to reductions in childhood mortality (among all children), reductions criminal activity (among African American children), and increases in educational attainment (among white children).

On the other hand, a number of studies find negative effects of publically subsidized child care programs. For example, Baker, Gruber, and Milligan (2008) evaluate the impact of Quebec's "\$5 per day child care program" on child care utilization, labor supply, and child and parent outcomes. Although the program increased parental labor supply and raised attendance in formal child care arrangements, it also had negative effects on children and parents. In particular, subsidized children were worse off in a variety of behavioral and health dimensions, ranging from increased physical aggression and diminished social skills to increases in common illnesses. The authors also find that the program led to more hostile and less consistent parenting, worse parental health, and lower-quality parental relationships. Similar results are uncovered in a recent study of Denmark's universal child care regime (Gupta & Simonsen, 2007). In particular, the authors find that enrollment in both preschool programs and family-based care is associated with poorer non-cognitive outcomes, especially among boys. Finally, Herbst and Tekin (*in press*) examine the relationship between child care subsidy receipt in the U.S. and children's weight outcomes throughout kindergarten. Their results indicate that subsidies are associated with increases in body mass index (BMI) and a greater likelihood of being overweight and obese.

There is a comparatively large number of studies examining the impact of child care utilization on children's intellectual and social development (Baydar & Brooks-Gunn, 1991; Bernal & Keane, 2008; Blau, 1999; Desai et al., 1989; Hill et al., 2002; Loeb et al., 2004; NICHD, 2000a, 2000b, 2003a, 2003b; NICHD & Duncan, 2003; Peisner-Feinberg et al., 2001).⁶ This body of work is relevant to our research because mothers respond to child care subsidies by moving children away from parent and relative care and into formal arrangements.⁷ Whether this substitution influences child outcomes positively or negatively depends on the relative productivity of parental care. Formal child care may improve child well-being if these arrangements place children in safer and more stimulating environments. However, significant time in these arrangements could lead to low-quality mother-child interactions and less responsiveness of children to maternal sensitivity.

Overall, these studies produce inconsistent results on the impact of nonparental arrangements on child well-being. The diversity of findings is due, in part, to

identification problems stemming from the treatment of child care choices as exogenous. A recent study by Bernal and Keane (2008), however, addresses some of these self-selection issues by using welfare and other social policy reforms as instruments for a measure of child care time. Using a sample of single mothers in the NLSY, the authors find that an additional year of child care attendance reduces cognitive ability test scores by 0.11 standard deviations. Previous studies on social and emotional development generally find that children attending center-based care display more behavior problems and less self-control than children in other settings (NICHD, 2003b). When studies are able to discern levels of child care quality, the results consistently suggest that children attending high-quality center-based care perform better on cognitive tests than children in family homes or relative care (NICHD & Duncan, 2003). Moreover, the cognitive benefits of high-quality care are greater among children from disadvantaged backgrounds, a finding echoed by several random assignment studies evaluating states' welfare-to-work programs (Crosby, Gennetian, & Huston, 2005; Gennetian, Crosby, Dowsett, Huston, & Principe, 2005) as well as recent work on state pre-kindergarten programs (Gormley & Gayer, 2005; Magnuson et al., 2007).

A final strand of empirical research that is relevant to the current study focuses on the impact of early maternal employment on child well-being. Findings from this body of work are important given that child care subsidies are strongly tied to employment mandates for low-income parents. A sizeable literature emphasizes measures of cognitive ability (Baum, 2002; Bernal, 2008; Blau & Grossberg, 1992; Brooks-Gunn et al., 2002; Desai et al., 1989; James-Burdumy, 2005; Liu et al., 2003; Ruhm, 2004; Waldfogel, Han, & Brooks-Gunn, 2002). This evidence suggests that maternal work during the first year of a child's life is associated with small, negative effects on cognitive ability. Additional research in this area tentatively points to the persistence of negative effects into early-adolescence (Han, Waldfogel, & Brooks-Gunn, 2001; Ruhm, 2008). More recent work extends the literature to an array of health outcomes. For example, Gordon, Kaestner, and Korenman (2007) find that early maternal work has no adverse effects on the incidence of injuries, respiratory problems, and other health events, while estimates by Morrill (2009) point to increases in hospitalizations, asthma episodes, and poisonings. In addition, there is a growing literature suggesting that early and later maternal employment is associated with increases in childhood obesity, especially among high-income children (Anderson, Butcher, & Levine, 2003; Ruhm, 2008).

3. Data sources

The data used in the analysis are drawn from the Early Childhood Longitudinal Study, Kindergarten cohort (ECLS-K), a nationally representative sample of 21,260 children attending kindergarten in the fall of 1998.⁸ Children in

⁶ See Smolensky and Gootman (2003) for a thorough review of this research.

⁷ It is also possible that child care subsidies allow parents to shift children between formal arrangements, or simply keep children in the same arrangement and either purchase more of it or pay less for the existing level of services.

⁸ The ECLS-K is sponsored by the U.S. Department of Education. For more information, see the ECLS-K website at <http://nces.ed.gov/>

the ECLS-K are followed through the eighth grade, with detailed parent, child, and teacher interviews conducted in the fall and spring of kindergarten (1998 and 1999) and the spring of first (2000), third (2002), fifth (2004), and eighth (2007) grade. About 20 kindergartners per school from over 1200 public and private schools are included in the sample.⁹

Analyses in this study are based on the fall and spring of kindergarten waves of data collection, in which child cognitive and behavioral assessments were conducted and parents were asked questions about child care attendance in the year prior to kindergarten entry. We limit our sample to 2795 children who lived with a single mother as of the fall of kindergarten interview.¹⁰ We limit the sample to female-headed families because they are the central focus of recent social policy reforms, including the PRWORA that created the current subsidy system. In addition, constraining the sample to single mothers allows us to focus on potentially eligible families without having to rely on exclusions based on endogenous family characteristics (e.g., earnings and welfare receipt). Indeed, unmarried mothers constitute 64 percent of eligible subsidy recipients (Herbst, 2008a). Exclusions from the sample are made if children were living in two-parent families (12,431) or missing data on one or more of the primary outcome variables (4421), child care arrangements (1189), and child care subsidy questions (27). We exclude an additional 335 children attending Head Start, since the decision to participate in this early intervention program is not influenced by child care subsidies.¹¹ Rates of item non-response on the remaining child and family variables are low, usually well below one percent of the final sample, and we retained these cases by imputing zeroes for the missing values and creating dummy variables to control for the possibility of non-random imputation.

[ecls/kindergarten.asp](#). An additional longitudinal study, the ECLS-Birth cohort, follows 14,000 children born in 2001 through kindergarten entry.

⁹ The ECLS-K used a multistage probability sample design to select the sample of children attending kindergarten in 1998. The primary sampling units (PSUs) were geographic areas consisting of counties or groups of counties. The second-stage consisted of public and private schools within sampled PSUs. The final stage units were students within schools. The school frame was refreshed in the spring of 1998 to include newly opened schools that were not included in the original sample. Once the sample children were identified, parent contact information was obtained from the school, which was used to locate parents and seek consent for the child assessments and parent interviews. Completion rates (or response rates that are conditioned on earlier stages of data collection) for the fall of kindergarten interviews were high: 89.9 percent of child assessments were completed, 85.3 percent of parent interviews were completed, and over 90 percent of the teacher interviews were completed.

¹⁰ Single mothers were identified in the ECLS-K by using the variable P1HPARNT, which describes the child's living arrangements. We defined single mother families as those in which the child lived with the "biological mother only."

¹¹ Sensitivity tests show that our results are qualitatively similar when Head Start children are included in the analysis sample. Additional minor exclusions from the sample were made due to missing zip code identifiers, an inability to match children to the 2000 Census geocoded data, and mothers under age 19. A number of researchers drop children who were not first-time kindergartners. However, we decided to retain these children and add a control for their presence in all models. In any case, they comprise a small number of the total analysis sample (147).

3.1. Child outcomes

We explore a large set of child outcomes, broadly organized around cognitive, behavioral, and psychomotor categories. In the cognitive domain, reading and math tests were administered to all children in the fall of kindergarten.¹² The reading test was designed to measure language and literacy skills, such as print familiarity, letter recognition, beginning and ending sounds, vocabulary, and reading comprehension. The math test evaluated identification of one- and two-digit numerals, recognition of geometric shapes, counting and reading numerals, pattern and sequence recognition, and solving simple word problems. Reading and math outcomes are transformations of the raw scores into T-scores, which are population-referenced measures of children's achievement. As a result, these scores are interpreted in relation to a given child's peer group. For ease of interpretation, T-scores are scaled to have (for the full sample) a mean of 50 and a standard deviation of 10. Effect sizes are therefore derived by dividing all parameter estimates by 10. Reliabilities for both cognitive tests are high (0.93 for reading and 0.92 for math).

