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ABSTRACT

The Impact of Child Care Subsidies on Child Well-Being: Evidence from Geographic Variation in the Distance to Social Service Agencies*

In recent years, child care subsidies have become an integral part of federal and state efforts to move economically disadvantaged parents from welfare to work. Although previous empirical studies consistently show that these employment-related subsidies raise work levels among this group, little is known about the impact of subsidy receipt on child well-being. In this paper, we identify the causal effect of child care subsidies on child development by exploiting geographic variation in the distance that families must travel from home in order to reach the nearest social service agency that administers the subsidy application process. Using data from the Kindergarten cohort of the Early Childhood Longitudinal Study, our instrumental variables estimates suggest that children receiving subsidized care in the year before kindergarten score lower on tests of cognitive ability and reveal more behavior problems throughout kindergarten. However, these negative effects largely disappear by the time children reach the end of third grade. Our results point to an unintended consequence of a child care subsidy regime that conditions eligibility on parental employment and deemphasizes child care quality.

JEL Classification: I18, I2, J13

Keywords: child care, subsidy, development

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I. Introduction

Child care subsidies are increasingly used by state and local governments to facilitate employment and reduce welfare use among economically disadvantaged families. Most public expenditures on child care assistance are funneled through the federal Child Care and Development Fund (CCDF), which was created alongside welfare reform in 1996. Consistent with the explicit goal of welfare reform, CCDF funds are targeted primarily at low-income families participating in a state-defined work activity. As such, these employment-related subsidies are intended to defray only those child care expenses accrued during work hours, and they maximize parental choice by placing few restrictions on the quality of care that can be purchased (Adams & Rohacek, 2002; Adams et al., 2007; Blau, 2001; 2003). Such design features highlight a longstanding tension between the twin objectives of child care policy in the U.S.: facilitating parental employment and ensuring that children have access to safe and stimulating early care environments.

The existing empirical evidence confirms that child care subsidies administered through the CCDF encourage low-skilled parents to move from welfare to work (Blau & Tekin, 2007; Herbst, 2010; Tekin, 2005; 2007). Yet researchers have paid little attention to the potential impact of these work-related subsidies on children's well-being. Most of what is currently known about the developmental effects of subsidized child care comes from international studies of the Canadian (Baker et al., 2008), Danish (Gupta & Simonsen, 2010), and Norwegian (Havnes & Mogstad, 2010) regimes. In contrast, there is an extensive literature on publicly subsidized early education programs such as Head Start and state pre-kindergarten as well as the model programs Perry Preschool and Abecedarian (e.g., Barnett, 1995; Berlinski et al., 2008; 2009; Currie & Thomas, 1995; Fitzpatrick, 2008; Garces et al., 2002; Gormley & Gayer, 2005; Karoly et al., 2005; Ludwig & Miller, 2007; Ramey et al., 2000).[2]

Although it is tempting to draw conclusions about the impact of child care subsidies from the

[2] See Blau and Currie (2006) for a thorough summary of this literature.

largely positive results generated by early education interventions, there are reasons to doubt their comparability. Head Start and pre-kindergarten are explicitly designed to promote school readiness by setting relatively high quality standards and offering children educational services. Head Start, in particular, is regarded as a "two generation" program that offers bundles of services (e.g., nutrition, social services, and mental health services) to children as well as parents. Subsidized child care, in contrast, currently operates as a labor market policy that encourages parental employment by reducing the costs associated with child care services. In fact, unlike early education programs, eligibility for subsidies is conditioned on parental involvement in work-related activities. Moreover, a key feature of the CCDF is the principle of "parental choice," in which parents may take their subsidy to any legally-operating child care provider. Although this design feature increases flexibility for working parents, it also means that children may be exposed to low-quality care.

To our knowledge, only two studies provide direct evidence on the relationship between CCDF child care subsidies and children's well-being. Using data from the Kindergarten cohort of the Early Childhood Longitudinal Study (ECLS-K), Herbst and Tekin (2010a) find that child care subsidy receipt in the year before kindergarten is associated with negative cognitive and behavioral outcomes at kindergarten entry. In a related paper, the same authors examine children's weight outcomes throughout kindergarten and find that subsidized children are more likely to be overweight and obese (Herbst & Tekin, 2010b). While these studies provide an initial picture of the developmental effects of child care subsidies, they fall short of establishing a causal relationship because of remaining concerns over the potential endogeneity of subsidy receipt. Furthermore, both studies focus on the immediate impact of subsidies, ignoring the possibility that these benefits continue to influence child well-being throughout the school-age years.

In this paper, we provide new evidence on the impact of child care subsidy receipt on children's cognitive, behavioral, and psychomotor outcomes. Our paper contributes to the child care literature in several ways. First, very little is known about the potential consequences of child care

policy reforms that are designed to interact with parents' employment decisions. Given that the welfare reform law is scheduled to be reauthorized in 2010, our results may have important policy implications. Furthermore, the evidence to date focuses exclusively on short-term measures of child well-being. In this study, we reexamine the ECLS-K, exploiting its longitudinal design to examine the trajectory of child development over the first five years of children's school experiences.

Finally, we pay careful attention to providing causal estimates by leveraging plausibly exogenous variation in subsidy utilization through a novel instrumental variable. Finding exogenous sources of variation in child care costs and related policy reforms presents challenges for studying maternal and child outcomes. In fact, identification problems are commonly cited as being primarily responsible for the diversity of empirical estimates documented throughout the child care literature (e.g., Anderson & Levine, 2000; Bernal & Keane, 2009). In this study, we identify the impact of subsidy receipt by exploiting geographic variation in the *distance* that low-income families must travel from home in order to reach the nearest social service agency that administers the subsidy application process. To implement our empirical strategy, we collected information on the precise location of virtually every public social service agency in the U.S., used these addresses to generate geocodes for each agency, and then calculated the distance between these administrative offices and the residential location of families in our data. Instrumenting for subsidies using our distance measure is conceptually equivalent to comparing the developmental outcomes of children who differ in their propensity to receive subsidized care because they reside various distances from social service agencies.[3]

We develop and test a simple theoretical model in which employment-related child care subsidies do not directly influence child well-being. Rather, we show that subsidy receipt operates indirectly through three primary channels in the child production function. First, child care subsidies

[3] The distance database we construct is also a potentially valuable tool for researchers examining the effects of child care subsidies on other relevant outcomes such as maternal employment.

encourage maternal employment, which has been shown by previous work to have implications for child well-being. In particular, the most recent studies suggest that early maternal work is associated with small, negative effects on early and later cognitive ability (Baum, 2002; Bernal, 2008; Brooks-Gunn et al., 2002; James-Burdumy, 2005; Liu et al., 2003; Ruhm, 2004; 2008), increases in a number of adverse health outcomes (Morrill, 2009), and increases in childhood obesity (Anderson et al., 2003).[4] Second, subsidies increase the use of non-parental child care services, especially center- and family-based care, which is shown to have conflicting effects on child well-being (Bernal & Keane, 2008; Blau, 1999; NICHD, 2003a; 2003b). However, there is an emerging consensus that high-quality care is beneficial for disadvantaged children (Hill et al., 2002; NICHD & Duncan, 2003). Finally, subsidies can influence child well-being through increases in parental income, which could be spent on goods and services that enhance child quality. The existing evidence suggests that the effect of income on child well-being is small (Blau, 1999; Korenman et al., 1995). In sum, the overall impact of child care subsidy receipt is theoretically ambiguous.

Using data from the Kindergarten cohort of the Early Childhood Longitudinal Study (ECLS-K), we apply our instrumental variables strategy to examine the short- and long-term impact of receiving subsidized child care in the year before kindergarten entry. Our results point to sizeable negative impacts on cognitive ability tests and teacher-reported behavioral measures in the fall and spring of kindergarten. For example, our estimates suggest that subsidized children score 0.4 and 0.3 standard deviations lower on tests of reading and math ability, respectively. However, these negative effects begin to fade by the end of first grade and are completely attenuated by the end of fifth grade. Interestingly, we find robust evidence that the adverse effects of subsidy receipt are concentrated among children of high-skilled mothers.

[4] The literature on the effect of maternal employment has generally produced mixed results. Bernal and Keane (2009) summarize the results from this literature and conclude that about one-third of the studies report negative effects and another one-third report positive effects, with the remainder documenting effects that are either insignificant or that vary by the sub-group analyzed or the timing of the inputs. It is important to note, however, that several recent papers, which attempt to address the endogeneity of maternal employment, consistently find negative effects (Bernal, 2007; Bernal & Keane, 2009; James-Burdummy, 2005; Liu et al., 2010).

II. Introduction to the CCDF and Its Implications for Child Development

As previously stated, the CCDF was created alongside the passage of the 1996 Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA). Overall, welfare reform legislation allocated $21 billion for child care assistance over the first seven years, 70 percent of which was earmarked to subsidize child care costs for families receiving welfare or transitioning into work (Greenberg et al., 2000). In 2007, approximately $10.2 billion was spent through the CCDF, providing subsidies to 1.7 million children per month (Child Care Bureau, 2007). In comparison, Head Start in 2005 served 906,993 children, with expenditures totaling $6.8 billion, and state pre-kindergarten programs enrolled 801,902 children at a cost of $2.8 billion (NIEER, 2005). Thus, expenditures on and recipients of CCDF child care subsidies exceed those of other early care and education programs.

In order to qualify for a subsidy, families must have at least one child under age 13, have an income below 85 percent of the state median income, and be employed or participate in a state-defined work-related activity (e.g., education, job search, or job training). Subsidized child care is available to eligible families largely through vouchers and contracts with providers. In 2007, 86 percent and 10 percent of children were served by vouchers and contracts, respectively, while the remainder were served by cash (Child Care Bureau, 2007). States are given substantial latitude to establish key program parameters, including income eligibility thresholds, benefit reimbursement rates, and co-payment rates. Market rate surveys are conducted periodically to ensure that recipient families have "equal access" to high-quality providers, defined as reimbursements that cover 75 percent of the local child care price distribution and copayments that do not exceed 10 percent of family income (Greenberg et al., 2000).

States are able to use CCDF funds in a variety of ways to directly influence child care quality within the market. For example, states are required to spend a minimum of four percent of the annual CCDF allocation to support such initiatives as teacher training and education, improvements

to health and safety conditions, and establishing quality rating systems. However, there is substantial variation in quality-related expenditures across the states, with some jurisdictions spending over 10 percent of its total on these initiatives (nine states) and others spending just below the four percent minimum (13 states). Overall, quality expenditures comprise about six percent of CCDF spending, while direct service provision accounts for 82 percent (Child Care Bureau, 2007).

In addition, several features of the CCDF may indirectly influence the quality of care purchased by parents. Perhaps the most important design feature is the principle of "parental choice," in which parents may utilize subsidies to purchase most legally-operating child care services, including unregulated relatives and in-home caregivers. The increased flexibility through "parental choice" enables parents to quickly transition into employment, but it raises concerns over whether subsidized children enroll in high-quality child care environments. Without strong quality restrictions, for example, it is plausible that parental decision-making is instead guided by a range of other factors, including personal biases and cultural expectations, word-of-mouth recommendations, and convenience (Pungello & Kurtz-Costes, 1999). Furthermore, previous research finds that parents allocate little time to the child care search (Walker, 1991), consistently overestimate the quality of their children's arrangements (Cryer & Buchinal, 1997), and are unable to distinguish low- from high-quality services (Mocan, 2007). These information asymmetries therefore interact with certain features of the CCDF to discourage low-income parents from purchasing high-quality care, which may ultimately undermine child well-being.

The CCDF also creates quality challenges on the supply-side of the market. For example, by mandating only minimum quality standards, the CCDF reduces the incentive for providers to invest in costly quality improvements that promote child development. In addition, conditioning subsidy eligibility on parental employment further discourages providers from offering high-quality services. 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. The

volatility associated with serving subsidized children prevents child care providers from making long-term quality investments (Adams & Rohacek, 2002; Adams et al., 2007). Frequent changes in eligibility due to changes in parental work status or earnings can also increase instability for children.[5] Indeed, Ha (2009) provides evidence that parents cycle on-and-off the child care subsidy rolls, with 50 percent of first spells ending within six months (Ha, 2009). If accompanied by frequent changes in child care arrangements, these interruptions could have adverse effects on child well-being (Huston et al., 2002; Loeb et al., 2004; Shonkoff & Phillips, 2000; Tran & Weinraub, 2006).[6] A final supply-side constraint is created by states' reimbursement-rate policies. It is only a recommendation that subsidy reimbursements be set at the 75th percentile of the local price distribution, leaving states with considerable flexibility to set lower benefit rates. In fact, only nine states in 2007 abided by the federal recommendation (Schulman & Blank, 2007). Low reimbursement rates limit parental access to high-quality early care environments and intensify resource constraints among providers.

