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Abstract

The paper investigates the influence of two distinct family attributes on children's test scores in reading and mathematics. One is the family's resources – its income level, the parents' education levels, own ability in reading and math, among others. The strong, well-documented relationship of family resources to children's cognitive skills is confirmed in the two British data sets analyzed here. The other attribute is the parents' "caring" for the child, the family's habits regarding nurturing the children, the inclination to sacrifice in behalf of the children or to expend time and effort with the children. Measured by several behaviors during the pregnancy and the child's early years, the study shows that these family habits of caring for their child are also strongly correlated with the child's test scores in both reading and math, controlling for the family's resources. The magnitude of the family caring relationship to the child's test scores is nearly as strong as is the relationship of the parent's education to the child's test scores. Moreover, since the two data sets cover three generations of the same families, the study shows the strong cross-generational linkage in family caring behavior and in the relationship of grandparent caring of their child and the test scores of their grandchild.

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1. Introduction

The influence of family resources on children's cognitive capabilities has long been documented; it justifies much social policy effort to ameliorate the adverse effects of family poverty and economic deprivation on children's healthy development. This paper suggests that families differ not only in the level of resources that they have available to nurture children, but also differ in their inclination to use those resources in behalf of their children – called family caring. The nurturance of children begins at the earliest stages of life: even the behaviors of the mother during the pregnancy have been shown to influence the healthy development of her child. From birth onward, the family plays a pivotal role in stimulating, nurturing, and facilitating the development of skills, knowledge and the habits that promote cognitive as well as socio-emotional development. While the family's resources may be a necessary element in its nurturance of the child, the sheer availability of resources does not guarantee that they will be deployed in behalf of the child. This paper first discusses the nature of "family caring" and frames the issue of its relevance to the production of skills in children. A second step shows empirically the relationship between family caring and children's skills in reading and in math, controlling for the levels of family resources. It does so with two distinct bodies of parent-child data, using test scores as the outcomes of interest. It compares the magnitude of the relationship of family caring to test scores with the more conventional relationship of family resource levels to the child's test scores. The findings in one of these data pairs suggest that the order of magnitude of influences of family caring is roughly comparable to the magnitude of influence of family resources; the other data pair replicates that finding. Since these data sets are in fact two parent-child pairs of a three-generation data set, a final step is taken in which the measures of family caring of one generation is compared to measures of family caring of the next generation and these findings suggest that there is much consistency within families across generations in how families care for their children – an empirically important difference in what might be termed family culture.

2. Analytic Framing

A fruitful, simple framework for thinking about how skills are generated is a production function of the general nature

$$\text{Skill} = f(S, F, C),$$

where S is a vector of school attributes that affect the child's skill acquisition, F is a vector of family characteristics and behaviors that do so as well, and C is a vector of the child's own attributes and actions that help determine the productivity of the school and family inputs. Various disciplines and literatures feature estimates of effects of elements of S or F on skills. Few studies have the data resource to investigate the influence of both S and F simultaneously. This paper follows that unfortunate tradition and focuses on the effects of F on children's skills.

While some skills, both cognitive and emotional, may be acquired without specific effort or investment, reading and mathematical skills require effort in learning, in

practice, and in usage to gain the facility that is assessed in any reasonable test of these skills. Like most forms of human capital, these two skills can be modeled as an accumulation of increments year by year, with some erosion or depreciation of the skills if unused, and with the characteristic that the greater the skill acquired by one age, the greater the capacity to absorb new units of that skill subsequently. (See, i.e., Ben Porath 1967; Heckman 2000.) If we think about the specific production function that produces reading or math skills, early "inputs" in the form of genetic endowment and healthy development of the fetus are surely important antecedents. Studies have shown the harmful effects on neuro-development of exposure to toxic chemicals such as lead and to maternally ingested toxins such as tobacco smoke, for example (Landrigan et al 1975, 2002). Similarly, infant health and early cognitive stimulation influence the infant's biological and behavioral nature. The curiosity, habits, attention span, etc. that begin to develop in infancy, well before the child actually learns even the elements of words or numbers, begin this process of developing the "human capital" which enhances the child's later inclinations and capacities to acquire reading and math skills. The pre-school habits of time spent exploring books, the experience of enjoying the activity of reading or working out math problems, and the experience of observing adults also doing so influence the child's receptivity to making the efforts needed to acquire these skills. So the family has much opportunity to influence the child's accumulated skills and his interest or motivation in acquiring these skills, long before the child enters any formal schooling. Moreover, I assume parents wish to have their children develop these skills since reading and basic mathematics are essential for functioning in society. No concerned parent would wish their child not to have these skills necessary for competent social intercourse. This paper focuses on a reduced-form model of the parental and familial "inputs" in the production of these skills.