In the behavioral domain, we explore teachers' subjective reports of children's internalizing behavior problems, externalizing behavior problems, approaches to learning, self-control, and interpersonal behavior.¹³ The Internalizing Behavior Scale asks about the frequency with which children display anxiety, loneliness, low self-esteem, and sadness (four items). The Externalizing Behavior Scale inquires about the frequency of acting out behaviors, including arguing, fighting, anger, and impulsive behavior (five items). The Approaches to Learning Scale measures behavior reflecting the ease children display in the learning environment, including attentiveness, task persistence,

¹² The reading and math tests were designed specifically for use in the ECLS-K. However, many of the individual items are derived from existing instruments, all with high reliability scores. For example, instruments such as the Peabody Individual Achievement Test—Revised (PIAT-R), Peabody Picture Vocabulary Test—3 (PPVT-3), and the Woodcock-Johnson Psycho-Educational Battery—Revised (WJ-R) were drawn from to create the ECLS-K measures. Overall reading and math scores can be broken down into proficiency scores, which provide a means of analyzing specific skills or content areas. Reading scores are comprised of proficiencies in letter recognition, beginning sounds, ending sounds, sight words, and words in context. Math scores are comprised of proficiencies in numbers and shapes, relative size, sequencing, addition/subtraction, and multiplication/division. In addition to the reading and math tests, the ECLS-K cognitive battery also includes a general knowledge test designed to capture children's "conceptual understanding of scientific facts, and skills and abilities to form questions about the natural world, to try to answer them on the basis of the tools and the evidence collected, and to communicate answer and how the answers were obtained." The ECLS-K does not provide proficiency scores for the general knowledge test, and its reliability scores are consistently below the other cognitive tests. Therefore, we limit our analyses to the reading and math scores.

¹³ Teachers were also asked to respond to several questions about children's academic performance. This academic rating scale (ARS) provides information in areas of language and literacy, general knowledge, and mathematical thinking. However, we limit our outcome list to teachers' assessments of social skills. Furthermore, in the fall of kindergarten, parents were asked about children's social skills in many of the same domains as teachers. Reliabilities for these assessments are often substantially below that of the teacher assessments, and so we chose to concentrate on teachers' evaluations of children's social skills.

and eagerness to learn (six items). The Self-Control Scale measures the extent to which children are capable of controlling behavior by respecting the property of others, limiting temper, and responding appropriately to peer-pressure (four items). Finally, the Interpersonal Skills Scale provides information on children's ability to form and maintain friendships, comfort or help others, and show sensitivity toward one's peers (five items). All of the behavioral outcomes are measured on a scale of one to four. Higher scores on the Internalizing and Externalizing Behavior Scales indicate more frequent behavior problems, while higher scores on the remaining scales indicate increasingly positive behavior. These measures are scaled to have a mean of zero and a standard deviation of 10. Reliabilities are once again high (0.80 for Internalizing Behavior, 0.90 for Externalizing Behavior, 0.89 for Approaches to Learning: 0.89, 0.79 for Self-Control, and 0.89 for Interpersonal Skills).

The final set of outcomes explored in the study focus on children's psychomotor skills, specifically fine and gross motor skills. Fine motor skills capture hand-eye coordination and include such tasks as building a gate, drawing a person, and copying simple figures. The test of gross motor skills evaluates children in the areas of balancing, hopping, skipping and walking backward. Fine motor skills are measured on a scale of zero to nine, and gross motor skills are measured on a scale of zero to eight, with higher scores indicating greater abilities. As with the behavioral outcomes, these measures are scaled to have a mean of zero and a standard deviation of 10. Reliability scores for these measures are 0.57 for fine motor skills and 0.51 for gross motor skills.

3.2. *Measures of child care subsidy receipt and child care arrangements*

The key independent variable in our analysis is a dummy variable indicating whether a child received subsidized, nonparental child care in the year prior to kindergarten. Parents are asked a series of questions about child care use during the past 12 months, including the number of arrangements, the amount of time (i.e., months, days, and hours) that each arrangement was used, whether there was a cost associated with each arrangement, and if so, the amount paid for care. Regarding subsidy receipt, parents were asked the following: "Did any of the following people or organizations help to pay for this . . . provider to care for {CHILD} the year before {he/she} started kindergarten?" Four possible choices were then presented to parents, and we coded those answering "a social service agency or welfare office" as receiving a child care subsidy. Similar questions appear in several nationally representative surveys (e.g., National Survey of America's Families and the Survey of Income and Program Participation), and other researchers have constructed indicators of subsidy receipt based on them (Blau and Tekin, 2007; Herbst, 2008a; Tekin, 2007). The U.S. Department of Health and Human Services (1999) finds that between 12 percent and 15 percent of eligible families received a CCDF subsidy in 1998. In our ECLS-K sample, 14.8 percent of children are coded as receiving subsidized care during

the same period, further increasing our confidence in the measure.¹⁴

We also create mutually exclusive groupings of child care arrangements. Specifically, we code children as having attended relative care (which includes caregiving inside and outside the child's home), non-relative care (nanny, babysitter, or family-based), center-based care (daycare center), or school-based services (pre-kindergarten, preschool, and nursery school). Children who did not attend any of these services are coded as receiving exclusively parent care. A non-trivial number of children received child care from more than one provider, so we create a decision rule to ensure mutually exclusive and exhaustive categories.¹⁵ Participation rates in the various child care arrangements are as follows: 14.6 percent of children received no nonparental care (parent care only); 22 percent received care from a relative; 7.2 percent received care from a non-relative; 16.3 percent participated in center-based care; and 39.9 percent participated in a school-based program.

3.3. *Child and family characteristics, contextual factors, and the policy context*

We exploit the richness of the ECLS-K to control for a detailed vector of child and family characteristics as of the fall of kindergarten. Key child characteristics include age, race, and birth weight. Parental time and skill inputs are captured by mother's age, mother's and father's educational attainment, and parent's educational expectations for the child. Parental resources and other goods inputs are represented by WIC and food stamps participation, total household income, and the number of books and audio CDs/tapes available in the home.¹⁶ Finally, all models

¹⁴ Rates of child care subsidy receipt calculated by researchers using the NSAF match closely our ECLS-K estimate. For example, Tekin (2007) calculates a participation rate of 11.6 percent for a sample of single mothers, and Herbst (2008a) estimates a take-up rate of 13.9 percent, also from a sample of single mothers.

¹⁵ Our decision rule is constructed so that we drop only those children who receive exclusively Head Start. Therefore, our indicator of subsidy receipt omits those reporting subsidy receipt while participating only in Head Start. However, our comparisons are similar when we estimated our models labeling these mothers as subsidy recipients. A child participating in Head Start along with another service is coded as participating in the non-Head Start service. The remaining tie-breakers are settled as follows: relative and center: center; non-relative and center: center; relative and school: school; non-relative and school: school; non-relative, relative, and center: center; non-relative, relative, and school: school.

¹⁶ We also experimented with a more extensive variable list, including a composite measure of socioeconomic status, which was constructed by ECLS-K staff and comprises parental education, occupation, and family income. This was ultimately excluded from the analysis, given that we include most of its constituent parts in the analysis. Our results are not sensitive to this exclusion. Furthermore, we experimented with a number of parent-child activities, such as frequency of reading, storytelling, playing games and sports, and participating in nature activities. Another cluster of potential variables included the extent to which parents thought it was important to have certain skills (e.g., counting and knowing letters) at the time of kindergarten entry. Finally, we considered additional family context variables, such as whether the child moved at all since birth and whether the current home location was chosen because of the school system. These variables are inconsistently associated with the outcomes, and removing them did not alter the results.

control for a number of child and family background characteristics. These include indicators of early and current child health as well as developmental setbacks, specifically, whether the child was born prematurely, the child's current weight, and the presence of disabilities.¹⁷ This vector also contains family attributes that indirectly proxy time inputs and other resources, such as the age of the mother as of the first birth, the number of siblings in the household, and region of residence.

Although the ECLS-K asks parents a number of questions about subjective neighborhood quality, we control for contextual determinants of child outcomes by appending zip code-level Census data to our main data file. These variables are derived from the 2000 Decennial Census' long form, and are obtained by researchers through a restricted use data agreement. We incorporate 12 variables at the zip code-level into our analyses, including median household income, population density, the fraction of households receiving public assistance, five racial and ethnic categories, percent foreign born, female employment rates, and educational attainment.

A final set of variables included in our analysis attempts to capture the state-level social policy environment in which children are raised and which have implications for both children and their parents. Although the ECLS-K provides information on early and current child care experiences, there may be state-level attitudes and policies regarding the well-being of children that may be correlated with both child care subsidies and child outcomes. Therefore, we use a number of welfare and other social policy reforms implemented throughout the 1990s to account for heterogeneity in state resources and attitudes influencing child development. These variables include the maximum AFDC/TANF benefit for a family of three, the combined federal/state EITC maximum credit, a dummy variable for whether a state has a lifetime time limit on welfare receipt, the number of months for states' time limits, a dummy variable for whether a state has an immediate work requirement, child age exemption from work requirements, a dummy for whether a state has a full family welfare sanction for the first instance of non-compliance with work requirements, and a dummy variable for whether a state operates a formal cash diversion program, and state pre-kindergarten spending per child ages 0–4.

4. Conceptual framework and econometric model

Our goal is to examine the relationship between child care subsidy receipt and children's cognitive, behavioral, and psychomotor outcomes at the start of kindergarten. These outcomes are determined by a child development production function whose inputs include purchased goods (e.g., food, books, and medical care), the quality of non-parental child care, and the market and non-market

time of parents. Researchers have estimated variations of this production function to examine the impact of pre-kindergarten (Magnuson et al., 2007), child care inputs (Blau, 1999), child care use and income (Bernal & Keane, 2008), and parental employment (Ruhm, 2004) on measures of child well-being.