Beyond these child care constrains, the type and quality of parental employment obtained through child care subsidies may also have implications for child well-being. For example, previous studies find that parents receiving subsidies typically work in low-wage occupations that offer few training opportunities (e.g., Okuyama & Weber, 2001). Indeed, studies produce mixed evidence on the impact of subsidy receipt on earnings (e.g., Berger & Black, 1992; Danziger et al., 2004). Furthermore, the loss of government-provided health insurance is commonly cited in studies of welfare leavers (Loprest, 1999). Therefore, it is possible that the employment effects of child care subsidies lead to dramatic changes in the home environment—ranging from increased parental stress

[5] Ha and Meyer (2009) find that job separation accounts for many of the exists from the subsidy rolls.

[6] Ha (2009) finds that among children beginning another subsidy spell, 61 percent do so with a different child care provider. Even while receiving subsidized care, children have an average of three providers over a 12-month subsidized period (Weber, 2005). A survey of welfare mothers from California finds that recipients identify payment policies and practices in the subsidy system as negatively affecting affordability, availability, and access to high-quality child care (Pearlmutter & Bartle, 2003). A growing body of research compares child care quality across subsidized and unsubsidized (low-income) children. Results from these studies generally find that subsidized children receive lower-quality care (Adams et al., 2001; Jones-Branch et al., 2004; Mocan, 2007; Raikes et al., 2005; Queralt et al., 2000; Thornburg et al., 2002; Whitebook et al., 2004; Witt et al., 2000).

and anxiety to the loss of other policy supports—without an offsetting increase in material well-being.

III. Data Description

The dataset used in this paper is the Early Childhood Longitudinal Study, Kindergarten Cohort (ECLS-K), a nationally representative survey of 21,260 children entering kindergarten in the fall of 1998. Children in 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. More than 20 children per school from over 1,200 public and private schools are included in the sample.

Analyses in this study are based primarily on the fall of kindergarten wave of data collection, in which child cognitive and behavioral assessments were conducted and parents were asked about child care subsidy receipt in the year prior to kindergarten entry. We also exploit the longitudinal design of the ECLS-K and examine child outcomes in the spring of kindergarten and the spring of 1st, 3rd, and 5th grades.[7] Our analysis sample retains children living with an unmarried biological mother or female guardian (related and unrelated) as of the fall of kindergarten.[8] We focus on unmarried mothers because this group constitutes approximately two-thirds of eligible subsidy recipients (Herbst, 2008). Exclusions from the sample are made if the child is missing information on all outcome variables (1,766) or the entire fall of kindergarten parent interview (740), the questions regarding child care subsidy receipt (35), and census tract identifiers (2,256). We exclude an additional 12,607 children who do not meet our requirements for residence with an unmarried mother.[9] The resulting analysis sample includes 3,848 children.

We begin by exploring the impact of child care subsidy receipt on nine child outcomes

[7] Behavioral assessments were not administered in the spring of 8th grade. The psychomotor skills assessments (fine and gross motor skills) were administered only in the fall of kindergarten.

[8] In particular, children in our sample live with (1) a biological mother only, (2) a biological mother and a partner "father," (3) an unmarried adoptive mother who may or may not be living with a partner "father," and (4) or an unrelated, unmarried guardian who may or may not be living with a partner "father."

[9] Additional deletions are made because the mother reported a nonsensical age (6), or information from parent interview could not be merged with the geographic variables (2).

measured in the fall of kindergarten. Tests of reading and math ability comprise the outcomes in the cognitive domain.[10] The reading test measures language and literacy skills, including print familiarity, letter recognition, beginning and ending sounds, vocabulary, and reading comprehension. The math test evaluates 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. For ease of interpretation, T-scores are scaled to have a mean of 50 and a standard deviation of 10. Effect sizes are derived by dividing all parameter estimates by 10.

In addition to the overall cognitive assessments, we examine subject-area proficiency scores in reading and math. Such measures are useful for understanding performance in domain-specific content areas. In particular, we analyze five increasingly difficult reading and math domains through proficiency probability scores, which use the individual test score items to provide a measure of the likelihood that a given child has mastered each skill set. In the reading domain, we analyze proficiency scores for letter recognition, beginning sounds, ending sounds, word recognition, and word comprehension. In the math domain, we explore numbers and shapes, relative sizes, ordinality, addition and subtraction, and multiplication and division.

In the behavioral domain, we explore teachers' subjective reports of children's externalizing behavior problems, internalizing behavior problems, approaches to learning, self-control, and interpersonal skills. The externalizing behavior scale inquires about the frequency of acting out behaviors, including arguing, fighting, anger, and impulsive behavior. The internalizing behavior scale asks about the frequency with which children display anxiety, loneliness, low self-esteem, and sadness. The approaches to learning scale measures behavior reflecting the ease children display in

[10] 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 used to create the ECLS-K measures.

the learning environment, including attentiveness, task persistence, and eagerness to learn. 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. 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. 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.

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.

The primary right-hand-side variable in this analysis is a measure of child care subsidy receipt, defined as a binary indicator that equals unity if a given child received subsidized, non-parental child care in the year prior to kindergarten. During the fall of kindergarten interview, parents were asked about non-parental child care arrangements utilized throughout the previous 12 months. For each arrangement, a set of follow-up questions were then directed at parents to ascertain whether any help was received in paying for child care expenses. Specifically, 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.[11] Thirteen percent of children in our analysis sample are coded as receiving a child care subsidy. This figure is consistent with the U.S. Department of Health and Human Services' finding that 12 percent to 15 percent of eligible families received a CCDF subsidy around the same period (U.S. DHHS, 1999).[12]

Also included in the production function are several exogenous determinants of child well-being, including the child's gender, age (months), race and ethnicity (four dummy variables), weight in the fall of kindergarten (pounds), and dummy variables for premature birth, low birth weight, fair or poor health status, and first-time kindergartner. Maternal characteristics include age at the fall of kindergarten (years), educational attainment (three dummy variables), number of other children in the family (two dummy variables), a dummy variable to indicate whether English is the primary home language, log of family income, and a dummy variable indicating urban residence. In addition, we account for the neighborhood environment by adding census tract- and school-level controls for the log median household income, log of population density, percent non-Hispanic white, percent foreign born, percent ages 65 and over, percent female, percent of children ages 0-2, 3-5, 6-11, 12-13, 14, and 15-17 living in female-headed households, percent of children in the school eligible for free or reduced price lunch, a dummy variable indicating whether a majority of children in the school are minorities, and a dummy variable indicating whether the school receives Title I funding. Finally, our fullest specification incorporates state fixed effects.[13]

Summary statistics for the child and maternal variables are presented in Appendix Table 1. Subsidized children are more likely to be black and in fair or poor health than their unsubsidized counterparts. Such children also reside in families with lower incomes. It is somewhat surprising,

[11] Local social service agencies and welfare offices are typically the entities responsible for administering CCDF child care subsidies in the U.S. The Child and Dependent Care Credit is another employment-related benefit intended to defray families' child care expenses. However, this program is a federal tax credit and is not administered by local social service agencies.

[12] The subsidy question in the ECLS-K is similar to those in several other nationally representative surveys (e.g., National Survey of America's Families and the Survey of Income and Program Participation). The rates of child care subsidy receipt calculated by researchers using the NSAF match our ECLS-K estimate. For example, Tekin (2007) calculates a participation rate of 11.6 percent for a sample of single mothers, and Herbst (2008) estimates a take-up rate of 13.9 percent, also from a sample of single mothers.

[13] We create dummy variables that equal unity for observations with missing data on the explanatory variables.

therefore, that subsidized children are less likely to be born prematurely and deemed low birth weight. Moreover, mothers of subsidized children are less likely to be high school drop-outs and more likely to have some college education. These conflicting results imply that subsidy utilization is a complex phenomenon that likely reflects parental tastes for work and child care as well as state-specific practices to systematically ration benefits. Consistent with this, we find that mothers receiving a subsidy are more likely to be employment (79 percent compared to 72 percent) and make greater use of center-based care for their children (39 percent compared to 10 percent). Furthermore, the positive association between maternal education and subsidy receipt might reflect the skills and motivation necessary to navigate the complex application and recertification process (Blau & Tekin, 2007). It could also be an indication of local administrators' preferences for higher-skilled mothers, who might find employment more rapidly than those drawn from the bottom of the skill distribution.

IV. Theoretical Model and Econometric Framework

Child Care Subsidies and the Production of Child Well-Being

The conceptual framework for our analysis is based on the economic model of the family developed by Becker (1981), in which households combine time and market resources to maximize a utility function. In our case, a household receives utility from the mother's leisure (L), a vector of consumption goods (X), and child quality (Q) according to the function

(1) $U = U(Q, L, X, Z, \varepsilon)$,

where Z and ε are observed and unobserved determinants of preferences, respectively. A *i* subscript for the i^{th} single mother is suppressed for clarity.

Child quality can be modeled as a production function determined by the quality of maternal care (Q_M), the quality of market care (Q_C), and purchased goods related to child quality (G):

(2) $Q = Q(Q_M(H, J), Q_C(C, s(dc)), G(I))$.

As shown in (2), the quality of maternal care is a function of the mother's hours of work (H) and hours of maternal care (J); the quality of market care is a function of hours of market care (C)

and child care subsidy receipt (s); and the quantity of purchased goods is determined by the mother's total income (I).[14] In this model, we assume that subsidy receipt is a function of the distance (d_c) that a mother travels to reach the nearest social service agency that administers the subsidy program in her county of residence. Below we elaborate further on role of travel distance in determining household behavior. Note that G captures the additional consumption that occurs when subsidized families spend less on purchasing child care services. In addition, while G can be beneficial for child quality (e.g., books, cognitively stimulating toys, and fresh fruits/vegetables), it can also be potentially harmful (e.g., video games and fast food).

In principle, the impact of all inputs in (2) can be period-specific and can vary over the child's life (Ruhm, 2004). It is possible, for example, that children have multiple subsidy receipt spells prior to kindergarten entry, and that each spell differentially affects child well-being over time. Data restrictions preclude a fully specified child production function, so we instead focus on a contemporaneous representation, which yields the impact of each input in the current period combined with those in previous periods. Therefore, s should be interpreted as commingling the contemporaneous and lagged effects of child care subsidy receipt.

The mother's time constraint is

(3) $T = H + L + J$

and the child's time constraint is

(4) $T = C + J.$[15]

The household's budget constraint is the following

(5) $wH + Y = C(p_c - s(d_c)\, p_s) + p_g G + p_x X,$

[14] In principle, we can distinguish between the quality of various types of market care such as center-based care, relative care, and family home care. Since we do not model the process by which the choice of a particular type of care is affected by child care subsidy receipt, we do not make such a distinction.

[15] We assume that the total time available to a mother and child is identical. However, relaxing this assumption would not change any of the implications.

where p_c , p_g, and p_x are the prices of market care, purchased goods related to child quality, and other consumption goods, respectively. The p_s is the hourly equivalent of child care subsidy benefits if the household is eligible for and receives them; w is the mother's hourly wage rate; and Y is non-labor income. It is further assumed that $\partial Q/\partial Q_M>0$ and $\partial Q/\partial Q_C>0$. The effect of G on child quality depends on the extent to which the mother uses I to purchase goods that enhance child quality or goods that might hamper it. Therefore, $\partial Q /\partial G$ is ambiguous.

As the model shows, subsidy receipt can influence child well-being through three channels. First, it enters directly into the quality of market care. This is due to the aforementioned design features embedded in the CCDF that have implications for child care quality. Such characteristics are likely to have negative effects on child care quality, although we do not constrain the relationship between Q_C and s to be negative (i.e., $\partial Q_C/\partial s<0$) *a priori*. Second, the quality of maternal care is influenced by the mix of time spent in the labor market and time engaged in maternal care. Given that eligibility for child care subsidies is conditioned on employment, subsidy receipt should lead to an increase in labor market time and a decrease in the amount of time allocated to maternal care. Assuming that hours of maternal care is positively related to the quality of maternal care (i.e., $\partial Q_M/\partial J>0$) and hours of work is negatively related to maternal quality (i.e., $\partial Q_M /\partial H < 0$), a subsidy should have a negative effect on the quality of maternal care among non-working mothers. This relationship is unclear for mothers already in the labor force because subsidy receipt is predicted to have complicated employment effects at the intensive margin (i.e., hours of work) due to opposing income and substitution effects. However, it is unlikely that an employed mother would significantly alter her work effort after starting to use subsidized child care in light of the work requirements tied to these benefits. Therefore, the net effect of subsidy receipt on the quality of maternal care is anticipated to be negative. Finally, a child care subsidy can reduce expenditures on child care, thereby freeing up resources to increase consumption in other areas. However, as noted above, the effect of G on child quality is ambiguous. In sum, the overall impact of child care subsidies on child

well-being is ambiguous and therefore an empirical question.