The first set of inputs in the child's skill production is very conventional: the parent's economic and personal resources. Three primary resources and several secondary resources are emphasized here as influencing the child's development of reading and math skills. First, the family's financial resource, its income, affects the child's skill development through many channels. Most importantly, very low income can result in health deprivation through inadequate nutrition and poor medical care. More generally, higher levels of income imply a greater "demand" by the family for investments in their children generally and provide the capacity to buy products that encourage the child's learning, to provide opportunity to practice new skills, and to obtain better instruction. Likewise, by the nature of "public goods" within the family, there is greater quality and variety of most all products in a higher income family simply because of the choices parents make about their own consumption bundle. From the reading material lying around the house to the paintings on the walls, the quality of these family goods is positively correlated with income and the child benefits from exposure to these higher quality products. Much evidence exists documenting the positive relationship between family income and children's cognitive skills. (See Huston, McLoyd & Coll, 1994; Duncan & Brooks-Gunn, 1997; Blau, 1999; Mayer, 2002; McCulloch & Joshi, 2002; Aughinbaugh & Gittleman, 2003; Taylor, Dearing & McCartney, 2004, among others.)

The parents' own abilities also are an important input in this production activity. Having skill oneself makes it easier to teach, to show the usefulness or satisfaction from having a skill, and to encourage the child in the development of that skill. That

principle applies to music skills, interest in history or in politics, to manual dexterity and to social skills as well as to cognitive skills in reading and math. Parents who are good at any skill have a resource that makes it easier – less expensive in money, time or effort – to promote that skill in their children. For a good summary reference on the "crucial role that parental cognitive stimulation plays in fostering the intellectual competence of young children" see Saltaris et al, 2004, p.106.

A similar argument can be made about the parents' own levels of education. Parents with more schooling probably have greater facility in promoting an interest in schooling by their children. Education enhances the parents' ability to encourage and guide their child's learning. Moreover, parents with greater investment in their own human capital may have a greater inclination, as well as capacity, to stimulate those investments in their children, and perhaps as well those with more education have a lower rate of discount and hence an inclination to emphasize the long-term advantages of making human capital investments. It is not surprising, therefore, that many studies find that parental education is positively associated with the child's measured skills. (See Smith, Brooks-Gunn & Klebanov, 1997; Feinstein, 2003; Michael, 2004.)

In addition to these three key resources (income, own-skills in the specific subjects of reading and math, and general educational level), there are other family attributes that can be considered resources that may affect the child's skills. The structure of the family, its stability over time, the number of and relationship among adults in the family are often hypothesized as having effect, but the evidence is mixed especially on cognitive attributes of children. (See McLanahan, 1997; Pierret, 2001; DeLeire & Kalil, 2002.) The age of the mother at the birth of her child reflects her own maturity and a very young mother is often thought to have less adequate emotional resources available for rearing a child. The child's birth order has been shown to have association with cognitive test scores, as first-born children have a greater proportion of their interaction with adults, while later-born children spend more of their time with siblings. And of course, holding constant the amount of these various resources in the family, the larger the number of siblings the fewer the resources available per child, so family size or number of siblings is often found to have a negative association with the child's cognitive development.

These resource constraints have a long and illustrious pedigree. Convincing evidence shows that they affect the child's skill level through many mechanisms. This evidence justifies the social policy attention given to families in poverty, as assistance or remediation is called for to provide children in impoverished families the "head start" that gives them opportunity to keep up in their schooling. Beyond the focus on schools and their operations and expenses directly, the support of financially needy families is where much social policy focus appropriately lies.

But these resources that are known to influence the child's skills are typically not direct "inputs" in the skill production function. At best they represent a reduced form relationship: families that have higher levels of the resources have children who score better on standard cognitive tests and the association must imply, goes the often-unstated argument, that having more means the child is given more. Few studies actually show the connection between the expenditures on certain goods or services and the child's achievement; few document the mechanism by which the

parent's income or ability or knowledge influences the child's skills. Even if we stipulate that families with greater resources do, in general, provide greater input into their child's skill production function, not all families with a given level of resources provide the same amount. It is this variation that constitutes the domain of family caring. Most economic models implicitly assume that these differences are variations in preferences and they are paid little attention because they are considered to be distributed randomly. The point of this paper is to argue that we can do better than that: families differ in their willingness to expend their resources in behalf of their children[1] and this difference is not random. The hypothesis is that although this difference in caring for children can be considered a family preference, family caring is a family habit that persists over time and has antecedents across generations within a family. The essential aspect of family caring is the degree of commitment or resolve to invest in children, to engage with them as they grow up. In the developmental psychology literature "parenting" is an important focus, and styles of parenting (authoritative or authoritarian, for example) are identified and assessed, but that is not the idea here.[2] It is the family's commitment, determination, or resolve to use available resources of time, energy, attention, as well as money in behalf of their children that constitutes family caring.[3]