Rather than entering into the production function as a direct input, child care subsidies are assumed to influence child outcomes indirectly by affecting the mix of inputs toward purchased goods, nonparental child care, and the time allocation of parents. This is a plausible assumption because child care subsidies are essentially an in-kind benefit that enters parents' optimization problem through the budget and time constraints. In this framework, a subsidy-induced decrease in the price of child care is predicted to raise the likelihood that a parent will work and use paid child care by increasing the effective wage rate and making formal care relatively cheaper (Blau & Robins, 1988; Kimmel, 1998; Tekin, 2007).

As previously stated, a child care subsidy can influence child outcomes through several mechanisms. First, the income available for private consumption and purchasing goods to enhance child quality increases when families receive a subsidy. This stems from the fact that these benefits release money that can be directed toward purchases other than child care. It is straightforward to show that the effect of an in-kind service is equivalent to a pure income transfer, in that it causes a parallel and outward shift in the budget constraint. Parents will therefore respond by increasing both private consumption and purchases for child quality-enhancing goods and services.¹⁸ The extent to which an increase in disposable income is spent on private consumption as opposed to child quality depends on the relative size of the income elasticities.

Second, child care subsidies reduce the amount of time children spend with their parents, while increasing the amount of time in nonparental child care. Although increased spending on quality-enhancing goods is predicted to be beneficial for child development, the impact of reduced maternal time depends on the relative quality of maternal versus nonparental child care. Evidence on the effect of maternal employment and child care is inconclusive. However, a key determinant of this relative productivity is the way in which the CCDF influences access to high-quality providers. As the previous section makes clear, there are several design features associated with the CCDF that may influence the level of child care quality received by subsidized children. Overall, it is unclear *a priori* whether subsidies are beneficial or detrimental to child development, and so this is ultimately an empirical question.

By substituting subsidy receipt into the non-market time of parents and nonparental child care quality, we can represent child outcomes as a function of child care subsidy receipt. The ideal strategy for recovering unbiased causal estimates of subsidies involves the assignment of children

¹⁷ We define disability status using an ECLS-K composite variable. It includes individual questions on whether the child ever received any form of therapy before kindergarten, or had a learning, activity, mobility, speech, hearing, or vision problem diagnosed by a professional.

¹⁸ This is true under the plausible assumption that both are normal goods. Note that the additional expenditures on child care will be less than the amount of the subsidy due to the income effect.

to either a treatment group (who receives subsidized care) or a comparison group (who does not) and then compare measures of child well-being. In the absence of such a randomized design, we turn to quasi-experimental methods. Thus, our goal is to obtain quasi-reduced form parameters of the relationship between subsidy receipt and child outcomes. We begin with an econometric model as follows:

$$Y_i = X_i\beta + \alpha S_i + \varepsilon_i, \quad (1)$$

where Y_i is one of nine measures of child development taken for child i in the fall and spring of kindergarten; S_i is an indicator for child care subsidy receipt in the year before kindergarten; X_i is a vector of exogenous determinants of child outcomes; and ε_i is a disturbance term. Note that α is an estimate of the net effect of child care subsidies on child development. It represents the combined effect that takes place through parents' altered time and budget constraints, as well as supply-side limitations on the ability to purchase high-quality care.

Estimating Eq. (1) with the Ordinary Least Squares (OLS) will yield a biased estimate of α if the unobserved determinants of child outcomes are correlated with child care subsidy receipt. For example, mothers who seek and obtain a subsidy may be systematically different from those who do not in ways that are not observed by researchers. If high-skilled mothers are more likely to work, successfully navigate the subsidy system, and have high-skilled children, then failing to control for maternal productivity would lead to an upward bias of α . Another selection mechanism deals with the possibility that mothers take children's cognitive ability, temperament, and economic circumstances into consideration when deciding whether to work and obtain a child care subsidy. If mothers differentially select work and child care choices based on unobserved child characteristics, the coefficient on subsidy receipt will once again be biased.

We take a number of steps to guard against bias from unobserved heterogeneity. First, we exploit the richness of the ECLS-K data to control for an extensive set of child and family characteristics. Second, we incorporate detailed zip code-level and state social policy controls into the model. Finally, we estimate models using Two Stage Least Squares (TSLS). To implement this approach, we rely on exclusion restrictions to identify the subsidy coefficient, α , in Eq. (1). Specifically, we need at least one instrument that is correlated with child care subsidy receipt, but uncorrelated with child outcomes. We use variables that determine how subsidies are rationed by state and local administrators under the assumption that child outcomes are orthogonal to the rationing mechanism, conditional on subsidy receipt status. Furthermore, we assume that rationing is conducted at the county level and therefore use county dummies as identifying instruments (Blau & Tekin, 2007).

A number of recent studies provide evidence that local subsidy administrators have substantial autonomy to interpret federal and state policy, as well as the authority to shape policy decisions with little oversight (Blank, Behr, & Schulman, 2001; Layzer & Collins, 2000; Mitchell, Stoney, & Dichter, 1997). Appendix Table A1 shows that child care subsidy programs in all but seven states (Arizona, Connecticut, Hawaii, New Hampshire, Rhode Island, South

Carolina, and South Dakota) are administered by county welfare or social service agencies.¹⁹ In at least three states (Colorado, New York, and Texas), subsidy policy and administration are largely determined by county agencies, while another two states (Florida and Virginia) allow such agencies to establish local eligibility criteria. Perhaps the most common policy decision devolved to local agencies is establishing reimbursement rates, with counties in 38 states having the authority to do so. Appendix Table A1 also presents examples of administrative tools used by states to ration subsidies: creating wait lists/frozen intake (17 states) and providing an entitlement for TANF families (16 states). Such policies are critical to determining the mix of low-income families that access child care assistance. Thus, we believe that the combination of local administration and rationing makes the county identifiers plausible candidates for explaining variation in child care subsidy receipt.

This identification strategy will be invalid if the county dummies cannot be appropriately excluded from Eq. (1). For example, state and local government policies may influence child outcomes through mechanisms that are outside the child care subsidy system. If states and localities with generous subsidy benefits are also more likely to offer pre-kindergarten programs and other child-related benefits, then our identification strategy will be invalid if these programs are not accounted for in the estimation. In order to guard against this possibility, we include in some models 21 zip code-level and state policy variables that proxy the ability and determination of state and local governments to influence child outcomes.

Although the ECLS-K provides researchers with a rich set of information on children's early cognitive and behavioral development, it is important to mention some drawbacks associated with these data. First, with the exception of a single measure of early parental employment, the ECLS-K does not collect detailed information on parents' work histories. A related concern is that we are unable to account for earnings and other income sources over the first few years of a child's life. Second, information on children's early child care experiences is missing as well. In fact, the only historical child care data available in the ECLS-K focus on the age at which children began participating in nonparental care. A final drawback is that direct measures of child care quality are missing for children's arrangements in the year before kindergarten entry.

One might therefore be concerned that our estimates are confounded with early maternal work, income, and child care quality. However, there are reasons to be skeptical of incorporating such controls into the current analysis. It is well-known that maternal employment and child care quality are endogenous to child outcomes, and dealing with them in addition to the endogeneity of subsidy receipt would add undue complexity to the empirical analysis. As others have noted, finding plausible instruments for maternal employment and child care, in particular, is a difficult task (Bernal & Keane, 2008; Blau & Tekin, 2007). Furthermore, measures of maternal work and child care time are

¹⁹ In some states, the subsidy program is operated by regional agencies, which typically include groups of counties.

highly correlated for single mothers, making it difficult to distill their independent effects (Bernal & Keane, 2008). Rather than dealing with the endogeneity of maternal work and child care utilization, the quasi-reduced form approach that we adopt allows us to substitute the determinants of these variables into the empirical model. This is a reasonable approach for the purposes of this paper because the goal here is to examine the relationship between subsidy receipt and child outcomes. Others have adopted similar strategies in situations with multiple endogenous variables (e.g., Blau & Tekin, 2007; Ruhm, 2008), and excluding these factors allows us to concentrate on the bundled impact of child care subsidies, which we argue is the parameter of interest from a policy perspective.

5. Empirical results

Table 1 presents means for the outcome variables across subsidized and unsubsidized children in the ECLS-K. The figures reported in the table are weighed using the appropriate sample weight. Note that the reading and math scores of children in our sample are slightly below the mean for the full ECLS-K sample, with average scores of about 48. This is not surprising, given that the sample consists of children living in single-parent families. The table also shows that subsidized children perform worse than their counterparts in every domain, and most of these differences persist to the spring of kindergarten. In fact, tests of the null hypothesis of no difference between subsidy recipients and non-recipients are rejected for six of nine outcomes in the fall of kindergarten and six of seven outcomes in the spring of kindergarten. One should interpret these results with caution, as they do not adjust for any differences between subsidy recipients and non-recipients. Some of these poorer outcomes could reflect the possibility that subsidized children come from socially and economically disadvantaged backgrounds, an issue we explore next.

Table 2 displays summary statistics for the full set of variables used in the analysis. These results are presented for the entire sample and separately for subsidy recipients and non-recipients. As expected, subsidized children are much more likely to be placed in center care than non-recipients. More than 41 percent of subsidy recipients participate in center-based arrangements, while only 12 percent of non-recipients are in such care. Subsidy recipients are also more heavily represented in other modes of non-relative care (nine percent versus seven percent). Non-recipients are mostly cared for by relatives and parents: fully 41 percent of non-recipient children receive care in one of these settings.