The mother maximizes utility subject to the child quality production function and budget and time constraints. This optimization problem is solved to yield a reduced form quality demand function that depends on subsidy receipt (s), all prices, the mother's wage rate, non-labor income, exogenous production shifters (Z), and unobserved components of productivity and preferences. The production function can be formalized with the following equation:

(6) $Q = \alpha_0 + \alpha_1 s + Z\alpha_2 + \alpha_3 Y + \sum_k \alpha_k p_k + \varepsilon,$

where k = {c, g, x, and s}. The coefficient of interest is α_1, the impact of subsidy receipt on child well-being. There are a number of obstacles associated with estimating (6). Since labor market earnings is one of the predicted channels through which subsidies can influence measures of Q, a model including hourly wages would no longer be reduced form and would complicate the interpretation of α_1. Furthermore, hourly wages is potentially endogenous. Therefore, we substitute its exogenous determinants (e.g., age, race, and education) in the production function. Another complication stems from data limitations in the ECLS-K that prevent us from calculating child care expenditures and subsidy reimbursements, both of which are likely to be endogenous. These inputs to child well-being are assumed to be a function of child care quality, states' child care policy parameters, and the observable characteristics of children and parents (Tekin, 2007). We capture these inputs by substituting their exogenous family determinants and including detailed controls for the neighborhood environment. Finally, state fixed effects are added to account for states' subsidy policies as well as unobserved time-invariant determinants of child well-being that are correlated with subsidy receipt. This results in the following fully reduced form empirical model:

(7) $Q = \delta_0 + \delta_1 s + H\delta_2 + N\delta_3 + \sum_j \delta_j + \nu,$

where H is a vector of exogenous child and maternal determinants of child well-being; N represents a vector of neighborhood attributes; $\sum_j \delta_j$ is a set of state fixed effects; and ν is an idiosyncratic error term. It is important to note that (7) yields an estimate of the *overall* impact of child care subsidy

receipt that commingles the three channels through which subsidies may influence child well-being (i.e., child care quality, maternal time, and consumption). This is consistent with the main goal of the paper.

Estimating (7) with ordinary least squares (OLS) will yield an unbiased estimate of the impact of child care subsidies only if the unobserved determinants of child well-being are uncorrelated with subsidy receipt. This assumption is unlikely to hold in practice because parental decisions regarding work and child care are not the result of random processes (Tekin, 2007). For example, highly motivated mothers or those with strong work preferences may be more likely to request child care assistance. Since labor force participation is one of the channels through which subsidies can influence child well-being, failing to control for maternal motivation and preferences may produce a biased estimate of δ_1. Another selection mechanism deals with the possibility that mothers take children's cognitive ability and temperament 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. Finally, it is possible that subsidy administrators systematically ration child care benefits according to specific household characteristics. For example, administrators might target the least employable mothers in order to ease their transition into the labor market. Alternatively, case workers may give priority to higher-skilled mothers, thereby generating the greatest "return on investment" and allowing states to meet work participation targets.[16] These possibilities suggest that subsidy receipt is correlated with unobserved family and program characteristics. Therefore, we are concerned that estimating (7) with OLS will yield biased estimates of δ_1.[17]

Identification Strategy

[16] Our conversations with local CCDF administrators confirm that both practices are common.
[17] Another reason for bias in the estimate for the effect of subsidy receipt from OLS is potential measurement error in the reporting of subsidy receipt.

In the absence of a research design that randomly distributes child care subsidies to single mothers, we rely on a novel instrumental variable to generate quasi-experimental variation in child care subsidy receipt. To produce consistent estimates of the impact of subsidy receipt using instrumental variables, we need at least one variable that is correlated with subsidy utilization but uncorrelated with measures of child well-being except through its relationship with subsidy receipt. Our proposed instrument is based on the *distance* that families must travel from home in order to reach the nearest social service agency that administers the subsidy application process. The plausibility of this instrument rests in part on the assumption that families living in an area with an agency nearby face lower costs of obtaining a subsidy. It is therefore hypothesized that an inverse relationship exists between the likelihood of subsidy utilization and the distance between home and the closest social service agency. Furthermore, as outlined in the behavioral model, it is plausible that mothers' travel distance to an agency influences work and child care decisions only through its impact on subsidy utilization and should not directly influence child well-being.

To implement this strategy, we began by creating a database containing the precise location (building number, street name, city, state, and zip code) of virtually every social service agency in the U.S. In doing so, we were careful to ensure that a given agency is involved in eligibility and benefit determination for CCDF child care subsidies. Our database contains location information on over 3,600 social service agencies. The next step in the process involved geocoding the location of administrative offices by assigning a latitude and longitude coordinate to each. In the final step, we calculated the Euclidean (or as-the-crow-flies) distance (in miles) between the location of social service agencies and the centroid (or geographic center) of the census tract in which ECLS-K families reside. We generate the distance measure based on families' census tract because residential addresses are not available in the ECLS-K. Furthermore, given that states' child care subsidy programs are administered primarily at the county-level, we use families' county of residence as the

geographic boundary for calculating the distances.[18] Appendix A provides a detailed description of the steps taken to construct the agency database and distance measure.

There are several reasons to expect that the geographic accessibility of social service agencies influences the costs and benefits associated with subsidy participation.[19] First, it has been well-documented that low-income families already face substantial work- and child care-related costs because of the limitations of public transportation systems and low car ownership rates (Allard, 2009; Berube & Raphael, 2005; Ong, 2002). Edin & Lein (1997) estimate that single mothers' work commutes sum to an average of 10 hours per week, with another study finding that mothers' daily trip from home to the child care provider adds 28 percent more time to the total commute (Michelson, 1985). It is therefore not surprising that low-income working mothers stress the importance of locating child care services close to home or work (Henly & Lyons, 2000).[20] These preferences appear to translate in practice: a study of child care subsidy recipients in Cuyahoga County, Ohio finds that such families travel only two miles to center-based providers and 1.5 miles to family daycare homes (Bania et al., 2000).

Further intuition for a relationship between the distance measure and subsidy receipt is developed by examining states' policies regarding the subsidy application and recertification process. Generally speaking, proximity to a social service agency can impact utilization during multiple stages of a family's interaction with the subsidy system (Herbst & Tekin, 2010c). In particular, most parents are required to make one or more personal visits to an agency to conduct the initial in-take

[18] Approximately one-third of single mothers in our sample have access to two or more social service agencies in their county of residence. In those cases, our measure is defined such that the minimum distance is assigned to a given single mother. In robustness checks, we test an alternate distance measure that makes more explicit use of the presence of multiple agencies.

[19] Previous research consistently finds that measures of geographic accessibility are strongly associated with participation in other social services and means-tested programs. For example, Allard et al. (2003) show that greater spatial proximity to social service providers increases the probability that welfare recipients receive these services. Neidell & Waldfogel (2009) analyze the impact of local Head Start availability on immigrant children's participation. The authors find that having a Head Start center in a child's census tract significantly increases the likelihood of enrollment. It has also been shown that the distance to medical care facilities is negatively correlated with health care utilization (e.g., Nemet & Bailey, 2000) and treatment intensity for acute myocardial infarction (McClellan et al., 1994). Geographic variation in proximity to college campuses during childhood appears to be highly correlated with later college attendance (Card, 1995).

[20] Another study finds that nearly 70 percent of low-income parents rate "conveniently located services" as very important to their child care decisions, compared to 50 percent among high-income parents (U.S Department of Education, 1995).

and eligibility screening.[21] The number of office visits largely depends on state-specific rules governing the stringency of income and employment documentation and the extent to which families require assistance locating suitable child care providers. In addition, parents in many jurisdictions are required to report in-person all changes to employment and income. This can be particularly challenging for low-income parents, who tend to have less access to automobile transportation and are more likely to experience frequent job turnover, seasonal or irregular work hours, and highly volatile earnings. Finally, policies regarding eligibility recertification require parents to make multiple trips to the local social service agency. In particular, the time-limited nature of child care subsidies—usually lasting three to 12 months—implies that parents need to restart the eligibility process every few months or risk benefit termination.

Empirically, previous work by Herbst and Tekin (2010c) uses the ECLS-K to provide direct evidence on the relationship between the distance to social service agencies and subsidy utilization. Results suggest that increases in the travel distance (in miles) reduce the likelihood that a potentially eligible family receives a child care subsidy. The authors estimate an elasticity of subsidy receipt with respect to distance of -0.13. To formalize this relationship in the context of the current study, we estimate regressions of subsidy receipt on single mothers' travel distance, controlling for a rich set of child and family characteristics. Appendix Table 2 presents coefficients for two variants of this model. The top panel presents results using the natural logarithm of the distance to the nearest social service agency. We also allow for a non-linear relationship by incorporating polynomials in distance. These results are presented in the bottom panel. Column (1) includes only the distance

[21] A growing number of states allow families to apply for subsidies via the mail, online, or over the telephone. However, as of 1998—the year subsidy information was ascertained in the ECLS-K— these application modes were substantially less common. Only 14 states in our ECLS-K sample allowed families to *request* subsidy applications mail, telephone, or email (Alaska, Arizona, Arkansas, Kansas, Louisiana, Maine, Michigan, Missouri, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, and Washington). Another five states (Maine, Michigan, Oregon, Texas, and Washington) allowed families to *complete* the subsidy application via mail or telephone. Furthermore, although some parents may not be required to visit an office to receive a subsidy, there are numerous factors that may necessitate in-person visits both initially and later at recertification, such as lack of trust by parents in the system, errors made by parents or case workers, and visits required by case workers to provide additional documentation (Adams, Synder, & Sandfort, 2002). Finally, single mothers in our sample may not have the resources to navigate application process through online or telephone interactions. Therefore, it is plausible that distance continues to be costly for families that are allowed to submit subsidy applications through alternative means. Herbst and Tekin (2010c) show that the distance measure is associated with a statistically significant reduction in subsidy utilization irrespective of whether families must make personal visits to the social service agency in the county in which they reside.

measure, while Columns (2) and (3) add the child and family characteristics, respectively. As expected, results in the top panel reveal a negative and statistically significant relationship between the distance measure the likelihood of subsidy receipt. The coefficient on the distance variable implies that a one percent increase in the mileage to the nearest social service agency reduces the probability of subsidy utilization by 1.8 percentage points. Results in the bottom panel reveal that the relationship between distance and subsidy receipt is highly non-linear, with the distance variables individually and jointly statistically significant.

An implication of the behavioral model is that the monetary and psychic costs associated with a given travel distance are expected to vary according to where a family resides. For example, there is substantial geographic variation in the availability of local roads and highways, the amount of traffic congestion associated with these roads, and the accessibility of substitute forms of public transportation. Such differences within and across states imply that it is not appropriate to constrain the relationship between travel distance and subsidy receipt to be the same for mothers across all jurisdictions. To investigate this issue, we produce county- and state-specific correlations between the distance measure and subsidy receipt. As expected, both sets of correlations are negative on average, but the amount of variation is substantially greater among counties, as evidenced by a comparison of the standard deviations: 0.305 for the county-specific correlations and 0.172 for the state-specific correlations. Additional evidence of between-county variation in the distance-subsidy relationship is provided by comparing correlations across urban and rural counties. Not surprisingly, the average correlation in rural counties is nearly three times larger than that in urban counties, but the spread of correlations around the mean is also greater (SD rural: 0.397 versus SD urban: 0.277). Our identification strategy therefore exploits this county-level variation in travel distance by interacting the distance measure with mothers' county-of-residence indicators. With a p-value less

than 0.001, the set of distance-county interactions is highly statistically significant in the first-stage equation.[22]

In order for the distance measure to serve as an instrument to identify the impact of subsidy receipt on child well-being, it has to be validly excluded from the child production function. One concern is that the distance measure could be determined in part by the joint location preferences of families and social service agencies. For example, given the low car ownership rates among low-income families, such individuals may prefer to live near critical support services or employment centers. In addition, administrative offices might locate in low-income neighborhoods to be accessible to large numbers of potentially eligible clients. If these unobserved family and agency preferences influence the distance measure in ways that affect child well-being, the coefficient on subsidy receipt will be biased.