While resources constrain families in what they have available as useful "inputs" in helping their children produce human capital, families with the same resources differ in how much of those resources they choose to expend in behalf of their children. In an economic model, demand is determined by resources, prices and preferences. The money resource constraint, for example, is seldom binding except in so far as alternative uses of the money are considered more attractive. For poor families their level of resources may constrain what they can spend on their children, but for most families, while income levels affect the amounts spent on children, preferences also play an important role. A typical economic model of demand features the pattern of expenditures as it varies systematically by level of money resources, controlling for prices, and assumes preferences vary randomly. In terms of resources devoted to their children, the contention in this paper is that family caring is a separate factor, is not random, can be identified, and has influence.

Later sections present measures of family caring and show empirically that they differ across families and that these differences are strongly correlated with children's test scores even when measured family resource levels are held constant. The hypothesis tested there is that family caring – these parental allocations of energy, of attention to or engagement with their child, of emotional and intellectual interactions with the child – positively influences the child's human capital development in the form of reading and math skills. The logic of the argument is that the level of the family input into the child's skill production function depends on both the available resources and the family's willingness to expend them on the child. Neither parents' wealth nor their abilities impacts their children's skills automatically; the "inputs" into their children's skill production requires the commitment to spend the money, the time, and the attention with their child; this is "family caring." The paper uses several strategies for measuring family caring, and shows that it is associated with the child's reading and math test scores, controlling for the family's level of resources.

If there were no further evidence, a skeptic might argue that these measures of "caring" are simply indicators of parental preferences. But since the data set used

here is of three successive generations, the second step in the study looks across the generations and shows that there is substantial cross-generation consistency in these measures of caring. It shows also that the caring behavior of one generation is correlated with the test scores of grandchildren, suggesting that these caring behaviors persist across generations. In this sense they are not random, they constitute the nature, the culture, of that family. The contention is that parents' preferences or tastes for family caring are systematically related to their own experiences in childhood and so they persist within a family from one generation to the next. The level of this commitment is not arbitrary or random but reflects, instead, the experience of the parent back when he or she was a child. That experience helped form habits and perceptions about how to be a parent, about how to nurture and train a child, and about what level of care-giving and attention and personal sacrifice is appropriate. Families have and pass along from generation to generation practices, customs, and behaviors as surely as they pass down recipes and heirlooms. Some families make a big event of national holidays, birthdays and anniversaries of private events while others do not. Some families focus much of the household life around the activities of the children while others do not. Just as different ethnicities, different countries, and different religions have and promote different traditions, so too do families[4]. For much the same reason that we see modestly strong correlations across generations in religious affiliation, in political party affiliation, in occupational choice and in residential location choice, the way a parent raises his or her children is influenced by the way he was raised and the activities his parents taught him and showed him about child rearing. This notion of a habit or a priority or a commitment to caring for or investing in children is found in the literature of many social sciences, including economics (i.e., Becker 1991; Becker & Tomes 1986; Sen, 2001) and in psychology (i.e., *Developmental Psychology*, 1998; Hauser, 1999; Vandell, 2000) among others.[5] Put in another way, families differ in the degree to which they promote the care and nurturing of their children and that becomes a family fixed effect, a characteristic of that family that persists across generations.