Interestingly, the table draws a mixed picture about the social and economic environments from which subsidy recipients and non-recipients are drawn. Subsidy recipients appear to be more disadvantaged on the basis of whether the mother was a teenager at first birth and whether she received food stamps. Furthermore, recipient families have fewer resources that may positively influence child development, as measured by the number of children's books, tapes, and CDs available in the home. On the other hand, mothers of subsidized children are less likely to be high school drop-outs (13 percent versus 18 percent)

and more likely to have some college education (40 percent versus 34 percent). Several factors might explain this relationship. The process of locating information on states' subsidy systems, filling out applications, and navigating the child care bureaucracy likely requires a high degree of skill and motivation. Another possibility is that child care administrators favor the most employable mothers in light of the work requirements tied to subsidy receipt (Blau & Tekin, 2007).

As shown in Table 2, subsidized families have lower incomes, on average, which is not surprising given states' eligibility threshold. However, a closer look at family income reveals a non-linear relationship between income and subsidy receipt. In particular, families in the middle of the income distribution are more likely to receive a subsidy than those from other categories, indicating that subsidized families are not drawn disproportionately from the most disadvantaged backgrounds. This pattern is consistent with the explanation offered above for the non-linear relationship between education and subsidy receipt. A final piece of descriptive evidence points to a reasonable amount of observational equivalence between subsidy recipients and non-recipients. The ECLS-K produces an index of socioeconomic status (SES), which combines mother's and father's education, mother's and father's occupational status, and total family income. According to this measure, subsidized and unsubsidized families are equally represented in every SES quintile but the top one.

Results from OLS regressions of the fall of kindergarten child outcomes on child care subsidy receipt are presented in Table 3. Column (1) shows the subsidy coefficient for separate regressions that control for the child and family characteristics presented in Table 2.²⁰ Column (2) adds the state-level policy variables that are assumed to influence child outcomes, while column (3) incorporates the zip code-level variables that further account for local policy and attitudinal differences affecting child development.

As shown in Table 3, many of the differences in child outcomes between subsidy recipients and non-recipients disappear once the observable characteristics of children and families are added to the model. Specifically, differences in reading test scores, approaches to learning, interpersonal skills, and gross motor skills between subsidized and unsubsidized children are rendered statistically insignificant across each column. Subsidy receipt, however, continues to be associated with increases in externalizing behavior problems, with the coefficient indicating that subsidies increase the frequency of such behavior by 0.13 standard deviations. In addition, the coefficient on subsidy receipt is statistically significant in the self-control models, once again implying that subsidized children display more behavior problems.

Results from the fall TSLS models are presented in Appendix Table A2 (first-stage subsidy receipt equation) and Table 4 (second-stage child outcome equations). Looking first at the model predicting subsidy receipt, our results are consistent with previous studies (Blau & Tekin, 2007;

²⁰ The only variables omitted from Table 2 are the indicators of child care participation.

Table 1
Descriptive results for the child development outcomes, fall and spring of kindergarten.

Variable	Full sample	Subsidy recipient	Non-recipient
<i>Cognitive outcomes</i>			
Reading test score, fall (N=2795)	47.54 (9.42)	46.79 (9.03)	47.67 [*] (9.48)
Reading test score, spring (N=2659)	47.92 (9.73)	46.93 (9.21)	48.10 [*] (9.81)
Math test score, fall (N=2795)	47.82 (9.27)	47.14 (8.77)	47.94 (9.35)
Math test score, spring (N=2658)	48.14 (9.52)	47.05 (8.45)	48.33 ^{**} (9.69)
<i>Behavioral outcomes</i>			
Internalizing behavior, fall (N=2795)	0.117 (10.0)	0.092 (10.463)	0.122 (9.920)
Internalizing behavior, spring (N=2545)	0.047 (9.840)	0.839 (10.021)	−0.090 [*] (9.804)
Externalizing behavior, fall (N=2795)	0.155 (10.102)	1.848 (10.708)	−0.139 ^{***} (9.966)
Externalizing behavior, spring (N=2551)	0.261 (10.156)	1.853 (10.400)	−0.015 ^{***} (10.090)
Approaches to learning, fall (N=2793)	0.010 (9.994)	−0.864 (10.073)	0.162 [*] (9.974)
Approaches to learning, spring (N=2560)	−0.130 (10.056)	−0.889 (9.875)	0.000 (10.083)
Self-control, fall (N=2720)	0.005 (10.069)	−1.556 (10.096)	0.276 ^{***} (10.042)
Self-control, spring (N=2554)	−0.167 (10.073)	−2.009 (9.691)	0.151 ^{***} (10.105)
Interpersonal skills, fall (N=2699)	0.011 (9.994)	−1.340 (10.306)	0.251 ^{***} (9.921)
Interpersonal skills, spring (N=2539)	−0.212 (10.056)	−1.737 (9.773)	0.050 ^{***} (10.083)
<i>Physical and psychomotor outcomes</i>			
Fine motor skills, fall (N=2786)	−0.115 (9.949)	−0.155 (10.029)	−0.108 (9.937)
Gross motor skills, fall (N=2766)	−0.068 (9.933)	−0.850 (9.920)	0.068 [*] (9.931)

Source: Authors' calculations from the ECLS-K Base Year Restricted Use Data File.

Notes: All means are weighted using the ECLS-K Parent Full Sample weight. Standard deviations are in parentheses. Analyses are conducted on children with non-missing data. The number of subsidy recipients is 410 for the cognitive and behavioral outcomes, approaches to learning, and fine motor skills; 398 for self-control; 402 for interpersonal skills; 406 for gross motor skills.

^{*} Difference in means for subsidy recipients and non-recipients is statistically significant at the 0.10 percent level.

^{**} Difference in means for subsidy recipients and non-recipients is statistically significant at the 0.05 percent level.

^{***} Difference in means for subsidy recipients and non-recipients is statistically significant at the 0.01 level.

Herbst, 2008a; Meyers, Heintze et al., 2002). Black children and those with multiple siblings are more likely to receive a subsidy. Mother's education is positively correlated with the likelihood of subsidy receipt, which is consistent with the story that considerable knowledge and skill may be necessary to navigate the application process and deal with local government agencies. Finally, families receiving WIC and food stamps are more likely to obtain subsidies. To evaluate the strength of the identifying instruments, we calculate the partial R^2 and conduct an F -test for the joint significance of the county dummies. The R^2 increases by about 11 percentage points when the county dummies are added to the model, and the F -test yields a highly significant 25.2, more than twice the guideline suggested by Bound, Jaeger, and Baker (1995) to avoid weak instruments. Such findings suggest that our instruments are capable of leveraging sufficient identifying variation to estimate fairly precise subsidy effects.

Turning to the second-stage results, we find that nearly all of the subsidy coefficients imply poorer cognitive, behavioral, and psychomotor outcomes. Once again, adding the state policy and zip code-level controls does not appreciably change the results, so we focus our interpretations on the full model [column (2)]. Children receiving subsidized care have reading test scores that are 3.0 points lower than unsubsidized children. This translates to an effect size of 0.30 standard deviations. Similarly, subsidy recipients score 2.6 points lower than non-recipients on the standardized math test, translating to an effect size of 0.26 standard deviations. In the behavioral domain, subsidy receipt is consistently associated with increased behavior problems. In fact, the coefficient on subsidies for approaches to learning and self-control imply sizeable negative effects. Our estimates suggest that subsidized

children experience reductions in these positive behaviors of about one-third of a standard deviation. The negative impact of subsidy receipt increases dramatically for interpersonal skills and gross motor skills, as compared to the OLS results, although in both cases the coefficient remains statistically insignificant.

Column (3) provides a robustness check of our main estimates. In particular, we restrict the analysis to states with clear evidence of county administration of child care subsidy programs. We use the information in Appendix Table A1 to exclude states that do not meet two of the following three criteria: county-level variation in administration, eligibility determination, or reimbursement rates.²¹ Doing so allows us to be more explicit about the identifying variation in subsidy receipt due to local differences in policy implementation. Therefore, if the county identifiers are valid instruments, we anticipate that the pattern of negative subsidy effects would become more pronounced after constraining the sample in this manner. The estimates in column (3) confirm this expectation. In fact, the coefficient on subsidy receipt becomes larger and more negative for eight of the nine child outcomes, despite about a 20 percent reduction in the sample. Note that the subsidy estimate for interpersonal skills and gross motor skills is now statistically significant at the 10 percent level. The increase in statistical significance is not surprising given that the instrument is less noisy once we eliminate

²¹ Applying these criteria eliminates 16 states from the analysis: Arizona, Connecticut, Hawaii, Iowa, Louisiana, Mississippi, New Hampshire, New Jersey, North Dakota, Rhode Island, South Carolina, South Dakota, Utah, Vermont, West Virginia, and Wyoming. We also experimented with models that applied only the first of these criteria (county-level administration). The results are very similar to those discussed in the text.

Table 2

Descriptive statistics by subsidy receipt status.