Recent empirical work finds little support for the notion that individuals Tiebout sort across space in order to access government-provided goods and services (Rhode & Strumpf, 2003). Furthermore, although endogenous location choices are more plausible for entitlement programs or services with open-ended funding streams, it is highly unlikely that low-income parents move to a given neighborhood to be close to an agency administering child care subsidies. These benefits are heavily rationed by local agencies, and consequently it is common for parents to experience frozen intake or long waiting lists (Herbst, 2008). Therefore, it seems fairly risky to choose a residential location based on the location of these agencies. As pointed out by Allard (2009), the location choices of social service agencies are constrained in important ways, limiting the ability to adjust rapidly to changes in the spatial distribution of low-income families. These constraints help to explain why one-fifth of the social service agencies in Allard's (2009) three-city study had been

[22] Coefficients on the other variables are consistent with those documented by previous studies on the determinants of child care subsidy receipt. For example, the likelihood of subsidy utilization increases with mothers' education. In addition, black mothers and those with greater numbers of young children are more likely to receive a subsidy. Results from the first-stage equation are available from the authors upon request.

operating in the same location for six to 10 years, and over half were in the same location for more than 10 years.

Another concern is that our distance measure is a proxy for neighborhood and family characteristics that influence child well-being. For example, it is possible that mothers facing shorter distances to an agency do so in part because they reside in high-population-density (urban) and low-income neighborhoods. Conversely, those with longer distances may reside in largely rural and racially homogenous areas. To the extent that the neighborhood environment directly affects child well-being or is correlated with resident family characteristics, we might be worried that the travel distance is systematically related to child development. If these environmental factors are not properly accounted for in the production function, the distance measure would not constitute a valid instrument.

Table 1 explores the relationship between select family characteristics and the distance measure. Specifically, columns two through five present the means for child and maternal characteristics at each quartile of the distance distribution. Column six displays the p-value from an F-test of the equivalence of means before conditioning on the neighborhood environment. Column seven shows the p-value from a specification test that adjusts the means for median household income and population density in the census tract of residence. The raw means indicate that children living closer to an agency are significantly less likely to be white and more likely to be in fair or poor health than children living father away. In addition, mothers living near an agency have higher WIC participation rates and lower levels of educational attainment, and they are more likely to be drawn from the lowest quintile of the SES distribution.[23] Such results justify our concern that child and maternal characteristics may not be random with respect to the distance measure. However, these family-level differences are driven by neighborhood-level heterogeneity across the distance

[23] The SES measure was created by ECLS-K administrators, and reflects mother's and father's education, mother's and father's occupational status, and total family income.

distribution. In particular, families living near an agency tend to be located in low-income and densely populated census tracts with high rates of non-white households and those receiving public assistance. For example, differences in neighborhood household median income and population density by distance quartile are large in magnitude and highly statistically significant (F=110.56 and F=268.08, respectively). In fact, conditioning on these two neighborhood characteristics alone makes each of the child and maternal differences disappear (column seven). It is remarkable that background characteristics like socio-economic status, WIC participation, and maternal education are randomized over the distance distribution after controlling for these neighborhood characteristics. Such results indicate that the neighborhood environment is responsible for generating the observed family-level differences across the distance distribution, and as long as neighborhood controls are included in the production function, the distance measure can serve as a valid instrument.

To further bolster our confidence in the identification strategy, we incorporate an additional 13 census tract- and school- level variables in the child production function, for a total of 15 controls.[24] These variables capture several dimensions of neighborhoods' wealth and resources, urbanicity, racial and ethnic composition, and family structure that are either directly related to child well-being or correlated with the relevant attributes of our ECLS-K families. As previously mentioned, we also include state fixed effects to account for state-level policy, economic, and demographic unobservables that may influence child outcomes. Finally, in robustness checks, we estimate the production function separately on children living in urban areas. By making the sample more homogenous, it is an additional check on the impact of endogenous residential choices and unobserved neighborhood characteristics. Results from this exercise are consistent with our main findings.

[24] The census tract (neighborhood) variables include the log of median household income, log of population density, percent non-Hispanic white, percent foreign born, percent ages 65 and over, percent female, and percent ages 0-2, 3-5, 6-11, 12-13, 14, and 15-17 in female-headed households. The school variables include the percent of children in school who are eligible for free lunches, a dummy variable indicating whether a majority of children in school are racial/ethnic minorities, and a dummy variable indicating whether the school receives Title I funding.

V. Estimation Results

The Impact of Child Care Subsidy Receipt on Child Well-Being

Tables 2 through 4 present the main results for this study. We begin by examining raw differences in the fall of kindergarten outcomes for subsidized and unsubsidized children (Table 2). We then present OLS results for the child production function that condition on a rich set of observable child, family, and neighborhood characteristics (Table 3). Finally, we deal explicitly with the potential endogeneity of subsidy receipt by implementing our instrumental variables strategy (Table 4).

Table 2 provides the means and standard deviations for the child outcomes measured in the fall of kindergarten. We present these summary statistics for our full ECLS-K sample and for the sub-sets of subsidized and unsubsidized children. Note that the full sample reading and math test scores are below 50, indicating that children of unmarried mothers score lower than the average ECLS-K child. In addition, children in our sample display more externalizing and internalizing behavior problems and fewer positive social behaviors than other ECLS-K children. This is not surprising given that single-parent families tend to have fewer resources to invest in the production of child quality. The table also shows that subsidized children score lower on tests of cognitive ability and display more behavior problems than their unsubsidized counterparts. In fact, subsidy recipients perform worse in eight of the nine outcome measures (the exception is fine motor skills), and the raw differences are statistically significant for seven of the outcomes. Such differences should be interpreted with caution, however, as they do not account for the possibility that subsidy receipt is correlated with other factors that determine child well-being.

We begin to address the presence of potentially confounding variables in Table 3, which presents OLS estimates of the relationship between child care subsidy receipt and child well-being. Recall that subsidy receipt is measured in the year prior to kindergarten entry, and the outcomes are measured in the fall of kindergarten. Thus, these estimates reveal the short-term implications

associated with receiving subsidized child care. Each cell in the table presents the coefficient on subsidy receipt and its standard error (adjusted for clustering at the county level). Column (1) shows the estimates for subsidy receipt without controls. Columns (2) and (3) add the child and family covariates, respectively, and column (4) incorporates the neighborhood-level controls. Finally, our fullest OLS specification is presented in column (5), which adds state fixed effects to account for unobserved heterogeneity at the state-level that might be correlated with subsidy receipt and child well-being.

As shown in Table 3, the estimates for subsidy receipt exhibit considerable variation as controls are added to the specification. In the test score models, the impact of child care subsidies decreases in magnitude and loses statistical significance between columns (1) and (5). On the other hand, subsidy coefficients in the motor skills' models generally increase in size and become more precisely estimated. Finally, in the behavioral models, the impact of subsidy receipt is largely robust to the increased number of controls. Nevertheless, the results consistently point to poorer outcomes for subsidized children. Looking at column (5), we find that subsidy receipt is related to lower reading and math test scores and increased behavior problems, although only the behavioral measures show statistically significant results. Children receiving subsidized care, for example, score 2.4 points higher on the measure of externalizing behavior problems and about two points lower on the measures of self-control and interpersonal skills. Findings for the psychomotor outcomes are mixed, with the subsidy coefficient indicating significant increases in fine motor skills and decreases in gross motor skills. In sum, the OLS results are indicative of a negative relationship between child care subsidies and child well-being. These estimates, however, should not be interpreted as causal because the models do not fully account for the possibility that families non-randomly select into subsidy utilization. Furthermore, the fluctuating estimates create considerable uncertainty about the likely direction of the OLS bias.

Table 4 presents the causal results for the impact child care subsidy receipt using our

instrumental variables approach. The key results are presented in Column (3), in which two-stage least squares (2SLS) is used to estimate the equation of interest. Each regression includes the full set of child and maternal variables, neighborhood controls, and state fixed effects. The standard errors once again account for clustering at the county-level.

The instrumental variables estimates consistently point to negative effects of child care subsidy receipt on child well-being. Furthermore, the estimates grow in magnitude and are statistically significant for all outcomes except fine and gross motor skills. The finding that the coefficients increase in magnitude from the OLS to the instrumental variables method is consistent with the presence of measurement error in the subsidy receipt variable. Looking first at the cognitive outcomes, we find that children receiving subsidized care score nearly five points lower on the reading test and four points lower on the math test. These point estimates correspond to effect sizes of about 0.49 and 0.37 standard deviations, respectively, and would move the median child to the 36th percentile of the reading score distribution and the 29th percentile of the math score distribution.

In the behavioral domain, subsidy receipt is shown to have a deleterious effect on all five outcomes. The parameter estimates are statistically significant, and they correspond to larger effects than those in the cognitive domain. Interestingly, subsidy participation is expected to increase both externalizing (e.g., aggressive) and internalizing (e.g., anxious) behavior problems. The coefficients imply a seven-point increase in the externalizing scale and a three-point increase in the internalizing scale. These translate to effect sizes of 0.71 and 0.29 standard deviations, respectively. Our estimates also suggest that subsidy receipt reduces a number of positive social behaviors, including self-control and interpersonal skills. Parameter estimates consistently imply reductions of approximately five points—or half of a standard deviation—in the various measures of positive social behaviors.

Turning finally to the psychomotor domain, the coefficient on subsidy receipt points to negative effects on fine and gross motor skills, but the estimates are statistically insignificant.

Furthermore, the effect sizes are smaller than those in the other domains. Such results are not surprising given that these assessments are largely designed to measure bodily-kinesthetic skills (e.g., hand-eye coordination, balancing, hopping, skipping, and walking backward). These skills are less likely to be influenced by short-run home and child care changes associated with subsidy utilization. Unfortunately, the psychomotor assessments were not administered again by the ECLS-K, which prevents us from exploring longer-term effects.

In light of the negative correlation between travel distance and subsidy participation rates, if child care subsidies have a causal effect on child well-being, then a reduced form relationship between the distance measure and child outcomes should emerge. Appendix Table 3 reports average values of the fall of kindergarten outcome measures across the quartiles of the distance distribution. We also report p-values from two sets of F-tests: one testing differences in the unconditional means (column five) and another testing differences conditional on child and family characteristics (column six). Unconditional results point to a statistically significant relationship between the distance measure and seven of the nine child outcomes. Controlling for child and family covariates reduces this number to five significant relationships. A consistent pattern emerges from this analysis: measures of child well-being improve monotonically as the distance to the nearest agency increases. Such results, together with the negative correlation between the distance measure and subsidy receipt, imply that the 2SLS estimates of a negative impact on child well-being can be interpreted as causal.

To put these findings into perspective, we compare effect sizes in Table 4 with those reported elsewhere in the early care and education literature. Bernal and Keane (2009) document that an additional year of non-parental child care is associated with a 0.11 standard deviation decrease in children's cognitive test scores. In a study of the Quebec's child care program, Baker, Gruber, and Milligan (2008) find that subsidized children show a reduction in social development of 0.17 standard deviations. Gormley and Gayer's (2005) evaluation of Tulsa, Oklahoma's pre-kindergarten

program finds effect sizes of 0.39 (cognitive ability), 0.38 (language ability), and 0.24 (motor skills). Magnuson, Ruhm, and Waldfogel (2007a) estimate effect sizes of 0.24 (reading test) and 0.20 (math test) for pre-kindergarten attendance among disadvantaged ECLS-K children. 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). It appears that the absolute value of our effect sizes is at the upper end of the range of previous estimates. However, it is important to bear in mind that the impact of subsidy receipt is averaged over potentially large changes in maternal employment, children's child care arrangements, and families' financial resources. Although pre-kindergarten and Head Start programs introduce changes in the early care environment, parental employment is not likely to be an important channel through which these programs influence child well-being. Thus, the estimates presented here are comparable to those found elsewhere.

The 2SLS results discussed above suggest that subsidy receipt leads to significant reductions in tests of reading and math ability. Fortunately, the ECLS-K allows us to unpack these broad effects by exploring domain-specific proficiencies in reading and math. In particular, proficiency probability scores were created to represent a hierarchical progression of knowledge and skills at the beginning of kindergarten. As shown in Appendix Table 4, we examine the impact of subsidy receipt on five subject-area proficiencies in each of the overall cognitive domains, with the individual clusters representing increasingly difficult sets of reading and math test items. Since these measures are expressed as probability scores, the outcome means [presented in column (2)] are interpreted as the fraction of children reaching proficiency in a given domain. For example, approximately 57 percent of children are deemed proficient in letter recognition, and 89 percent are deemed as such in number and shape identification as of the fall of kindergarten. The likelihood of reaching proficiency decreases across the reading and math achievement domains as the subject areas grow in difficulty.