One recent, intriguing and important piece of physical evidence of the intergenerational transmission of maternal caring has recently been documented in the burgeoning genomic literature. There, in a non-human species, the evidence has led to the conclusion that:

> "variation in maternal care…is inherited; …[offspring] that receive the minimum care from their mothers grow up to return the favor when they have their own offspring….Hence, environmental influences on behavior can cause epigenetic changes in the genome that are inherited." (Robinson 2004, 398)

The species in this research is the Norway rat and the evidence is fascinating. Maternal care by the mother rat was known to be associated with hormone response to stress in her pups. A lab at McGill University directed by Michael Meaney used a cross-fostering study, placing pups born to high and low-caring mothers in litters of other low and high-caring females to create proper control groups for study. They found that pups raised by high-caring females were themselves high-caring mothers when they later had pups, while those raised by low-caring females were themselves low-caring mothers later. (Frances et al, 1999; Weaver et al, 2004) The maternal

caring behavior of the pups raised by a high-caring female was significantly higher than that of the pups *born* to a high-caring female but raised by a low-caring female. The fascinating conclusion is that "individual differences in maternal behavior were transmitted across generations." (Robinson, 2004, p.1156)

The McGill study took the next step, seldom available to us social scientists: they investigated the mechanism of generational transmission of the difference in behavior. (Weaver et al, 2004) That mechanism involves a hormonal response to the level of stress experienced early in life (in the rat pups, within the first seven days of life). The team focused on a single promoter (exon I_7) and a single gene (GR). The steroid hormone glucocorticoid can change the expression of that gene in the brain, and that change persists throughout the life of that pup. Pups that receive high levels of care and presumably experience less stress have a higher level of this hormone. It inhibits the presence of methylation, creating an epigenetic modification of the gene, which then “is stably maintained into adulthood” and affects adult behavior. So this study concludes that “variations in maternal care directly alters the methylation status of the exon I_7 promoter of the GR gene” (Weaver et al, 2004, p.849) and so “our findings provide the first evidence that maternal behavior produces stable alterations of DNA methylation ….providing a mechanism for the long-term effects of maternal care on gene expression in the offspring.” (p.852) As the *Science* essay contends, “individual differences in the expression of genes…can be transmitted from one generation to the next through behavior." (Robinson, 2004,p.1158)

In these data, the mother's behavior affects the stress experienced by the offspring which in turn creates a biological reaction that alters the gene’s expression but does not change its basic physical structure. So, if a pattern of high-care-giving were interrupted in some generation and the next pup was raised by a non-caring caregiver, the gene would revert, and that pup would not be a high-care-giving mother when she grew up even though the prior generations of her lineage were high-care-givers. A pup raised by a caring caregiver will, herself, be a caring care-giver in adulthood, and vice-versa. So the caring behavior is passed along from generation to generation through the methylation status of the gene, but only so long as there is no interruption in the transmission of the caring behavior.

If (a big leap and one not warranted at this time) a similar genetic mechanism applies to the human species, the potential policy implication would be fascinating. The human, unlike the Norway rat, may be persuaded by evidence that caring has attractive outcomes, so a mother's behavior might be modified by information, public education, or encouragement. Persuaded to be a caring parent, the expression of some of the genes of her offspring might be affected and thus that child would grow up to be a more caring parent also. But on the downside, humans have the capacity to decide to change their behavior, so even after several generations of positive effective caring within the family, the transmission from one generation to the next requires caring behavior to be experienced by the offspring each generation. There is no polymorphism in the gene, no inherited structural change: it is an epigenetic modification in the gene, limited to that one generation. Without continued caring, the next generation does not inherit in its DNA a "caring" gene; the environment is a critical component. If the mother's behavior is modified by some other mechanism, either positively through information and persuasion or negatively through some external intervening force, this particular generational transmission might be altered.

A suggestive foray, perhaps, but we return to the reality of evidence that family caring differs across families, is correlated with the child's test scores, and is correlated across generations within a single family strongly enough that the caring behavior of one generation is correlated with the grandchild's test scores.

3. Data

The two data files used in this study both come from the "National Child Development Study" (NCDS), the longitudinal study of a British birth cohort of 1958. Begun as a complete enumeration of all births in Great Britain during one week in March 1958, these children (and their mother for the first several waves) were re-interviewed or tested at ages 7, 11, 16, 23 and 33 and subsequently at 41 and 45. The first of the data files uses information from the 1958, 1965 and 1969 waves of the NCDS. It has extensive information about the parent's behaviors during the pregnancy that resulted in the 1958 birth and during that child's infancy and early childhood. It also has a reading and math test score for each of these children obtained when he or she was age 11 (in 1969). Thus, we can study the relationships to the child's test scores at age 11 of the family's resources and of the parental behaviors during the pregnancy and the child's infancy. To keep the generations straight in the discussions that follow, the parents of the child born in 1958 will be called G1 (generation #1) and the children born in 1958 will be called G2. The G2 boys and girls are the subjects followed longitudinally in the NCDS.