Variable	Full sample	Subsidy recipient	Non-recipient
<i>Child characteristics</i>			
Subsidy recipient (%)	0.148 (0.355)	1.000 (0.000)	0.000 (0.000)
Parent child care (%)	0.146 (0.353)	0.000 (0.000)	0.172*** (0.377)
Relative child care (%)	0.220 (0.414)	0.137 (0.344)	0.234*** (0.423)
Non-relative child care (%)	0.072 (0.258)	0.091 (0.288)	0.068 (0.253)
Center-based child care (%)	0.163 (0.370)	0.413 (0.493)	0.120*** (0.325)
School-based child care (%)	0.399 (0.490)	0.359 (0.480)	0.406* (0.491)
Child's age (months, fall of K)	68.50 (4.47)	68.36 (4.02)	68.52 (4.54)
Boy (%)	0.506 (0.500)	0.506 (0.501)	0.506 (0.500)
White (%)	0.399 (0.490)	0.344 (0.476)	0.409** (0.492)
Black (%)	0.370 (0.483)	0.421 (0.494)	0.362** (0.481)
Hispanic (%)	0.159 (0.366)	0.142 (0.350)	0.162 (0.369)
Asian (%)	0.016 (0.125)	0.008 (0.091)	0.017 (0.130)
Other race/ethnicity (%)	0.055 (0.229)	0.084 (0.278)	0.050*** (0.218)
Weight (pounds, fall of K)	47.12 (9.59)	47.93 (9.61)	46.97* (9.58)
Premature birth (%)	0.181 (0.385)	0.181 (0.386)	0.181 (0.385)
Low birth weight (%)	0.071 (0.258)	0.058 (0.233)	0.074 (0.262)
Disabled (%)	0.160 (0.366)	0.191 (0.394)	0.154* (0.361)
First-time kindergartner (%)	0.947 (0.224)	0.943 (0.232)	0.948 (0.222)
Only child (%)	0.298 (0.457)	0.243 (0.429)	0.307*** (0.461)
One sibling (%)	0.370 (0.483)	0.350 (0.478)	0.374 (0.484)
Two or more siblings (%)	0.332 (0.471)	0.407 (0.492)	0.319*** (0.466)
<i>Family characteristics</i>			
Mother's age (years, fall of K)	30.22 (5.99)	28.98 (5.35)	30.44*** (6.07)
Mother was teen at first birth (%)	0.444 (0.497)	0.548 (0.498)	0.426*** (0.495)
Mother's education: less than HS (%)	0.175 (0.380)	0.128 (0.335)	0.183*** (0.386)
Mother's education: HS/GED (%)	0.377 (0.485)	0.422 (0.495)	0.369** (0.483)
Mother's education: some college (%)	0.348 (0.476)	0.397 (0.490)	0.339** (0.473)
Mother's education: BA+ (%)	0.100 (0.300)	0.052 (0.223)	0.109*** (0.312)
Father's education: less than HS (%)	0.191 (0.393)	0.202 (0.402)	0.189 (0.392)
Father's education: HS/GED (%)	0.529 (0.499)	0.612 (0.488)	0.515*** (0.500)
Father's education: some college (%)	0.175 (0.380)	0.157 (0.364)	0.178 (0.382)
Father's education: BA+ (%)	0.105 (0.307)	0.029 (0.167)	0.118*** (0.323)
WIC participant (%)	0.732 (0.443)	0.921 (0.269)	0.699*** (0.459)
Food stamp recipient (%)	0.450 (0.498)	0.669 (0.471)	0.412*** (0.492)
Total family income (\$)	26,365 (33,084)	20,506 (22,308)	27,383*** (34,519)
Primary home language is English (%)	0.930 (0.256)	0.946 (0.226)	0.927 (0.261)
Children's books in home (no.)	58.05 (52.30)	53.43 (47.03)	58.85* (53.13)
Children's tapes/CDs in home (no.)	12.97 (17.27)	11.45 (14.34)	13.24* (17.71)
Parent expects hs or less for child (%)	0.131 (0.337)	0.124 (0.330)	0.132 (0.339)
Parent expects some college for child (%)	0.156 (0.363)	0.208 (0.407)	0.147*** (0.354)
Parent expects BA for child (%)	0.420 (0.494)	0.423 (0.495)	0.419 (0.494)
Parent expects post-BA for child (%)	0.293 (0.455)	0.245 (0.430)	0.302** (0.459)
Southern residence (%)	0.447 (0.497)	0.388 (0.488)	0.458*** (0.498)
<i>Zip code characteristics</i>			
Population density (persons/km ²)	3859 (7790)	3943 (7747)	3844 (7799)
Median household income (\$)	38,719 (13,964)	37,037 (11,169)	39,012 (14,376)
Households receiving welfare (%)	0.048 (0.040)	0.052 (0.041)	0.047 (0.040)
Hispanic (%)	0.130 (0.183)	0.116 (0.149)	0.132 (0.188)
Non-Hispanic White (%)	0.577 (0.314)	0.602 (0.299)	0.573 (0.317)
Non-Hispanic Black (%)	0.222 (0.272)	0.211 (0.252)	0.223 (0.275)
Non-Hispanic American Indian (%)	0.025 (0.108)	0.026 (0.101)	0.025 (0.109)
Non-Hispanic Asian (%)	0.035 (0.064)	0.030 (0.056)	0.036 (0.065)
Non-Hispanic Other Race (%)	0.008 (0.006)	0.008 (0.005)	0.008 (0.006)
Foreign born (%)	0.103 (0.119)	0.091 (0.100)	0.105 (0.122)
Female ages 16+ employed (%)	0.925 (0.048)	0.925 (0.044)	0.925 (0.049)
Ages 25+ with less than HS (%)	0.237 (0.118)	0.229 (0.101)	0.238 (0.121)
<i>State-level social policy environment</i>			
TANF benefit (three-person family, \$)	362 (147)	378 (142)	359 (148)
Lifetime welfare time limit (%)	0.749 (0.433)	0.724 (0.448)	0.754 (0.431)
Length of time limit (months)	43.18 (25.50)	41.32 (26.33)	43.50 (25.34)

Table 2
(Continued)

Variable	Full sample	Subsidy recipient	Non-recipient
Immediate work requirement (%)	0.714 (0.452)	0.747 (0.435)	0.708 (0.455)
Child age for exemption from work requirement (months)	13.00 (13.15)	12.13 (14.24)	13.13 (12.95)
Full family welfare sanction (%)	0.231 (0.421)	0.251 (0.434)	0.227 (0.419)
Formal cash diversion program (%)	0.291 (0.454)	0.317 (0.466)	0.287 (0.452)
Federal/state EITC max credit (one child, \$)	2320 (132)	2334 (150)	2317 (129)
Expenditures on state pre-K programs (per child ages 0–4, \$)	99.84 (112.62)	106.30 (121.28)	98.72 (111.03)

Source: Authors' calculations from the ECLS-K Base Year Restricted Use Data File.

Notes: All means are weighted using the ECLS-K Parent Full Sample weight. Standard deviations are in parentheses. Analyses are conducted on children with non-missing data.

* Difference in means for subsidy recipients and non-recipients is statistically significant at the 0.10 percent level.

** Difference in means for subsidy recipients and non-recipients is statistically significant at the 0.05 percent level.

*** Difference in means for subsidy recipients and non-recipients is statistically significant at the 0.01 level.

Table 3
OLS results for the impact of child care subsidies on child development, fall of kindergarten.

Child outcome	(1)	(2)	(3)
Reading test score	0.612 (0.505)	0.618 (0.509)	0.653 (0.510)
Math test score	0.702 (0.478)	0.722 (0.482)	0.722 (0.478)
Internalizing problem behavior	−0.502 (0.594)	−0.498 (0.598)	−0.500 (0.599)
Externalizing problem behavior	1.311** (0.589)	1.334** (0.586)	1.254** (0.586)
Approaches to learning	−0.138 (0.555)	−0.153 (0.555)	−0.007 (0.555)
Self-control	−0.951* (0.577)	−1.111* (0.576)	−1.118* (0.579)
Interpersonal skills	−0.652 (0.585)	−0.683 (0.588)	−0.632 (0.591)
Fine motor skills	0.980* (0.549)	0.924* (0.546)	0.991* (0.545)
Gross motor skills	−0.446 (0.564)	−0.425 (0.561)	−0.347 (0.569)
State policy controls	No	Yes	Yes
Zip code-level controls	No	No	Yes

Source: Authors' calculations from the ECLS-K Base Year Restricted Use Data File.

Notes: Each cell represents the coefficient on child care subsidy receipt derived from an OLS regression of each child outcome on the subsidy dummy, the full set of child and family controls presented in Table 2, and depending on the column, state policy controls and zip code-level controls. Robust standard errors are in parentheses. All models include dummy variables that equal unity for the child care and family controls with missing data. Analyses are weighted using the ECLS-K Base Year Full Sample Parent Weight. Full results are available from the authors upon request.

* Subsidy coefficient is statistically significant at 0.10 level.

** Subsidy coefficient is statistically significant at 0.05 level.

***Subsidy coefficient is statistically significant at 0.01 level.

Table 4
TSLS results for the impact of child care subsidies on child development, fall of kindergarten.

Child outcome	(1)	(2)	(3) Robustness check
Reading test score	−2.992** (1.499)	−3.044* (1.629)	−5.081*** (1.864)
Math test score	−2.366* (1.379)	−2.565* (1.452)	−4.236** (1.719)
Internalizing problem behavior	0.911 (1.708)	0.981 (1.811)	1.521 (2.075)
Externalizing problem behavior	0.932 (1.732)	0.736 (1.881)	0.570 (2.181)
Approaches to learning	−3.881** (1.570)	−3.283* (1.723)	−5.945*** (2.014)
Self-control	−1.104 (1.732)	−3.050* (1.874)	−4.037* (2.132)
Interpersonal skills	−1.861 (1.665)	−2.373 (1.810)	−3.879* (2.111)
Fine motor skills	0.079 (1.604)	−0.074 (1.715)	−1.316 (2.025)
Gross motor skills	−2.191 (1.658)	−1.850 (1.809)	−3.654* (2.083)
State policy controls	No	Yes	Yes
Zip code-level controls	No	Yes	Yes

Source: Authors' calculations from the ECLS-K Base Year Restricted Use Data File.