The 2SLS results presented in column (3) of Table 4 suggest that subsidy participation lowers a variety of domain-specific reading and math skills. As for reading achievement, subsidized

children perform worse than their unsubsidized counterparts in every subject area. For example, children who received a subsidy in the year before kindergarten are 15 percentage points less likely to be proficient in letter recognition and between 12 and 14 percentage points less likely to be proficient in recognizing beginning and ending word sounds. The results for math achievement are mixed, with subsidized children performing the same as their unsubsidized counterparts in the most and least complex subject areas, but underperforming in several of the mid-level tasks. For example, whereas subsidy receipt is expected to decrease the probability of reaching proficiency in number and shape recognition (the least complex mathematical task) by 4 percentage points, the impact estimate becomes substantially larger in the relative size (13 percentage points) and ordinality (11 percentage points) domains before decreasing once again in multiplication/division (the most complex mathematical task).

Heterogeneous Effects of Child Care Subsidy Receipt

Our results so far have assumed that the impact of child care subsidies on child well-being is the same for all children. However, the estimates may vary with the characteristics of the child and mother. To explore this possibility, we estimate 2SLS models for subsets of the full ECLS-K analysis sample. In particular, we examine differential effects of subsidy receipt by children's gender, mothers' educational attainment, and families' socioeconomic status (SES). These analyses are particularly important for instrumental variables given that the impact estimates apply only to the group of unmarried mothers whose subsidy decisions are influenced by the distance instrument. As such, 2SLS estimates are often referred to as the local average treatment effects (LATE) (Angrist & Imbens, 1994). We might be concerned that this subset of unmarried mothers differs from the full sample of unmarried mothers in important ways. In particular, the OLS and IV estimates might differ because OLS recovers the average effect of subsidy receipt, while the IV results apply to a non-representative subset of the sample. It is plausible, in other words, that child care subsidies are beneficial for large numbers of disadvantaged children while showing detrimental effects among

specific groups. We address this concern by estimating the 2SLS model on sub-groups of children in our ECLS-K sample.

Columns (1) and (2) of Table 5 present the subsidy estimates separately for boys and girls, respectively. Results in these columns reveal an interesting role for gender in the impact of child care subsidies. In the cognitive domain, boys' math scores are more negatively affected by subsidy receipt. In fact, the coefficient on subsidy receipt for boys is more than double that for girls and is highly statistically significant. Conversely, the impact of subsidy receipt on reading test scores is larger for girls by about 0.10 standard deviations. In addition, subsidy receipt has large negative effects on the behavioral outcomes for boys, while the effects for girls are small in magnitude and usually imprecisely estimated. The finding of a pronounced effect of work-related subsidies on boys' behavior is consistent with several studies which find that boys tend to be more adversely affected by early maternal employment (Blau & Grossberg, 1992; Brooks-Gunn et al., 2002; Desai et al., 1989; Hill & Duncan, 1987; Richards & Duckett, 1991; Ruhm; 2008). It is plausible child care subsidies aggravate the gender disparity in the development of behavior problems (Buchnical et al., 2000; Scarr & Eisenberg, 2003).

Several studies find that the negative effects of child care participation and maternal employment are concentrated among economically advantaged children (Anderson et al., 2003; Bernal & Keane, 2009; Brooks-Gunn, et al., 2002; Ruhm, 2004; 2008). It is plausible that such heterogeneity exists with respect to child care subsidies. To explore this possibility, we first estimate the 2SLS models separately for low- and high-skilled mothers. Low-skilled mothers are defined as those with a high school degree or less, and high-skilled mothers are those with at least some college education. We then estimate the models separately for children drawn from the bottom and top quintiles of the SES distribution.

As shown in columns (3) through (6), our results largely confirm those in previous work. Looking first at the findings stratified by maternal education, it appears that child care subsidies have

similar effects on cognitive ability test scores for children with low- and high-skilled mothers. In the behavioral domain, however, the impact of subsidy receipt is concentrated among children with high-skilled mothers. In particular, the estimated effect of subsidy utilization is large and statistically significant for externalizing behavior problems, approaches to learning, self-control, and interpersonal skills. The comparable behavioral results for children with low-skilled mothers are small in magnitude and never precisely estimated.

It is important to note that splitting the sample by maternal education may not be the most appropriate way to test for subsidy effects across different family environments. It is possible, for example, that education alone may not capture the most important familial inputs to child development. Therefore, we also consider models that stratify the sample according to the bottom and top quintiles of the SES distribution. As shown in columns (5) and (6), the results now strongly indicate that subsidy receipt among high SES children adversely affects well-being, compared to neutral or even positive consequences among low SES children. Effect sizes for reading and math tests, for example, are -0.56 and -0.21 for high SES children, while their low SES counterparts experience effect sizes of 0.06 and -0.11. High SES children who receive subsidized care show substantial increases in behavior problems, especially externalizing behaviors, and reductions in all three positive social behaviors. In contrast, their low SES counterparts are neutral with respect to externalizing and internalizing behaviors, and actually show *increases* in all three measures of positive social behaviors, one of which is statistically significant (interpersonal skills).

To explain these results, we find that child care subsidies trigger more dramatic changes in maternal employment and child care arrangements among high SES children. For example, 93 percent of subsidized high SES mothers are employed, compared to 65 percent among their low SES counterparts. Furthermore, among those who are employed, subsidized high SES mothers are working more intensively: 81 percent of such mothers are employed full-time (35+ hours per week), versus 74 percent among subsidized low SES mothers. Subsidized high and low SES children also

participate in different child care services, with the former less likely to be enrolled in center- and family-based care. Finally, note that the marginal productivity of maternal time is assumed to be positive in the child production function. It is reasonable to further assume that this marginal productivity is greater for high-skilled (and high SES) mothers. If this is the case, then the subsidy-induced reduction in maternal time inputs (and the attending rise in intensive paid employment) would be expected to adversely affect children in high SES families.

Robustness Analyses

We subject the main results to a number of specification checks to ensure robustness. Results from this exercise are presented in Table 6. The plausibility of our 2SLS estimates hinges on the validity of our identifying assumption that, conditional on the observable family and neighborhood controls and state fixed effects, the distance instruments can be excluded from the child production function. This assumption cannot be tested directly, but we offer some indirect evidence through a falsification test. If our identification strategy is valid, then a variable predicting child care subsidy receipt should not affect children in families that are highly unlikely to be eligible for assistance. Since all families in the ECLS-K have children, we focus the falsification test on *two-parent families* in the *top two quintiles* of the SES distribution. We first estimate the first-stage subsidy receipt equation on the sample of single mothers in order to calculate a predicted probability of subsidy receipt for the subset of two-parent families in the top SES quintiles. We then include this variable in the child production function. The falsification test provides no evidence against the validity of our identification strategy: in no case do we find that predicted subsidy receipt negatively influences the well-being of children in high SES two-parent families.[25]

Although our expanded instrument set can increase the efficiency of the IV estimates, it can also lead 2SLS to perform poorly. In particular, the "many-and-weak-instruments" problem is shown

[25] For example, the coefficient (and standard error) on subsidy receipt in the reading test model is: 0.803 (1.761). The comparable result in the math test model is: 3.330 (1.735), which is statistically significant at the 10 percent level. In no other case is the coefficient on subsidy receipt statistically significant. Full results are available from the authors upon request.

to produce bias in the 2SLS estimates that converge to the OLS estimates as the number of identifying instruments increases (Bound et al., 1995; Hansen et al., 2006). We deal with this concern by using an alternative to 2SLS, the jackknife instrumental variables estimator (JIVE), to examine the impact of child care subsidy receipt on child well-being. The JIVE exhibits finite-sample properties superior to those of 2SLS and comparable to alternative estimators such as limited information maximum likelihood in the presence of many weakly correlated instruments (Angrist et al., 1999). The JIVE estimator has also been shown to perform well in Monte Carlo simulations (Poi, 2006). Column (1) in Table 6 presents the JIVE estimates for the impact of subsidy receipt. These results are largely consistent with those of 2SLS, although in most cases the magnitude of the subsidy estimates are slightly larger, suggesting that the 2SLS estimates may be biased toward OLS.

Until this point, our IV estimates have been based on mothers' travel distance to the *nearest* social service agency. As previously discussed, some mothers have multiple agencies from which to choose in the county of residence. For these mothers, we have assumed that the relevant agency is the one closest to the residential location. We believe this is a plausible assumption. However, to make more explicit use of the presence of multiple administrative offices, we estimate the IV models using the sum of the inverse distances as an alternative instrument.[26] An advantage of this measure is that it gives more weight to distances closer to mothers' residential location. As shown in column (2), results using this measure are not substantially different from the main findings.

To the extent that our instrumental variables are orthogonal to child well-being, our estimation strategy should produce consistent estimates of the impact of subsidy receipt. We guard against the possibility that the distance instrument is correlated with unobserved child and maternal characteristics by including in the model a detailed set of family, neighborhood, and school controls. To further strengthen our confidence, we incorporate additional controls for parental participation in

[26] In results not reported, we add to the model a dummy variable that equals unity if a given family has access to multiple social service agencies in the county of residence. Our results are unchanged by the inclusion of this variable.

several cash assistance programs (TANF and food stamps) in column (3) of Table 6. In addition to controlling for unobserved work and welfare preferences that may influence child well-being, inclusion of these variables should account for the possibility that parents need to travel to the same social service agencies to apply for cash assistance. If welfare or food stamp participation is correlated with both the distance measure and various dimensions of child well-being, then failure to include these in the production function would invalidate our distance instrument. Fortunately, our main results do not change when TANF and food stamp participation are included in the model.

Next, we explore the impact of omitting Head Start children from the analysis. Note that about 10 percent of children in our analysis sample are enrolled in Head Start. A very small number of these children (11) report receiving subsidies for their Head Start services. Such a small number is auspicious given that Head Start is a fully subsidized program for which CCDF child care subsidies are not necessary to help defray program costs. Therefore, we believe these children have been erroneously coded as receiving a subsidy. Our main results are robust to the exclusion of these 11 children from the analysis. In addition, we test the sensitivity of our results to the exclusion of all Head Start children from the analysis sample. This exercise is important because, while the presence of Head Start might be relevant to the decision to apply for child care assistance, it is considerably less important to mothers' work and child care decisions after obtaining a subsidy. As shown in column (4) of Table 6, our results remain very similar when we exclude Head Start children altogether.

We also estimate models in which children living in non-urban areas are excluded from the analysis. We do so because families living in urban neighborhoods are presumably more homogeneous with respect to family and neighborhood attributes that influence both the travel distance to social service agencies and measures of child well-being. In particular, it is plausible that urban families face relatively similar psychic and monetary costs associated with accessing major roadways and public transportation. Therefore, an urban sample is less likely to suffer from

endogenous location choices and unobserved neighborhood characteristics that affect child well-being. Our empirical estimates are once again robust to this change in sample definition, as shown in column (5) of Table 6.

Until this point, all 2SLS models have included a control for the (log of) total family income. Unfortunately, the ECLS-K does not allow researchers to identify the individual sources of parental income, including labor market earnings and various sources of non-wage income. Ideally, we would prefer to omit sources of income that change as a result of utilizing a child care subsidy. For example, the employment effects of subsidy receipt may cause earnings to increase while reducing the amount of income drawn from traditional cash assistance programs. To the extent that subsidized families experience an increase in disposable income, these additional resources can be spent on goods and services that might positively impact child well-being. This is one of the anticipated channels through which subsidy receipt can influence child outcomes. However, the permanent component of family income is likely to be correlated with subsidy receipt and child well-being. Failure to account for such resources may therefore bias the IV estimates. To assess whether our results are robust to the exclusion of total family income, we estimate the 2SLS models without this control. As reported in column (6), exclusion of income as a right-hand-side variable does not significantly alter our results

Longer-Term Effects of Child Care Subsidy Receipt

The results discussed so far indicate that child care subsidies lower cognitive ability test scores and increase teacher-reported behavior problems in the year following their utilization. An important question is whether these negative effects persist throughout the school-age years. To address this question, we estimate the 2SLS models using the available outcomes measured in the spring of kindergarten and the spring of first, third, and fifth grade. Note that the assessments of psychomotor skills are not administered beyond the fall of kindergarten, but all other outcomes measures are available through the fifth grade survey wave.