The second data file exploits another feature of the NCDS. At the time of the 1991 interview of the G2 subjects, at age 33, the biological children of a randomly selected one-third of these men and women's were also interviewed or tested. There were 4,229 children in this supplemental data set known as the "Children of the NCDS," funded primarily by NICHD. Some 2,510 of these children were old enough to be given the PIAT cognitive tests on reading recognition and mathematics in that 1991 interview. These children constitute another generation, G3. The 1991 survey also asked the G2 respondent many facts about his or her parenting behaviors. This second data file uses 1991 information about the prior parenting behavior of G2 and the test scores of G3 to investigate the relationships to the child's reading and math test scores in 1991 of the family's resources and parental behaviors.[6] Initially, this paper treats the two parent-child pairs, G1-to-G2, and G2-to-G3, as independent data files.

4. Family Influences on the Children born in 1958: the influence of G1 on G2.

Table 1 shows summary statistics of the variables used in the investigation of the influence of the family on the NCDS cohort-member's test scores in reading and math assessed at age 11. The number of observations is 2,565. This is the sub-set who were randomly selected in 1991 for testing their children. Using this subset facilitates comparisons later and imposes no particular censoring except that these 1969 respondents are all still in the longitudinal data set in 1991 and all do have at

least one child age four or older by that date. Since all are identically the same age, and all were assessed at the same age, these two cognitive test scores have not been normed. The standard deviation of the math score is substantially higher than of the reading test; their simple correlation of the two tests is 0.73 which is relatively high.

The table shows the available measures of family resources and the indicators of family caring. Regarding income and economic circumstances of the family at the child's birth in 1958, a key piece of information is the socio-economic status of the family (based on its income, education and occupation), calibrated in quintiles. Additionally, the data file has a dummy variable indicating whether the family was in the process of buying their home (i.e., relatively well-off), which 40% were doing. Another 12% were renting their home, while some 43% lived in subsidized housing indicating relatively poor financial means. We also know if the child received subsidized school lunches at age 7, which is an indication of relatively low family income (14%). These several measures provide a good indication of the family's financial circumstance at or near the time of the child's birth. The age of each parent at the child's birth, the marital status of the mother at the child's birth, whether each resident parent was the biological parent of the child, and the number of children in the home at the child's birth are also facts about the family that are used in the analysis. Finally, we know the age at which the mother and father left school, which is a useful indication of their human capital. These are the measured resources of the family.

Since these NCDS data were collected initially as a perinatal mortality study by the Medical Research Council of Great Britain, it also contains relatively much information about the behavior of the (G1) mother during her pregnancy with the child (G2) and her maternal behavior soon after the birth. Nine behaviors are used here to reveal the “family caring” by G1. The notion of family caring is a latent construct, so it is not directly measurable; the nine behavioral facts are used in three distinct statistical strategies. One strategy includes the nine separate dummy variables in the multivariate regression on the child's test score, controlling for the family resources and a few attributes of the child. A second strategy uses the sum of the nine behaviors as a single covariate. A third strategy performs factor analyses on sequential subsets of the nine measures, including somewhat greater detail about them, in extracting the latent construct of family caring, then uses these indicators as covariates in the regression.

The nine behaviors and their summary statistics are reported in Table 1. There are three behaviors reported during the pregnancy: (1) a dummy indicating that the mother did not smoke before or during that pregnancy (54% and 8%, respectively did not); (2) a dummy indicating that her first prenatal visit occurred within the first 16 weeks of the pregnancy (46%); (3) a dummy indicating that she had at least 16 prenatal medical visits (25%). These three variables suggest the effort or concern the mother evidenced during the fetal period. In the factor analysis, the smoking behavior is more finely parsed in dummies indicating if she had smoked before the pregnancy, stopped during the pregnancy, reduced, maintained or increased her smoking during the pregnancy and also includes the average number of cigarettes smoked during the fourth month of the pregnancy, yielding a single factor that is used in the regression analysis. (Appendix Table A1 summarizes this and all other factor

analyses used in the multivariate statistical models.) Since that factor positively reflects smoking, it is negatively associated with family caring, and so it expected to be *negatively* associated with the child's test scores.

The second set of three variables reflect the parents' caring behaviors during the child's pre-school years: (4) a dummy indicating that the mother breastfed the child (59% did); (5) a dummy indicating that the father read to the child frequently (30%); (6) a dummy indicating that the mother took the child "on outings" frequently (75%). These too are behaviors that take time and effort, imply engagement with the child and thus "caring," but they do not require an expenditure of money. In the factor analysis of the parents' behaviors in this pre-school interval, these three variables are augmented by dummies indicating whether the other parent also read to or went on outings with the child, so five dummy variables are included, yielding a single composite indicators of parental caring during this stage of the child's life. It is a positive indicator of caring, thus it is expected to be *positively* associated with the child's test scores.