Notes: Each cell represents the coefficient on child care subsidy receipt derived from a TSLS regression of each child outcome on the subsidy dummy, the full set of child and family controls presented in Table 2, and depending on the column, state policy controls and zip code-level controls. The model for states with clear local subsidy administration excludes the following states: Arizona, Connecticut, Hawaii, Iowa, New Hampshire, Rhode Island, South Carolina, South Dakota, Louisiana, Mississippi, New Jersey, North Dakota, Utah, Vermont, West Virginia, and Wyoming. All models include dummy variables that equal unity for the child care and family controls with missing data. Robust standard errors are in parentheses. Analyses are weighted using the ECLS-K Base Year Full Sample Parent Weight. Full results are available from the authors upon request.

* Subsidy coefficient is statistically significant at 0.10 level.

** Subsidy coefficient is statistically significant at 0.05 level.

*** Subsidy coefficient is statistically significant at 0.01 level.

states without local variation in child care subsidy policy. We argue that the pattern exhibited in column (3) provides additional evidence in support of our identification strategy.

To assess whether these effects persist beyond the fall of kindergarten, we re-estimate our TSLs models using child outcomes measured during the spring of kindergarten interview. Results from these models are presented in Table 5. As illustrated in column (2), it appears that the impact of subsidy receipt persists throughout kindergarten for some of the child outcomes. For example, children receiving subsidized care have reading and math test scores that are about 0.3 and 0.4 standard deviations lower, respectively, than unsubsidized children. Subsidy receipt also maintains a statistically significant relationship with the measure of self-control. The coefficients for approaches to learning and interpersonal skills are negative, again suggesting that subsidies are associated with worse behavioral outcomes, although neither coefficient is estimated precisely. Results from the robustness check, shown in column (3), indicate that the impact of subsidy receipt once again becomes stronger across virtually every child outcome when the sample is constrained to states with clear local administration of subsidy policy. In particular, the coefficients for approaches to learning and interpersonal skills more than triple in size, but nonetheless remain imprecisely estimated, while the estimates for cognitive ability tests and self-control remain statistically significant and increase in magnitude.

It is useful to put some of these effect sizes into context. Specifically, we compare the estimates for reading and math tests [Table 4, column (2)] to those for cognitive ability tests generated by other studies. Recent work on state pre-kindergarten programs provides particularly useful benchmarks. Gormley and Gayer's (2005) evaluation of Tulsa, Oklahoma's program finds effect sizes of 0.39 (cognitive ability), 0.38 (language ability), and 0.24 (motor skills). Magnuson et al. (2007) estimate effect sizes of 0.24 (reading test) and 0.20 (math test) for pre-kindergarten attendance among ECLS-K children. Impact estimates from Head Start evaluations also provide useful comparisons. A recent study by the U.S. Department of Health and Human Services (2005) finds short-term test score impacts as large as 0.20, while long-term impacts have been estimated at 0.28 for the most disadvantaged children (Deming, 2009). Finally, an analysis of intensive early education programs reveals an effect size of 0.97 for Perry Preschool participants and 0.62 for Abecedarian participants at age five (Karoly et al., 2005). Thus, it appears that the magnitude of our (negative) subsidy estimates is roughly comparable to those from other early childhood intervention programs.

5.1. Specification checks

The results discussed so far indicate a negative relationship between child care subsidy receipt in the year before kindergarten and child outcomes measured during the fall and spring of kindergarten. Table 6 presents TSLs estimates from several specification checks that further examine the robustness of our main findings. These analyses are based on child outcomes measured during the fall of kinder-

garten, and we use as the baseline specification the model estimated in column (2) of Table 4.

As previously stated, eligibility for child care subsidies is conditioned, in part, on family income falling below 85 percent of SMI, although states may use thresholds below this federal recommendation.²² The TSLs models discussed so far have not been estimated on the income-eligible subsample of children. Doing so may lead to a form of sample selection bias because child care subsidies are predicted to influence parental earnings and other sources of income. The estimate for child care subsidies should therefore be interpreted as the average impact of subsidy receipt over families from all income levels. Nevertheless, we expect that the impact of subsidies would be concentrated among the subsidy-eligible population. Therefore, row 2 estimates the model using only those children whose family income is below states' income eligibility threshold. As an additional check, row 3 presents results from the low-skilled subsample, defined as mothers with less than a B.A. degree. We also provide for comparison purposes estimates from the set of income-ineligible children (row 4).

As shown in rows 2 and 3, the impact of subsidy receipt is consistent with the full sample results, despite a substantial reduction in the sample size. In addition, several coefficients increase dramatically in magnitude and statistical significance as a result of the sample definitions. For example, subsidized children now score 0.36 standard deviations higher on the measure of internalizing behavior problems and 0.39 standard deviations lower on gross motor skills, and both effects are statistically significant. Furthermore, subsidy receipt continues to show reductions in approaches to learning and self-control, as well as sizeable negative effects on tests of reading and math. In contrast, results in row 4 indicate that, as expected, child care subsidies do not influence measures of well-being among ineligible children. The effect sizes are essentially zero for many of the child outcomes, and in no case does an estimate point to a negative and significant effect. Such a pattern of results once again lends support to our estimation strategy.

To this point, we have not considered the possibility that mothers choose to reside in a given jurisdiction because of its favorable labor market conditions or social policy regime. If these unobserved location preferences are correlated with the likelihood of subsidy receipt and child well-being, the impact of child care subsidies will be biased. Although the ECLS-K does not permit us to control explicitly for policy preferences, the survey does ask parents whether the home location was chosen because of local school characteristics. When we incorporate this control into the model, as shown in row 5 of Table 6, the coefficients on subsidy receipt do not change appreciably. Furthermore, we re-estimate the models separately on the subset of children for whom the home location was and was not chosen due to school characteristics. The pattern of subsidy results is similar across both subsets of children.

²² For example, as of 2000, only four states (Alaska, Hawaii, Maine, and Texas) established income eligibility at or above 85 percent of SMI.

Table 5

TSLs results for the impact of child care subsidies on child development, spring of kindergarten.

Child outcome	(1)	(2)	(3) Robustness check
Reading test score	–2.586* (1.581)	–3.347** (1.652)	–4.630** (1.914)
Math test score	–2.819** (1.388)	–4.363*** (1.467)	–5.566*** (1.738)
Internalizing problem behavior	–0.090 (1.626)	–2.196 (1.699)	–2.819 (1.961)
Externalizing problem behavior	0.589 (1.642)	–0.333 (1.765)	0.632 (2.036)
Approaches to learning	–1.287 (1.583)	–0.951 (1.702)	–2.833 (1.987)
Self-control	–1.365 (1.651)	–3.177* (1.771)	–3.829* (2.019)
Interpersonal skills	–0.906 (1.617)	–0.856 (1.754)	–2.347 (2.046)
State policy controls	No	Yes	Yes
Zip code-level controls	No	Yes	Yes

Source: Authors' calculations from the ECLS-K Base Year Restricted Use Data File.

Notes: Each cell represents the coefficient on child care subsidy receipt derived from a TSL regression of each child outcome on the subsidy dummy and the full set of child and family controls presented in Table 2. The model for states with clear local subsidy administration *excludes* the following states: Arizona, Connecticut, Hawaii, Iowa, New Hampshire, Rhode Island, South Carolina, South Dakota, Louisiana, Mississippi, New Jersey, North Dakota, Utah, Vermont, West Virginia, and Wyoming. All models include dummy variables that equal unity for the child care and family controls with missing data. Robust standard errors are in parentheses. Analyses are weighted using the ECLS-K Base Year Full Sample Parent Weight. Full results are available from the authors upon request.

* Subsidy coefficient is statistically significant at 0.10 level.

** Subsidy coefficient is statistically significant at 0.05 level.

*** Subsidy coefficient is statistically significant at 0.01 level.

The last two rows attempt to deal with some of the drawbacks associated with missing data on child care quality and parental employment. To account for differences in child care quality across subsidy recipients and non-recipients, we add nine controls for states' child care regulations, including child-staff ratios and maximum group sizes.²³ Given that these regulations vary across children in different states, the subsidy effects are still not adjusted for differential quality within child care institutions or classrooms for a given state. Nevertheless, the results indicate that the impact of subsidy receipt is robust to cross-state differences in regulation-based child care quality. Results in row 7 assess the influence of missing parental work histories in the ECLS-K. In particular, we use as a proxy for early maternal work dummy variables indicating whether children began nonparental care arrangements during the first three years of life. Adding these variables does not change our results.

5.2. Interpretation of empirical results

By accounting for the endogeneity of child care subsidy receipt, we mitigate the influence of unobserved child and family characteristics that are correlated with measures of child well-being. An important question is why subsidies continue to influence child outcomes even after removing systematic differences between subsidized and

unsubsidized children. In this section, we elaborate further on the mechanisms through which subsidies might have detrimental effects on children. The thrust of our discussion focuses on the stability and intensity of child care use during the period ECLS-K children received subsidized care. We then turn our attention to summarizing previous research on overall child care quality in the U.S., as well as studies comparing quality across subsidized and unsubsidized children.