As shown in Table 7, the impact of child care subsidy receipt persists throughout kindergarten. As of the end of kindergarten, subsidized children continue to experience lower reading and math test scores and increased behavior problems. The effects remain sizeable and statistically significant at conventional levels. However, one year later—at the end of first grade—these negative effects largely disappear. The remaining negative and statistically significant effects are found for the measures of self-control and interpersonal skills. The impact of subsidy receipt continues to attenuate in both magnitude and statistical significance throughout the third and fifth grade. In fact, by the end of fifth grade, the effect sizes are substantially smaller than was the case in the fall of kindergarten, and none of the subsidy coefficients are precisely estimated.

The evidence presented in Table 7 partially alleviates the concerns raised by the large, negative short-run effects of subsidy receipt. It is beyond the scope of this paper to provide a full assessment of the explanations underlying the attenuation of subsidy effects over time. Nevertheless, we offer several observations about these results. First, it is possible that subsidy receipt during the preschool years has a so-called "sleeper" effect on children's long-term development. In other words, the attenuation of subsidy effects throughout the first few years of children's schooling may not be representative of its full effects later in life. Future research should therefore consider the possibility that the negative effects of early subsidy receipt might reemerge in other ways as children age. Second, our finding of a declining impact of subsidy receipt is mirrored by studies evaluating other early childhood interventions. For example, recent work finds that the early effects of pre-kindergarten programs (Barnett, 1995; Magnuson et al., 2007b) and Head Start (Barnett & Camilli, 2002; Currie & Thomas, 1995) tend to fade out within a few years. However, whereas children in these programs experience declining benefits over time, the subsidized children in our study experience declining negative effects. To explain the lack of persistence in program effects, most researchers distinguish between "fade out" and "catch up," with the former indicating that the school performance of children who attended early interventions decreases to the level of their peers, and

the latter implying that the school performance of non-participants improves relative to program participants. That subsidized children finish first grade at parity with their unsubsidized counterparts—after falling behind throughout kindergarten—strongly suggests that these children "catch up" to their peers.[27] A final and related point is that early school experiences likely play a critical role in the extent to which subsidized children are able to catch up. Previous work finds that classroom characteristics matter greatly for whether the positive effects of pre-kindergarten persist over time (e.g., Magnuson et al., 2007b). Thus, it seems plausible that subsidized children placed in high-quality classrooms might be able to fully erase the subsidy-induced academic and behavioral deficits that emerge throughout kindergarten. Such issues are fruitful avenues for future research.

VI. Summary and Discussion of Policy Implications

Parental decisions regarding employment and child care can have important implications for children's well-being. Given that child care subsidies are found to affect both decisions, they also have the ability to shape the developmental trajectory of young children. Yet despite the potentially important ways in which subsidies can influence child well-being, much of the child care literature continues to focus on maternal outcomes. In contrast, there is a substantial literature evaluating the impact of Head Start and other early education programs on children's cognitive and behavioral outcomes. Results from this body of work, however, cannot provide a useful guidepost for child care subsidies. Programs such as pre-kindergarten and Head Start focus explicitly on school readiness, whereas the key feature of CCDF child care subsidies is the rapid facilitation of disadvantaged mothers to move from welfare to work. Consequently, there are reasons to be concerned about the consequences of child care subsidies for low-income children's short- and long-term well-being.

Using rich longitudinal data from the ECLS-K, this paper provides a comprehensive examination of the impact of subsidy receipt on child development. To identify the effect of child

[27] It is also possible that the employment effects of child care subsidies may not result in an immediate increase in maternal financial and psychological well-being, as the "work-first" philosophy of the subsidy system may push vulnerable women into initially low paying jobs with undesirable work conditions. However, if parental work experience and training increase over time, material well-being could improve. This scenario is consistent with subsidies causing short-run negative effects on child development that attenuate over time.

care subsidies, we use a novel instrumental variable based on the distance between mothers' residential location and the nearest social service agency that administers the subsidy application process. Our empirical results suggest that subsidy receipt in the year prior to kindergarten entry substantially reduces reading and math test scores and increases a variety of behavior problems at the start of kindergarten. Our estimates indicate that subsidized children score approximately 0.4 to 0.5 standard deviations lower on reading and math tests, and 0.3 to 0.7 standard deviations higher on measures of internalizing and externalizing behavior problems. The sub-group analyses indicate that the deleterious effects of subsidies tend to be larger for boys and children living in high SES families. Although the negative effects of subsidy receipt persist throughout kindergarten, our results show that they largely disappear by the end of first grade.

These results have potentially important implications for child care subsidy policy in the U.S. In particular, the current policy regime intensifies the tension between the twin goals of child care: enabling parents to work and promoting child development. Consistent with the primary goal of welfare reform, the CCDF focuses almost exclusively on facilitating parental employment, while placing few restrictions on child care quality and deemphasizing low-income children's health and well-being. Indeed, eligibility for CCDF subsidies is conditioned on participation in a work-related activity, and as discussed in Section II, there is an array of design features embedded in the CCDF that may discourage parents from purchasing and providers from offering high-quality care. Such design features stand in stark contrast with states' pre-kindergarten programs and "two generation" service-based programs such as Head Start. These services are child-development-related and hence generally do not mandate parental employment.

There are a few compelling reasons why the government may wish to establish employment-related child care subsidies. This type of intervention in the child care market is often justified on the grounds that subsidies increase long-term economic self-sufficiency by generating human capital. Evidence from subsidy take-up data suggests that human capital development is occurring through

two channels: fully 80 percent of recipients use child care subsidies for direct work experience, while 12 percent are engaged in education and job training programs. These activities, in turn, might lead to future earnings and tax revenue that exceed the short-run cost of providing child care assistance, thus increasing government's net savings in the long-run (Robins, 1991).

However, child care subsidies are at best an indirect approach to inculcating a work ethic and increasing human capital among low-skilled families. If low-wages create work disincentives as well as discourage individuals from developing relevant skills, labor market policies such as the EITC and minimum wage are more direct interventions. At their worst, employment-related subsidies attempt to remedy a distortion in the labor market, but instead create distortions in the child care market that did not initially exist. For example, these subsidies encourage a shift in child care demand from unpaid to paid services. In addition, CCDF child care policy, in particular, may exacerbate quality constraints in the larger child care market by increasing parental choice and discouraging child care providers from making costly quality enhancements.

Consistent with the concerns raised by Blau (2001), our empirical results suggest that employment-related child care subsidies have an important unintended consequence: in the short-run, at least, subsidy receipt adversely affects the well-being of low-income children. By design, CCDF child care subsidies influence child well-being through their positive employment effects or by encouraging parents to purchase low-quality child care. Indeed, the empirical evidence we cite in Section I suggests that early maternal work has deleterious effects on children's cognitive and behavioral development. Furthermore, high-quality early care and education programs are shown to be particularly beneficial for economically disadvantaged children. Therefore, it is not surprising that a government policy to promote work and increase parental flexibility in choosing child care would have harmful effects on child development.

Proposals to revise the current child care subsidy system might consider decoupling child care assistance from the current work-based welfare system, and by extension, from parental

employment. In other words, child care policy should neither explicitly promote nor inhibit employment. Instead, child care policy should be refocused to provide parents with strong incentives to choose high-quality care. There are several ways to accomplish this, but recent quality-based policy proposals stress two critical pieces. First, the generosity of child care subsidy reimbursements should be conditioned, in part, on the quality of care purchased by parents. It may still be means-tested, so as to phase-out as family income increases, but the reimbursement rates should not be different for working and non-working parents. Second, given that recent studies consistently show that parents are not able to discern low- from high-quality care and are not well-informed about the potential benefits of high-quality care, governments at all levels should engage in aggressive outreach campaigns to educate parents. States currently spend some CCDF money to engage in fairly targeted information campaigns, but these should be broadened to reach all new parents, and not just those within the subsidy system. It is reasonable to assume that, once informed, parents will increase their demand for high-quality care, and child care providers will be more likely to provide it.

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Table 1: Select Child and Family Characteristics by Distance Quartile

		Distance Quartile				F-test of Equivalence: p-value	
						Adjusted for Neighborhood Income and Population Density	
Variable	Full Sample	1st	2nd	3rd	4th	No	Yes
Distance to Social Service Agency (miles)	6.87	1.56	3.75	7.24	19.92		
Child Characteristics							
Boy (%)	0.499	0.502	0.511	0.502	0.474	0.471	0.788
White (%)	0.380	0.283	0.348	0.452	0.511	0.000	0.684
Premature Birth (%)	0.184	0.189	0.188	0.176	0.177	0.835	0.965
Low Birth Weight (%)	0.077	0.080	0.077	0.079	0.066	0.700	0.636
Fair/Poor Health (%, fall of k)	0.046	0.056	0.046	0.032	0.045	0.082	0.542
First-Time Kindergartner (%)	0.944	0.949	0.936	0.951	0.939	0.348	0.313
Family Characteristics							
Mother: Age (years, fall of k)	30.45	29.93	30.56	30.71	30.87	0.005	0.217
Mother: Less than High School (%)	0.208	0.261	0.196	0.185	0.161	0.000	0.307
Mother: WIC participation Rate (%)	0.741	0.808	0.723	0.696	0.700	0.000	0.234
In the Bottom SES Quintile (%)	0.334	0.403	0.318	0.285	0.296	0.000	0.375
Two or More Other Children (%)	0.351	0.362	0.345	0.335	0.362	0.527	0.594
ln(family income) ($, fall of k)	9.664	9.471	9.701	9.849	9.735	0.000	0.175

Notes: Analyses are conducted on children and mothers with non-missing data. Means are derived from an OLS regression of each child/family characteristic on four distance quartile dummy variables (with the constant omitted). The p-values are based on F-tests of the null hypothesis of the equality of means across the distance quartiles. P-values in the second column are derived from OLS regressions that add controls for log of household income and log of population density (measured at the census tract-level).

Table 2: Child Outcomes by Subsidy Participation Status, Fall of Kindergarten

Outcome	(1) Observations	(2) Full Sample	(3) Subsidy Recipient	(4) Non-Recipient	(5) H_0:(3)–(4)=0 p-value
Reading Test Score	3,528	47.43 (9.06)	46.27 (8.71)	47.61 (9.10)	0.003
Math Test Score	3,719	47.38 (9.21)	46.63 (8.52)	47.50 (9.30)	0.055
Externalizing Behavior	3,738	1.79 (10.81)	3.79 (11.84)	1.48 (10.62)	0.000
Internalizing Behavior	3,675	1.24 (10.77)	1.26 (11.24)	1.24 (10.70)	0.968
Approaches to Learning	3,785	-2.12 (10.14)	-3.05 (10.15)	-1.98 (10.13)	0.027
Self-Control	3,647	-2.00 (10.22)	-3.70 (10.51)	-1.74 (10.16)	0.000
Interpersonal Skills	3,596	-1.79 (10.12)	-3.29 (10.38)	-1.56 (10.06)	0.001
Fine Motor Skills	3,705	-2.22 (10.36)	-1.98 (10.04)	-2.26 (10.40)	0.585
Gross Motor Skills	3,683	0.05 (10.13)	-0.74 (10.04)	0.17 (10.14)	0.068

Notes: Standard deviations are in parentheses.