The third set of variables pertains to the child's early school years. In the data collected at ages 7, 11, and 16 the child's school teachers were interviewed and asked about the involvement by each parent in the child's school life. Two composite indicators are included here that reflect that the three teachers said the mother and the father, separately, showed a big interest in the child's school activities (32% of the mothers and 21% of the fathers). Finally, the parents were asked in 1969 if they hoped their child would continue in schooling beyond the mandatory age of 16 and the final dummy variable indicates an affirmative response (72%). In the factor analysis of these early-schooling behaviors, dummies that reflected the other end of the spectrum (not caring) were also included (the dummy indicates that the teachers reported that the parent had particularly little interest in their child's school life (13% of the mothers and 14% of the fathers). In that factor analysis, one additional dummy variable is included, indicating that the teacher said the parents did or did not initiate discussion about the child with the school (doing so is interpreted as showing attentiveness by the parent). In this factor analysis, the single "caring" factor loads positively on parental attentiveness or interest in the child's schooling; it positively reflects family caring so it is expected to be *positively* associated with the child's test scores.

These several measures of the parent's behaviors with the child prenatally, in the pre-school years, and in the early-school years reflect family caring.[7] We cannot hope to measure all the behaviors that constitute family caring. The presumption is that the many behaviors are broadly intercorrelated and so when we observe a few of these habits or efforts, they reflect the degree of overall commitment or caring by this family: they serve as proxies or instruments for the broader set of efforts that distinguish families by their caring behavior. The notion is that there is persistence over time in caring behavior, so measuring it at one stage of the child's life does not imply that we capture the dynamic of the investment, just its level across children in different families. The hypothesis is that family caring is positively associated with the family inputs into the child's skill production function and thereby with the child's reading and math test scores. We expect to find a positive association between these proxies for family caring and the child's measured abilities. The expectation for a positive association is not linked to any one particular behavior.

Table 2 reports the regression analyses for the child's reading test score. Model #1 controls for the child's gender and shows the strong influence of the family's resources on the test score. Children have higher reading test scores in families with higher socioeconomic status, with parents who remained in school longer, in families that were relatively well-off as measured by their owning their home or by their ineligibility for subsidized school lunches. Children in families with a larger number of children have lower test scores. This regression clearly documents the importance of family resources in influencing the child's cognitive test score in reading. The same pattern of influence is seen for the mathematics test score in Table 3. These British children born in the late 1950s and assessed in the late 1960s are no exception to the well-documented finding that children's cognitive test scores are strongly positively associated with the level of family resources.

Models #2 – 4 in Tables 2 and 3 introduce the indicators of family caring. Model #2 shows that several of the specific parental behaviors are statistically significantly associated with both reading and math skills: early visitation to the physician in the pregnancy and each of the parent's taking a big interest in the child's schooling as assessed by the teachers, and the parent's expression of high aspirations for their child's schooling all show significant and positive associations. For the math test (model #2 of Table 3), the dummy variable for the mother not smoking during the pregnancy does so as well.

When those specific behaviors are condensed through factor analyses, the three composite variables also show this same positive influence of caring behavior on the child's two test scores (recall that the first of these, "G1Care-Preg" is a negative indicator so the negative sign of the coefficient is as expected). When the simple composite sum of the nine variables is used instead (model #4), it shows a very strong positive relationship with each of the two test scores. In these several regression models, parental behaviors toward their child – caring behaviors – are statistically, strongly, positively associated with the child's test scores, and they are so while controlling for the family's level of resources.

To explore the implied magnitude of these several effects on the child's test scores, Table 4 shows the pattern of test scores generated by predictions based on model #4 for both reading (Panel A) and math (Panel B). As the resources of the family rise from the lowest SES class and with subsidized housing and school meals, to the highest SES class and home ownership, we see a rise in the child's test score of about 5.5 points for reading and about 10 points for math – about one standard deviation in each case. Alternatively, as the parental caring index rises from a low value (1) to its highest value (9), the reading test score rises by about 4.5 points, and the math test score rises by about 7 points, also approaching a standard deviation increment in each. The regression shows that both family resources and parental caring, separately, are strongly related to test scores in reading and math among these G2 children.