As previously stated, conditioning eligibility for child care subsidies on employment and income can be at odds with child development if lapses in eligibility lead to unstable child care arrangements.²⁴ Indeed, studies show that children participating in multiple arrangements have difficulties adjusting to new environments and developing trusting relationships with teachers and peers (Bacharach & Baumeister, 2003; Youngblade, 2003). Such concerns are heightened given that the median subsidy spell lasts only 3–7 months (Meyers, Peck, et al., 2002). Furthermore, by increasing purchasing power, child care subsidies create incentives to buy more child care in the formal market. If the quality of care purchased with subsidies is poor, then subsidies might lead to a situation in which subsidized children are exposed to risky environments for longer periods.

Using the ECLS-K, we examine whether subsidized and unsubsidized children differ according to the intensity and stability of nonparental arrangements. Results from this exercise are presented in Table 7. The top panel of Table 7

²³ The full set of regulation controls is the following: center child-staff ratios for four-year-olds; family child-staff ratios for four-year-olds; center maximum group size for four-year-olds; family maximum group size for four-year-olds; a dummy variables that equals unity if center directors are required to have at least a BA degree; a dummy variables that equals unity if center/family child care staff are required to enroll in child development coursework; a dummy variables that equals unity if center/family staff are required to undergo a criminal background check; a dummy variables that equals unity if center/family indoor space is regulated by states; and a dummy variables that equals unity if states can impose a fine on center/family providers for failing to comply with regulations.

²⁴ Recent work by Adams et al. (2002) highlight many challenges faced by parents in retaining access to child care subsidies. For example, states' recertification process, which occurs at regular intervals (usually every six or 12 months), is a way for agencies to check employment and income eligibility status. However, a failure to recertify can leave families ineligible for subsidies. Furthermore, states require parents to notify agencies if there is a change in employment status, including a job loss or a change in hours worked. Some states offer a brief window of continued access to subsidies if parents lose their job (to facilitate a job search), but others move quickly to eliminate eligibility.

Table 6
Additional results and tests of robustness, fall of kindergarten.

	RTS	MTS	IPB	EPB	ATL	SC	IS	FMS	GMS
Baseline specification	-3.044* (1.629)	-2.565* (1.452)	0.981 (1.811)	0.736 (1.881)	-3.283* (1.723)	-3.050* (1.874)	-2.373 (1.810)	-0.074 (1.715)	-1.850 (1.809)
Family income below the CCDF eligibility threshold	-1.933 (1.476)	-1.417 (1.337)	3.587*** (1.745)	2.544 (1.829)	-2.606* (1.572)	-4.121** (1.762)	-2.559 (1.698)	-0.493 (1.493)	-3.859* (1.735)
Mothers with less than a B.A. degree	-3.142** (1.574)	-2.042 (1.403)	0.959 (1.778)	0.990 (1.849)	-2.903* (1.652)	-3.479* (1.821)	-1.939 (1.789)	0.078 (1.676)	-1.949 (1.799)
Family income above the CCDF eligibility threshold	-0.346 (1.940)	-1.614 (1.958)	-4.644* (2.429)	1.759 (2.502)	-0.270 (2.388)	-0.584 (2.349)	0.744 (2.350)	-2.027 (2.463)	2.647 (2.195)
Add control for whether home location was chosen b/c of school attributes	-2.949* (1.619)	-2.503* (1.448)	0.967 (1.803)	0.534 (1.875)	-3.286* (1.715)	-2.907 (1.859)	-2.296 (1.795)	-0.065 (1.707)	-1.737 (1.796)
Add controls for states' child care regulations	-3.544** (1.679)	-3.005** (1.495)	1.382 (1.841)	0.310 (1.939)	-3.921** (1.788)	-3.628* (1.923)	-3.169* (1.874)	-0.528 (1.777)	-2.447 (1.918)
Add controls for nonparental care, ages 0–2	-2.835* (1.629)	-2.324 (1.449)	0.945 (1.825)	0.743 (1.870)	-3.270* (1.719)	-3.159* (1.862)	-2.609 (1.807)	0.027 (1.700)	-1.960 (1.816)

Source: Authors' calculations from the ECLS-K Base Year Restricted Use Data File.

Notes: Each cell represents the coefficient on child care subsidy receipt derived from a TSLS regression of each child outcome on the subsidy dummy and the full set of child and family controls presented in Table 2, including the state and zip code controls. All models include dummy variables that equal unity for the child care and family controls with missing data. RTC: reading test score; MTC: math test score; IPB: internalizing problem behavior; EPB: externalizing problem behavior; ATL: approaches to learning; SC: self-control; IS: interpersonal skills; FMS: fine motor skills; GMS: gross motor skills. The model including states' child care regulations includes: center child-staff ratios for four-year-olds; family child-staff ratios for four-year-olds; center maximum group size for four-year-olds; family maximum group size for four-year-olds; a dummy variables that equals unity if center directors are required to have at least a BA degree; a dummy variables that equals unity if center/family child care staff are required to enroll in child development coursework; a dummy variables that equals unity if center/family staff are required to undergo a criminal background check; a dummy variables that equals unity if center/family indoor space is regulated by states; and a dummy variables that equals unity if states can impose a fine on center/family providers for failing to comply with regulations. Robust standard errors are in parentheses. Analyses are weighted using the ECLS-K Base Year Full Sample Parent Weight.

* Subsidy coefficient is statistically significant at 0.10 level.

** Subsidy coefficient is statistically significant at 0.05 level.

*** Subsidy coefficient is statistically significant at 0.01 level.

Table 7

Patterns of nonparental child care use for subsidy recipients and non-recipients in the years prior to kindergarten entry.

Characteristic	Full sample	Recipients	Non-recipients
<i>Child care use in the years prior to subsidy receipt</i>			
Began first nonparental arrangement at age <1	0.435	0.459	0.431
Began first nonparental arrangement at age 1	0.121	0.176	0.112***
Began first nonparental arrangement at age 2	0.104	0.108	0.103
Began first nonparental arrangement at age 3	0.143	0.149	0.141
<i>Child care use in the year of subsidy receipt</i>			
Months in child care (%)			
1–2 months	0.027	0.025	0.028
3–5 months	0.059	0.096	0.051***
6–8 months	0.126	0.140	0.124
9–12 months	0.784	0.737	0.793**
5+ days/week in child care (%)	0.764	0.823	0.751***
Hours/week in child care			
1–20 h	0.377	0.296	0.394***
21–39 h	0.262	0.285	0.257
40+ h	0.360	0.417	0.347***
Multiple child care arrangements (%)	0.433	0.567	0.408***

Source: Authors' calculations from the ECLS-K Base Year Restricted Use Data File.

Notes: Analyses are weighted using the ECLS-K Base Year Full Sample Parent Weight. Analyses are limited to children in nonparental child care arrangements (relative, non-relative, center-based, school-based, and Head Start) in the years prior to kindergarten entry. The percentages for children in multiple child care arrangements include children in Head Start. Center-based arrangements include daycare services, while school-based arrangements include pre-k, preschool, and nursery school. Non-relative care includes both in-home and out-of-home arrangements.

* Percentages for subsidy recipients and non-recipients are statistically significantly different at the 0.10 level.

** Percentages for subsidy recipients and non-recipients are statistically significantly different at the 0.05 level.

*** Percentages for subsidy recipients and non-recipients are statistically significantly different at the 0.01 level.

provides an overview of child care use in the years prior to subsidy receipt. Specifically, it shows the fraction of recipients and non-recipients beginning their first nonparental arrangement at a given age. It appears that the patterns of early child care use are similar for both groups of children. For example, about equal proportions of subsidized and unsubsidized children first participated in nonparental care before age one (46 percent versus 43 percent). A significantly greater fraction of recipients started care at age one, but the percentages are identical at each starting-age thereafter.

The story changes dramatically, however, for child care use in the year of subsidy receipt (bottom panel of Table 7). In particular, subsidized children participate in nonparental care more intensively than non-recipients. Recipients are more likely to use a nonparental arrangement at least five times per week (82 percent versus 75 percent), and are more likely to be in care at least 40 h per week (42 percent versus 35 percent). In addition, we find evidence that subsidized children receive less stable child care: a significantly greater share of subsidy recipients participates in multiple arrangements (57 percent versus 41 percent). Taken together, these data suggest that subsidy recipients participate in nonparental care child environments more intensively, but at the same time, these arrangements tend to be more unstable. Of course, greater intensity of child care use cannot by itself explain the poorer outcomes among subsidized children; the impact of exposure depends crucially on the quality of care. However, the ECLS-K data do not permit detailed comparisons of child care quality, so we turn to the literature to provide insights.

Recent empirical work finds that average child care quality in the U.S. is rated “minimal” or “good” according to structural (e.g., child-to-staff ratio, group size, and conformity with health and safety standards) and process (e.g., caregiver interactions and cognitive/language stimulation) measures of child care environments (Helburn et al., 1995; Mocan, 1997; NICHD, 2000a). Studies by the NICHD Early Child Care Research Network (2000a) estimate that 42 percent of preschool child care settings are “poor” or “fair” quality, and that positive caregiving is “highly characteristic” for only 12 percent of children. A review of child care settings by the National Research Council appears to corroborate this, finding that 10 percent to 20 percent of early care and education environments are “inadequate” and pose serious risks to child development (National Research Council & Institute of Medicine, 2000).