Table 3: Ordinary Least Squares Estimates of the Relationship between Child Care Subsidy Receipt and Child Well-Being, Fall of Kindergarten

Outcome	(1) Baseline	(2) + Child Controls	(3) + Family Controls	(4) + Local Controls	(5) + State FE
Reading Test Score	-1.340***	-1.084**	-0.670	-0.582	-0.376
	(0.484)	(0.484)	(0.466)	(0.465)	(0.449)
Math Test Score	-0.861*	-0.669	-0.427	-0.402	-0.210
	(0.470)	(0.444)	(0.415)	(0.418)	(0.411)
Externalizing Behavior	2.310***	2.199***	2.274***	2.264***	2.400***
	(0.637)	(0.614)	(0.621)	(0.624)	(0.625)
Internalizing Behavior	0.020	0.159	0.179	0.091	0.169
	(0.604)	(0.596)	(0.597)	(0.581)	(0.596)
Approaches to Learning	-1.076*	-0.897*	-0.899*	-0.964*	-0.971*
	(0.582)	(0.537)	(0.535)	(0.552)	(0.552)
Self-Control	-1.956***	-1.748***	-1.834***	-1.920***	-2.105***
	(0.547)	(0.511)	(0.506)	(0.508)	(0.526)
Interpersonal Skills	-1.728***	-1.534***	-1.544***	-1.576***	-1.674***
	(0.557)	(0.524)	(0.530)	(0.521)	(0.513)
Fine Motor Skills	0.275	0.536	0.667	0.813	0.877*
	(0.530)	(0.535)	(0.549)	(0.542)	(0.529)
Gross Motor Skills	-0.905	-1.093*	-1.140**	-1.079*	-0.929*
	(0.557)	(0.561)	(0.563)	(0.552)	(0.535)

Notes: Each cell presents the coefficient on child care subsidy receipt in the year before kindergarten entry and the standard error (in parentheses) that is adjusted for clustering at the county-level. Column (2) adds controls for child's gender, child's age, child's age squared, race/ethnicity, child's weight in the fall of kindergarten, premature birth, low birth weight, fair/poor health status, and first-time kindergartner. Column (3) adds controls mother's age, mother's educational attainment, number of other children in the family, English as the primary home language, log of family income, and urban residence. Column (3) adds controls for log of median household income, log of population density, percent non-Hispanic white, percent foreign born, percent ages 65 and over, percent female, percent of children ages 0-2, 3-5, 6-11, 12-13, 14, and 15-17 living in female-headed households (all at the census tract-level), percent of children in the school eligible for free/reduced price lunch, an indicator for whether a majority of children in the school are minorities, and an indicator for whether the school receives Title I funding. Column (5) adds state fixed effects. *, **, *** indicate that the subsidy coefficient is statistically significant at the 0.10, 0.05, and 0.01 levels, respectively.

Table 4: Instrumental Variables Estimates of the Impact of Child Care Subsidy Receipt on Child Well-Being, Fall of Kindergarten

Outcome	(1) Outcome Mean	(2) Participation Rate	(3) IV: 2SLS
Reading Test Score	47.43	0.134	-4.891**
			(2.045)
Math Test Score	47.38	0.131	-3.713**
			(1.675)
Externalizing Behavior	1.79	0.132	7.172***
			(2.123)
Internalizing Behavior	1.24	0.130	2.926*
			(1.722)
Approaches to Learning	-2.12	0.132	-5.084**
			(2.167)
Self-Control	-2.00	0.131	-5.839**
			(2.326)
Interpersonal Skills	-1.79	0.132	-4.468*
			(2.390)
Fine Motor Skills	-2.22	0.131	-0.446
			(1.583)
Gross Motor Skills	0.05	0.130	-2.790
			(1.768)

Notes: Each cell in columns (3) presents the coefficient on child care subsidy receipt in the year before kindergarten entry and the standard error (in parentheses). Standard errors are adjusted for clustering at the county-level. The model includes controls for child's gender, child's age, child's age squared, race/ethnicity, child's weight in the fall of kindergarten, premature birth, low birth weight, fair/poor health status, first-time kindergartner, mother's age, mother's educational attainment, number of other children in the family, English as the primary home language, log of family income, urban residence, log of median household income, log of population density, percent non-Hispanic white, percent foreign born, percent ages 65 and over, percent female, percent of children ages 0-2, 3-5, 6-11, 12-13, 14, and 15-17 living in female-headed households (all at the census tract-level), percent of children in the school eligible for free/reduced price lunch, an indicator for whether a majority of children in the school are minorities, an indicator for whether the school receives Title I funding, and state fixed effects. *, **, *** indicate that the subsidy coefficient is statistically significant at the 0.10, 0.05, and 0.01 levels, respectively.

Table 5: Heterogeneous Effects of Child Care Subsidy Receipt, By Child and Maternal Characteristic

Outcome	(1) Boys	(2) Girls	(3) Low-Skilled	(4) High-Skilled	(5) Low SES	(6) High SES
Reading Test Score	-1.816	-2.714*	-3.422*	-3.211**	0.548	-5.586***
	(1.927)	(1.594)	(1.847)	(1.472)	(1.881)	(1.712)
Math Test Score	-3.838**	-1.475	-4.181**	-1.811	-1.086	-2.057
	(1.730)	(1.316)	(1.867)	(1.493)	(1.947)	(1.675)
Externalizing Behavior	5.307*	3.498**	0.668	8.184***	0.192	10.206***
	(2.772)	(1.759)	(2.051)	(1.982)	(2.281)	(2.182)
Internalizing Behavior	5.305**	-0.256	-0.399	0.638	-0.337	1.112
	(2.265)	(1.700)	(2.410)	(1.902)	(2.191)	(2.015)
Approaches to Learning	-5.404**	-1.331	-0.766	-4.756***	2.057	-7.025***
	(2.343)	(1.889)	(2.207)	(1.850)	(2.011)	(2.219)
Self-Control	-4.885**	-2.118	-0.349	-5.340**	2.166	-8.455***
	(2.302)	(2.082)	(1.826)	(2.119)	(2.192)	(2.342)
Interpersonal Skills	-3.696	-0.848	0.896	-4.783**	4.556**	-6.780***
	(2.311)	(2.147)	(2.301)	(2.009)	(2.095)	(2.319)
Fine Motor Skills	-0.644	2.388	-0.017	-0.600	1.548	-1.479
	(1.842)	(1.688)	(2.055)	(1.540)	(1.955)	(1.573)
Gross Motor Skills	-2.369	-2.282	-2.734	-0.462	-1.248	-0.470
	(2.471)	(1.862)	(2.260)	(2.015)	(2.493)	(1.853)

Notes: Each cell presents the coefficient on child care subsidy receipt in the year before kindergarten entry and the standard error (in parentheses). Standard errors are adjusted for clustering at the county-level. Low-skilled is defined as mothers with a high school degree and less, and high-skilled is defined as mothers with some college education and above. Low SES is defined as families in the bottom SES quintile, and high SES is defined as families in the top SES quintile. The model includes controls for child's gender, child's age, child's age squared, race/ethnicity, child's weight in the fall of kindergarten, premature birth, low birth weight, fair/poor health status, first-time kindergartner, mother's age, mother's educational attainment, number of other children in the family, English as the primary home language, log of family income, urban residence, log of median household income, log of population density, percent non-Hispanic white, percent foreign born, percent ages 65 and over, percent female, percent of children ages 0-2, 3-5, 6-11, 12-13, 14, and 15-17 living in female-headed households (all at the census tract-level), percent of children in the school eligible for free/reduced price lunch, an indicator for whether a majority of children in the school are minorities, an indicator for whether the school receives Title I funding, and state fixed effects. *, **, *** indicate that the subsidy coefficient is statistically significant at the 0.10, 0.05, and 0.01 levels, respectively.

Table 6: Robustness Checks

Outcome	(1) IV: JIVE	(2) Inverse Distance	(3) + TANF and Food Stamp Controls	(4) Omit Head Start Children	(5) Urban Children	(6) Omit Control for Family Income
Reading Test Score	-5.168**	-4.308**	-4.078*	-4.493**	-4.558*	-5.034**
	(2.349)	(2.023)	(2.101)	(1.969)	(2.510)	(2.046)
Math Test Score	-4.227	-3.878**	-3.120*	-3.888**	-3.086	-3.937**
	(3.301)	(1.660)	(1.691)	(1.663)	(1.979)	(1.673)
Externalizing Behavior	3.897*	7.887***	7.226***	6.906***	5.808**	7.221***
	(2.359)	(2.238)	(2.239)	(2.071)	(2.552)	(2.109)
Internalizing Behavior	4.436*	3.120*	3.043	2.211	3.847*	3.082*
	(2.413)	(1.735)	(1.903)	(1.694)	(2.277)	(1.708)
Approaches to Learning	-5.374**	-4.165*	-4.907**	-5.984***	-6.879***	-5.191**
	(2.192)	(2.343)	(2.288)	(2.138)	(2.416)	(2.155)
Self-Control	-5.061**	-5.439**	-5.890**	-6.835***	-5.142*	-5.966***
	(2.286)	(2.423)	(2.417)	(2.284)	(2.659)	(2.298)
Interpersonal Skills	-4.923**	-4.750*	-4.250*	-5.290**	-5.019*	-4.588*
	(2.209)	(2.492)	(2.462)	(2.411)	(2.816)	(2.374)
Fine Motor Skills	-2.962	-0.229	-0.014	-0.844	0.926	-0.633
	(4.172)	(1.483)	(1.629)	(1.629)	(1.892)	(1.572)
Gross Motor Skills	-2.985	-2.145	-2.451	-3.293*	-2.089	-3.033*
	(4.073)	(1.767)	(1.857)	(1.725)	(2.159)	(1.756)

Notes: Each cell presents the coefficient on child care subsidy receipt in the year before kindergarten entry and the standard error (in parentheses) that is adjusted for clustering at the county-level. JIVE is jackknife instrumental variables estimator. The model includes controls for child's gender, child's age, child's age squared, race/ethnicity, child's weight in the fall of kindergarten, premature birth, low birth weight, fair/poor health status, first-time kindergartner, mother's age, mother's educational attainment, number of other children in the family, English as the primary home language, log of family income, urban residence, log of median household income, log of population density, percent non-Hispanic white, percent foreign born, percent ages 65 and over, percent female, percent of children ages 0-2, 3-5, 6-11, 12-13, 14, and 15-17 living in female-headed households (all at the census tract-level), percent of children in the school eligible for free/reduced price lunch, an indicator for whether a majority of children in the school are minorities, an indicator for whether the school receives Title I funding, and state fixed effects. *, **, *** indicate that the subsidy coefficient is statistically significant at the 0.10, 0.05, and 0.01 levels, respectively.

Table 7: The Long-Term Impact of Child Care Subsidy Receipt

Outcome	(1) Spring Kindergarten	(2) Spring 1st Grade	(3) Spring 3rd Grade	(4) Spring 5th Grade
Reading Test Score	-3.739**	-2.681	-0.757	-0.512
	(1.913)	(1.927)	(1.541	(1.871)
Math Test Score	-3.356*	-0.239	-0.289	-3.573
	(1.730)	(1.850)	(1.765)	(2.266)
Externalizing Behavior	8.612***	2.899	2.782	-2.056
	(2.522)	(2.305)	(2.060)	(2.165)
Internalizing Behavior	2.662	0.552	1.461	-0.445
	(2.152)	(2.113)	(1.995)	(2.214)
Approaches to Learning	-6.530***	-3.451	-4.088**	1.037
	(2.237)	(2.169)	(2.022)	(2.016)
Self-Control	-7.284***	-4.868**	-2.280	-0.118
	(2.072)	(2.345)	(2.137	(2.118)
Interpersonal Skills	-4.283**	-4.706**	-2.585	1.507
	(2.151)	(2.347)	(2.135)	(2.134)

Notes: Each cell presents the coefficient on child care subsidy receipt in the year before kindergarten entry and the standard error (in parentheses) that is adjusted for clustering at the county-level. The model includes controls for child's gender, child's age, child's age squared, race/ethnicity, child's weight in the fall of kindergarten, premature birth, low birth weight, fair/poor health status, first-time kindergartner, mother's age, mother's educational attainment, number of other children in the family, English as the primary home language, log of family income, urban residence, log of median household income, log of population density, percent non-Hispanic white, percent foreign born, percent ages 65 and over, percent female, percent of children ages 0-2, 3-5, 6-11, 12-13, 14, and 15-17 living in female-headed households (all at the census tract-level), percent of children in the school eligible for free/reduced price lunch, an indicator for whether a majority of children in the school are minorities, an indicator for whether the school receives Title I funding, and state fixed effects. *, **, *** indicate that the subsidy coefficient is statistically significant at the 0.10, 0.05, and 0.01 levels, respectively.