5. The Children of the NCDS: the influence of G2 on G3.

A similar analysis of family influences on children's reading and math tests can be undertaken with these same families a generation later, when the child in the section above (G2) has grown up and was interviewed at age 33 along with his or her biological children (G3). Here, the children vary in age so their test scores on the PIAT-Reading Recognition and PIAT Math tests are normed for these 2,509 children. The intercorrelation of the two tests is 0.57. Table 5 summarizes the information used in this analysis. The G3 children are about equally divided by gender, nearly all are white. About two-thirds of them have their mother as the cohort member-parent (G2), some 58% have married parents, the average age at which their mothers first gave birth is 22.5, and the data include the family's religious affiliation as well as the frequency of the family's church attendance. The number of siblings of the child averages 2.4. Of course, at least one of their parents, the NCDS cohort member, is age 33 at the time of the interview in 1991 (variable not shown).

Compared to the data file used in the previous section, this data file has relatively better information about the family's resources but less complete information about the family's caring behaviors. The G2-parent's reading and math test score from age 11 (the variables that was the dependent variable in the section above) measures one of the several resources available to the family in promoting the G3-child's skills. Another resource is the level of formal schooling of the cohort member parent (schooling is shown as dummy variables reflecting the certifications attained; one who completed the A-level qualifications has about the equivalent of a U.S. high school education). For the spouse, instead of the qualifications earned, we have the age at which he or she left schooling; about one-quarter did so under age 16, about half at 16, and as many as ten percent went to school into their twenties.

Measuring income in the NCDS is complex since the conventional measure of money income is not available for about 16% of the cases. Instead, an excellent set of seven circumstances closely related to income level yields a good measure of the family's income reflecting a longer term concept than annual flow income. The information includes whether the family had each of the following seven assets or circumstances (listed here in descending order of prevalence): had a bath in their home, had a phone, were not currently on welfare, owned (or were buying) their home, had a savings account, had never been on welfare, and had some financial investments.[8] The sum of these seven dummy variables is the variable "incindex" used here. (Several other indicators of income, including log-annual income, log-house-value and a factor analysis of these seven attributes, have also been used and are noted below.) These several variables – income, education of both parents, the reading and math skills of the CM-parent -- reflect well the financial and human capital resources of the family.

There are six indicators that measure family caring by this generation, the family's willingness to make sacrifices or expend resources on the children. Three pertain to the child's pregnancy, two that reflect behavior soon after the child's birth, and one other pre-school indicator. These are all dummy variables. Regarding this pregnancy, one variable indicates whether the mother smoked before or during the pregnancy with this child (62% did not), whether this pregnancy was planned (as

reported at the 1991 interview; 71% reported that it had been), and whether the mother got prenatal care during the first trimester (60%). Following the birth of this child, we know if the mother breast fed this child (62%) and whether she did so for more than one month (30%). Finally, we know if the mother reported that the family took holidays together (74%). These six indicators reflect the family's efforts in behalf of their child, all are discretionary, and although each is costly in time or effort, none imposes a monetary burden on the family. In the analysis reported below, the six are used as a set of six separate indicators and also as a composite sum of the six.[9] The composite, "G2-Care" has the following distribution:

The Distribution of the variable "G2-Care"

Value	% of cases	Value	% of cases
0	1%	4	25%
1	7	5	19
2	15	6	10.
3	24		

While these few factors do not fully capture the family's child-rearing preferences or willingness to expend energy, time, and attention on their children, the contention is that there is signal content in these indicators. They are positively correlated with the degree of commitment to the child, so we expect to see a positive association between these several dummy variables, or their sum, and the child's cognitive development as reflected in the important skills of reading and mathematics.

Table 6 shows four regression models of the family's influence on the child's reading test score. In model #1, in addition to controls for a few of the child's characteristics and parental controls, the parent's resources are included. The model shows the strong influence of family resources on the child's test score: the parent's own abilities in reading and math, the educational achievements of both parents and the family's income level all have strong positive association with the child's test score.[10] The resources per child are lower as the total number of children in the household rises, explaining the observed negative effect of number of siblings on the test score. Here, the girls perform somewhat better than the boys, as do older children, and the age at which the mother first gave birth is also positively associated with the test score, interpreted as reflecting the resource of her maturity. Families that often attend religious services may have greater structure, perhaps explaining its positive influence (see Tepper, 2001). These relationships are quite robust in terms of similarity with many other studies looking at the role of family resources on children's cognitive development. (While this model includes a more extensive set of children and more control variables, model #1 qualitatively mirrors the finding for these reading and math tests reported by Aughinbaugh & Gettleman, 2003.)