Although overall child care quality has been rated “good” at best, it is important for the purposes of this paper to discuss differences in purchased quality across low- and high-income families and subsidized and unsubsidized families. Studies comparing child care use across income groups find inconsistent differences in the quality of center-based care, with some research pointing to higher quality among low-income children (NICHD, 1997; Phillips, Voran, Kisker, Howes, & Whitebook, 1994) and others finding lower quality (Loeb et al., 2004; Marshall et al., 2001). Research by Dowsett, Huston, Imes, and Gennetian (2008) finds that structural measures of child care quality are about equal for low- and high-income children, but that poor children experience lower-quality care across several process-oriented measures, including

negative adult interactions and cognitive stimulation. The quality of family-based and relative care, however, is more consistently of lower quality among low-income children (Coley, Chase-Lansdale, & Li-Grining, 2001; Dowsett et al., 2008; Votruba-Drzal, Coley, & Chase-Lansdale, 2004).

A sizeable body of research compares purchased child care quality across subsidized and unsubsidized (low-income) children. Generally speaking, results from these studies imply that subsidized children receive lower-quality care (Adams, Roach, Riley, & Edie, 2001; Jones-Branch, Torquati, Raikes, & Edwards, 2004; Mocan, 2007; Queralt, Witte, & Greisinger, 2000; Raikes, Raikes, & Wilcox, 2005; Thornburg, Scott, & Mayfield, 2002; Whitebook et al., 2004; Witt, Queralt, & Witte, 2000). For example, recent work by Mocan (2007) finds that subsidy density within child care centers (or the fraction receiving subsidized care) is negatively associated with a number of quality indicators, such as the sensitivity of child-teacher interactions, the frequency and nature of parent-teacher interactions, availability of materials that facilitate imaginative and active play, and the level of daily supervision. These findings are corroborated by state-specific analyses. An examination of daycare centers in Nebraska, for example, finds that subsidy density is negatively correlated with overall quality, as well as teacher salary and measures of cognitive stimulation (Jones-Branch et al., 2004). Many of these quality differences are pronounced for children attending family-based care. A general finding in the literature is that subsidized providers are rated worse on both structural and process measures, especially caregiver education and sensitivity, staff turnover, and social interactions. Other researchers find that subsidized providers are also more likely to be out of compliance with state licensing standards (Queralt et al., 2000; Thornburg et al., 2002).

In sum, this discussion suggests that child care subsidies shift children into a formal market providing “minimal” or “good” quality services, with (unsubsidized) low-income and subsidized children experiencing even poorer-quality environments. These quality concerns cut across the range of formal child care options—including center-based care—but appear to be particularly applicable to family-based settings. Results from this body of work, in combination with the descriptive evidence presented in Table 6, paint a tentative picture about the mechanisms through which the negative subsidy effects are operating. Specifically, it is conceivable that subsidized children receive intense exposure to low-quality care through center- and family-based arrangements. Furthermore, given that subsidized children are more likely to participate in multiple arrangements, these quality deficits might grow larger as the number of child care settings increases. Our story for the role of child care quality is plausible in light our earlier finding that subsidized families are equally represented across most socioeconomic strata.

6. Conclusions

In recent years, child care subsidies have become an important policy instrument to help low-income parents

move from welfare into the paid labor force. Given that the current subsidy system strictly ties benefits to participation in work-related activities, parents are able to use subsidies to purchase child care services from any legally operating provider. However, there are few incentives or requirements within the CCDF that encourage parents and providers to make quality-enhancing investments. As a consequence, there are reasons to be concerned about the implications of child care subsidies for the well-being of children.

In this paper, we provide the first systematic assessment of the impact of the U.S. child care subsidy system on child development. Using a sample of ECLS-K children living with single mothers, we find consistent evidence that subsidies are associated with negative child outcomes. In particular, our results suggest that subsidy receipt in the year before kindergarten lowers reading and math test scores, decreases the eagerness to learn, and leads to more behavior problems in the fall of kindergarten. The negative subsidy effects for reading and math test scores persist to the spring of kindergarten, but many of the behavioral effects attenuate. Although far from definitive, we provide evidence that the intense exposure to low-quality child care could be responsible for the negative subsidy effects. This story seems plausible in light of the fact that subsidized families are no worse off economically than their unsubsidized counterparts.

Our investigation points to the necessity of aligning the employment goals established by recent social policy reforms with the goal of ensuring child health and well-being. One way to accomplish this is by decoupling the strong relationship between subsidy receipt and employment, or by giving parents and child care providers strong incentives to make quality investments. Based on the results of this study, policy changes directed at increasing the continuity of subsidized care would be beneficial, as would establishing reimbursements at a level high enough to allow parents to choose among high-quality providers in the community. Furthermore, the recent experience with pre-kindergarten in the U.S. may provide additional guidance on how to integrate child development goals into the subsidy system.

There are several possible directions for future research in this area. First, it is critical that researchers understand the mechanisms through which child care subsidies influence child well-being. Although we put forth a plausible story about the role of child care quality, additional work needs to verify whether this is the case. Future work should also attempt to understand the role of maternal employment, given that previous studies tend to find a negative relationship between early maternal work and child development. Second, it is important to determine whether certain child care arrangements are responsible for the negative subsidy effects. It is clear that subsidy recipients are more likely to participate in center- and family-based child care, making these arrangements a reasonable place to begin an investigation. Finally, it is important to explore heterogeneity in the impact of child care subsidies. Given that previous research on child care finds a differential response depending on child and family characteristics, one may

assume that such heterogeneity exists with respect to subsidies.

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Appendix A.

See Tables A1 and A2.

Table A1
Variation in local administration and rationing of child care subsidies.

State	Local/county administration	Local/county eligibility determination	County reimbursement rates	Wait list or frozen intake	Entitlement for TANF families
Alabama	•		•	•	
Alaska	•		•	•	•
Arizona			•		•
Arkansas	•		•	•	•
California	•		•	•	
Colorado	•	•	•		
Connecticut			•	•	
Delaware	•		•		•
Dist. of Col.					
Florida	•	•	•	•	
Georgia	•		•	•	
Hawaii					•
Idaho	•		•		
Illinois	•		•		
Indiana	•		•		•
Iowa	•				
Kansas	•		•		
Kentucky	•		•		•
Louisiana	•				
Maine	•		•	•	•
Maryland	•		•		
Massachusetts	•		•	•	
Michigan	•		•		
Minnesota	•		•	•	
Mississippi	•			•	
Missouri	•		•		
Montana	•		•		
Nebraska	•		•		
Nevada	•		•		•
New Hampshire					
New Jersey	•				
New Mexico	•		•		•
New York	•	•	•	•	•
North Carolina	•		•	•	
North Dakota	•				
Ohio	•		•		•
Oklahoma	•		•		
Oregon	•		•		
Pennsylvania	•		•		
Rhode Island					•
South Carolina			•	•	
South Dakota			•		
Tennessee	•		•	•	•
Texas	•	•	•	•	•
Utah	•				
Vermont	•				
Virginia	•	•	•	•	•
Washington	•		•		
West Virginia	•				
Wisconsin	•		•		
Wyoming	•				

Notes: Data in this table come from the following: (1) Schulman, K., Blank, H., & Ewan, D. (2001). *A fragile foundation: State child care assistance policies*. Washington, DC: The Children's Defense Fund and (2) U.S. Department of Health and Human Services, Administration for Children and Families, Child Care Bureau. (2002). *Child care and development fund: Report of state plans FY2002–2003*. Most of these figures reflect state policies in 2000. The data on county reimbursement rates reflect county-level variation and regional (which typically includes groups of counties) variation. As of 2000, two states (Connecticut and South Carolina) had frozen intake for subsidies.

Table A2

Results from the first-stage child care subsidy receipt equation.

Variable	Coefficient	Standard error
Child's age	−0.002	0.002
Boy	0.006	0.015
Black	0.042*	0.024
Hispanic	0.031	0.028
Asian	−0.033	0.042
Other race/ethnicity	0.090**	0.045
Weight	0.002***	0.001
Premature birth	0.034	0.022
Low birth weight	−0.061**	0.030
Disabled	0.017	0.022
First-time kindergartner	−0.016	0.036
One sibling	0.011	0.018
Two or more siblings	0.042**	0.021
Mother's age	0.006	0.012
(Mother's age) ²	−0.013	0.017
Mother was teen at first birth	0.009	0.020
Mother's education: HS/GED	0.103***	0.023
Mother's education: some college	0.131***	0.027
Mother's education: BA+	0.152***	0.036
Father's education: HS/GED	0.027	0.022
Father's education: some college	0.003	0.027
Father's education: BA+	−0.050*	0.028
WIC participant	0.090***	0.016
Food stamp recipient	0.117***	0.020
ln(total family income)	−0.002	0.005
Primary home language is English	−0.016	0.032
Children's books in home	0.000	0.001
(Children's books in home) ²	0.000	0.000
Children's tapes/CDs in home	0.001	0.001
(Children's tapes/CDs in home) ²	0.000	0.000
Parent expects some college for child	0.048*	0.029
Parent expects BA for child	0.033	0.024
Parent expects post-BA for child	0.024	0.025
Southern residence	−0.103	0.155
Constant	2.289**	0.937
Zip code controls	Yes	
State policy controls	Yes	
County fixed effects (IV)	Yes	
Number of observations	2795	
Partial R ²	0.105	
F-statistic on the IVs (p-value)	25.20 (<0.01)	

Source: Authors' calculations from the ECLS-K Base Year Restricted Use Data File.

Notes: Analyses are weighted using the ECLS-K Base Year Full Sample Parent Weight. Also included in the model are dummy variables that equal unity for each variable with missing data. Not shown here are the coefficients on the zip code, state policy, and county fixed effects, which are the identifying instruments.

* Coefficient is statistically significant at 0.10 level.

** Coefficient is statistically significant at 0.05 level.

*** Coefficient is statistically significant at 0.01 level.

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