Appendix Table 1: Summary Statistics for the ECLS-K Sample

Variable	Full Sample	Subsidy Recipient	Non-Recipient
ln(distance to agency, miles)	1.419	1.296	1.438
	(0.998)	(0.975)	(1.000)
Boy (%)	0.499	0.506	0.498
	(0.500)	(0.501)	(0.500)
Child's Age (months, fall of K)	68.396	68.268	68.415
	(4.488)	(4.168)	(4.535)
White (%)	0.380	0.325	0.389
	(0.486)	(0.469)	(0.488)
Black (%)	0.345	0.411	0.335
	(0.476)	(0.493)	(0.472)
Hispanic (%)	0.205	0.174	0.209
	(0.404)	(0.379)	(0.407)
Asian (%)	0.030	0.018	0.032
	(0.170)	(0.133)	(0.175)
Other Race/Ethnicity (%)	0.040	0.072	0.035
	(0.196)	(0.259)	(0.185)
Child's Weight (pounds, fall of K)	46.824	47.295	46.753
	(9.402)	(9.644)	(9.364)
Premature Birth (%)	0.184	0.171	0.185
	(0.387)	(0.377)	(0.389)
Low Birth Weight (%)	0.077	0.057	0.080
	(0.266)	(0.232)	(0.271)
Child's Health is Fair/Poor (%)	0.046	0.054	0.045
	(0.210)	(0.226)	(0.207)
First-Time Kindergartner (%)	0.944	0.946	0.944
	(0.230)	(0.226)	(0.231)
Mother's Age (years, fall of k)	30.448	29.232	30.631
	(6.413)	(5.772)	(6.485)
Less than High School (%)	0.208	0.161	0.215
	(0.406)	(0.368)	(0.411)
High School (%)	0.374	0.385	0.372
	(0.484)	(0.487)	(0.483)
Some College (%)	0.326	0.394	0.316
	(0.469)	(0.489)	(0.465)
B.A.+ (%)	0.092	0.060	0.097
	(0.289)	(0.237)	(0.296)
Only Child (%)	0.292	0.235	0.300
	(0.455)	(0.425)	(0.458)
One Sibling (%)	0.357	0.345	0.359
	(0.479)	(0.476)	(0.480)
Two or More Siblings (%)	0.351	0.420	0.341
	(0.478)	(0.494)	(0.474)
English Primarily Spoken at Home (%)	0.899	0.932	0.894
	(0.301)	(0.252)	(0.308)
ln(total family income)	9.664	9.528	9.685
	(1.535)	(1.437)	(1.549)
Urban Residence (%)	0.845	0.815	0.850
	(0.362)	(0.389)	(0.358)

Notes: Standard deviations are in parentheses. Analyses are conducted on children and mothers with non-missing data.

Appendix Table 2: Estimates of the Relationship between the Distance to Social Service Agencies and Child Care Subsidy Receipt

	(1)	(2)	(3)
Linear Specification			
ln(distance to agency)	-0.016***	-0.016***	-0.018***
	(0.005)	(0.006)	(0.006)
Non-Linear Specification			
Distance to Social Service Agency	-0.005***	-0.005***	-0.006***
	(0.001)	(0.001)	(0.001)
(Distance to Social Service Agency)^2 (/100)	0.008***	0.008***	0.008***
	(0.003)	(0.003)	(0.003)
(Distance to Social Service Agency)^3 (/10000)	-0.003**	-0.002**	-0.003**
	(0.001)	(0.001)	(0.001)
Child Controls	No	Yes	Yes
Family Controls	No	No	Yes
Number of Observations	3,848	3,848	3,848

Notes: Robust standard errors are in parentheses. Distances are measured in miles. Column (2) adds controls for child's gender, child's age, child's age squared, race/ethnicity, child's weight in the fall of kindergarten, premature birth, low birth weight, fair/poor health status, and first-time kindergartner. Column (3) adds controls mother's age, mother's educational attainment, number of other children in the family, English as the primary home language, log of family income, and urban residence. *, **, *** indicate that a given distance coefficient is statistically significant at the 0.10, 0.05, and 0.01 levels, respectively.

Appendix Table 3: Child Outcomes in the Fall of Kindergarten by Distance Quartile, Reduced Form Relationships

	Distance Quartile				F-test of Equivalence: p-value	
					Adjusted for Child and Family Characteristics	
Variable	1st	2nd	3rd	4th	No	Yes
Reading Test Score	46.13	47.54	48.30	48.36	0.000	0.010
Math Test Score	45.98	47.57	48.75	47.95	0.000	0.015
Externalizing Behavior	2.410	1.373	2.067	0.966	0.017	0.015
Internalizing Behavior	1.612	0.716	1.217	1.327	0.290	0.392
Approaches to Learning	-2.679	-1.708	-2.120	-1.707	0.085	0.652
Self-Control	-2.746	-1.527	-1.932	-1.411	0.013	0.081
Interpersonal Skills	-2.601	-0.956	-1.744	-1.565	0.003	0.030
Fine Motor Skills	-2.939	-1.742	-2.055	-1.868	0.030	0.890
Gross Motor Skills	-0.189	0.021	0.723	-0.266	0.178	0.143

Notes: Analyses are conducted on children and mothers with non-missing data. Means are derived from an OLS regression of each child outcomes on four distance quartile dummy variables (with the constant omitted). The p-values are based on F-tests of the null hypothesis of the equality of means across the distance quartiles. P-values in the second column are derived from OLS regressions that add controls for child's gender, child's age, child's age squared, race/ethnicity, child's weight in the fall of kindergarten, premature birth, low birth weight, fair/poor health status, first-time kindergartner, mother's age, mother's educational attainment, number of other children in the family, English as the primary home language, log of family income, and urban residence.

Appendix Table 4: Instrumental Variables Estimates of the Impact of Child Care Subsidy Receipt on Subject-Area Proficiency Scores, Fall of Kindergarten

Outcome	(1) Outcome Description	(2) Outcome Mean	(3) IV: 2SLS
Reading			
Letter Recognition	Identify upper-/lower-case letters	0.574	-0.153** (0.078)
Beginning Sounds	Associate letters with sounds at the beginning of words	0.212	-0.138** (0.070)
Ending Sounds	Associate letters with sounds at the end of words	0.106	-0.118** (0.048)
Word Recognition	Recognize by sight or read simple words	0.015	-0.042*** (0.015)
Word Comprehension	Understand words in context	0.006	-0.017** (0.007)
Math			
Number and Shape	Identify numbers; recognize shapes; count up to 10 objects	0.887	-0.041 (0.034)
Relative Size	Recognize sequences; count beyond 10	0.446	-0.129** (0.063)
Ordinality	Read two-digit numbers; identify ordinal position of objects	0.126	-0.112** (0.045)
Add/Subtract	Solve simple addition and subtraction problems	0.014	-0.018* (0.011)
Multiply/Divide	Solve simple multiplication and division problems	0.001	-0.002 (0.001)

Notes: Each cell in columns (3) presents the coefficient on child care subsidy receipt in the year before kindergarten entry and the standard error (in parentheses). Standard errors are adjusted for clustering at the county-level. The model includes controls for child's gender, child's age, child's age squared, race/ethnicity, child's weight in the fall of kindergarten, premature birth, low birth weight, fair/poor health status, first-time kindergartner, mother's age, mother's educational attainment, number of other children in the family, English as the primary home language, log of family income, urban residence, log of median household income, log of population density, percent non-Hispanic white, percent foreign born, percent ages 65 and over, percent female, percent of children ages 0-2, 3-5, 6-11, 12-13, 14, and 15-17 living in female-headed households (all at the census tract-level), percent of children in the school eligible for free/reduced price lunch, an indicator for whether a majority of children in the school are minorities, an indicator for whether the school receives Title I funding, and state fixed effects. *, **, *** indicate that the subsidy coefficient is statistically significant at the 0.10, 0.05, and 0.01 levels, respectively.

Appendix A: Construction of the Database on U.S. Social Service Agencies

The process for creating the distance measure began by collecting data on the precise location of every social service agency in the U.S. In most cases, address data were available on the website of the state agency responsible for administering the child care subsidy system. For example, the Department of Economic Security administers the subsidy program in Arizona, and the office locations can be found here: https://www.azdes.gov/main.aspx?menu=128&id=2724. In Maryland, the subsidy program is managed by the Office of Child Care in the Department of Education, and information on agency locations can be found here: http://www.dhr.state.md.us/county.php. For some states, we were not able to readily find the office locations on states' websites, so we relied on administrator contact lists provided by the National Child Care Information Center (NCCIC): http://nccic.acf.hhs.gov/statedata/dirs/display.cfm?title=ccdf#az) and the *Child Care and Development Fund Report of State Plans* (various years) for this information. We were careful to ensure that each agency is involved in eligibility and benefit determination for child care subsidies.

For each social service agency, we collected information on the state name, state FIPS code, county name and county FIPS code in which each office is located; the address (including building or suite number), city, and zip code; telephone and fax numbers; and the name of the agency that administers the subsidy program. Most states organize social service provision at the county-level, with one agency located in each county. However, in some urban counties and many cities, there are multiple agencies located in the jurisdiction. For example, La Paz county, located in Western Arizona, is a rural jurisdiction, and its residents have access to a single social service agency. Maricopa county, in contrast, is an urban area (containing the city of Phoenix), and its residents have access to eight offices. As for Maryland, every county contains one social service agency, except for Baltimore City, which has nine offices. In a small number of cases, a locale does not include a social service agency, so that its residents must travel to adjacent counties to apply for child care assistance. For example, Pend Orielle county in Washington State does not have a social service agency. Therefore, as stipulated by the Department of Social and Health Services, residents in this county must travel to a branch office in Spokane county (located south of Pend Orielle) to apply for assistance. Generally speaking, these agencies serve residents from multiple counties.

Our database attempts to account for these complications. Agencies located in multiple-agency-jurisdictions are each treated as separate entries in the database. Agencies that serve residents from multiple jurisdictions (because their county-of-residence does not have one) are repeated in the database, with each entry denoting the relevant county served by the office. In all, we collected data on approximately 3,600 unique social service agencies.

One concern is that our agency database captures the current address of each agency, while our child care subsidy data come from surveys the conducted in the late-1990s and early-2000s. To the extent that some of these agencies moved to their current address after these years, our distance measure contains measurement error. However, as previously stated, we recorded the telephone number of each agency in the database, and we asked two research assistants to make phone calls to more than 10 percent of (randomly chosen) offices to inquire about their location history since 1998. Fortunately, an overwhelming majority of these agencies have been at the same location during this period, and we were able to identify the previous address in most cases for the small number of movers. Of the 405 phone calls made to social service agencies, we were able to speak to a representative in 228 cases. Of these cases, only 35 reported that they had moved at some point since 1997. The rest stated that they were either in the same location for sure or that they had "probably" been in the same location.

The next step in the process involved geocoding the location of social service offices by assigning a latitude and longitude coordinate to each. We worked in collaboration with Geocoder (www.geocoder.us) to generate the coordinates. Geocoder was able to provide these coordinates using its own application programming interface (API) as well as that from Google, now considered

the gold standard for producing geocodes. Based on our discussions with Geocoder analysts, we concluded that the Google-based geocodes were of higher-quality, so we use these as the basis for making the distance calculations. Of the 3,659 social service agencies (unique or repeated) in our database, 2,887 (approximately 80 percent) were able to be geocoded to its exact location (i.e., typically to 30 feet or less). Another 543 agencies (15 percent) were goecoded to roughly block- or street-level accuracy. For 229 agencies (six percent), only the city or zip code was available to be geocoded, decreasing locational precision to as many as a few miles. In sum, approximately 95 percent of social service agencies were geocoded with a level of precision at the block-level or better.

A potential concern with the geocoding process is that the agency addresses would not match those found in Geocoder's database. For example, slight errors in spelling or formatting in a set of agency addresses could cause a different set of addresses to be geocoded. Fortunately, Geocoder provided us with a measure called the Levenshtein-Damerau, which calculates the "edit distance" (or level of textual discrepancy) between the addresses provided and the addresses actually assigned geocodes. We used this measure to double-check the accuracy of agency addresses that were assigned low scores, and we corrected any errors that were discovered. Generally speaking, we found this measure to be quite sensitive to small inconsistencies between the provided and geocoded addresses. Therefore, our data checks were extensive.

In the final step, we calculated the distance between the location of social service agencies and the residential location of each family in our analysis samples. Given that we plan to use this distance measure with a number of datasets (e.g., Early Childhood Longitudinal Study—Kindergarten cohort and Fragile Families and Child Well-Being Study), we utilized the following approach. Users of the ECLS-K and FFCW contract data are able to observe families' residential locations at the census tract-level. Since child care subsidies are distributed by agencies organized at the county-level, we use the county as the geographic boundary for calculating the distances. As a result, we calculated the Euclidean (or as-the-crow-flies) distance (in miles) between the location of social service agencies and *every* census tract centroid in the county in which each agency resides. For example, La Paz County in Arizona has one social service agency and six census tracts. Therefore, our database contains six sets of distances associated with this agency: one for each census tract. In Maryland, Montgomery County also has one social serve agency but 176 census tracts. Our database contains the distance from this agency to each census tract in the county. Jurisdictions with multiple agencies have a set of distance calculations for each agency. For example, Baltimore City has nine agencies and nearly 200 census tracts, leading to approximately 1,800 separate agency-tract calculations. In addition to calculating the distance, we produced the census tract identification number associated with each agency-tract combination. We use the census tract code to merge the distance measure with families in our analysis samples. Although this process was extremely time-intensive, the results provide us with the flexibility to append the distance measure to virtually any dataset with census tract codes.