Model #2 replaces the parental resource variables with the set of six dummy variables reflecting the family's commitment to caring for their child. Here we see a positive association between several of these indicators and the child's reading test score: a positive coefficient on not smoking, on the planning status of the pregnancy, on breastfeeding the child. The F-test for this set of six is strong: 10.65. The model tells us that the child's reading test score is associated with these early parental behaviors, here controlling only for a few child and family attributes.

A more stringent test is shown in model #3 in which both the family resources and the six indicators of family caring are included. Every one of the family resource measures exhibits a smaller positive effect in model #3, but none loses its statistical significance by the inclusion of the family caring variables. The family caring coefficients are also smaller in model #3, and one of the variables loses its significance while the F-test for the set of six falls to 2.56, significant at the 2-percent level. In model #4 the six separate indicators are replaced by the index G2-Care which has a sizable and quite strong association with the reading test score.

Table 7 shows the same four models estimated on the G2 child's mathematics test score. Broadly similar results are found there. Interestingly, while both the reading and math ability of the parent affected the child's reading ability, only the math ability of the parent is associated with the child's math test score. Girls do not do better than boys on the math test but again the older children do somewhat better. Regarding the family's resources, again both parents' education levels are influential and the family's income has a significant positive effect.[11] Again for this math test, families with more children have fewer resources per child, explaining why the test score is lowered by the number of children.

In model #2 the family resources are replaced by the six indicators of family caring. All have the expected sign and four are strong statistically: smoking during pregnancy, breast feeding and the longer duration of breastfeeding, and families taking holidays together. In model #3 when both the resources and caring behaviors are included, both again are weakened by the other but the family caring variables separately lose statistical significance although the F-test (2.80) suggests the set is significant at a level of significance above 0.0103. When the six indicators are replaced by the single composite, G2-Care, it is highly significant again for this math test score.

To explore the implied magnitude of these several effects on the child's test scores, Table 8 shows the pattern of the test scores generated by prediction using model #4 for both reading (Panel A) and math (Panel B). The top of Panel A shows that holding all other covariates at their means, as income rises from a level of 2 to 7, the reading test score rises about four points or nearly one-third of a standard deviation. The test score rises about three points as the parent's educational achievement rises from lower than the O-levels to higher education. The magnitude of the index of family caring shows a comparable magnitude, again controlling for all the covariates in model #4: a 5-point increase in that composite is associated with about a three-and-a-half point rise, or about a quarter of a standard deviation increase, in the reading test score. So one way of describing this magnitude is that the index of caring has as its range of influence about the same as the education of the parent: as each goes from the lower end of the observed scale to the top, the child's reading test score rises by about a quarter of a standard deviation, which is a modestly large amount. It is well to caution that both the index for income and for caring are scaled arbitrarily as a simple sum of attributes. Within the range found in this sample of children, nonetheless, these magnitudes are substantial. Almost exactly the same magnitude of influence is seen in Panel B for the child's math test. Both the family's resources (parents' education, parent's own abilities in reading and math, family income) and the family's child caring behavior (measured as a sum of behaviors during the pregnancy, breastfeeding practices and family holidays) is strongly

associated with the child's test scores. These two influences are both measured with the other constraint controlled.

6. Sensitivity Checks

There are several reasonable concerns that might be expressed about the "family caring" variables, their estimated relationships and the interpretations offered here. For one thing, one might argue that these measured parental behaviors do not reflect purposive efforts in behalf of their children so the notion of "caring" is misplaced. Second, one might contend that many of these behaviors are themselves endogenous, influenced by the child's own attributes and thus misinterpreted as independently influencing the child's test scores.

Regarding "family caring," the measures are admittedly only modestly adequate. Each of the separate parental behaviors that is interpreted as an indicator of family caring might have been motivated by some other consideration and might be interpreted in ways quite unrelated to the concept of family caring. For example, a mother who does not breastfeed her infant is surely not necessarily uncaring: the child may have been unable to nurse, or the mother may have been unable to produce sufficient nourishment. Yet, to defend the interpretation, I contend that there is likely to be much signal amid the noise: if we could partition mothers into two groups, those who are more inclined to sacrifice for their child (i.e., caring mothers) and those who are less so, it seems likely that the former group would have a larger proportion of mothers who breastfeed. If so, there is relevant information in that dummy variable. A similar argument can be made for each of the variables included here. Even if one accepts the point, however, constructing a composite index that captures the idea of family caring from such a disparate set of behaviors surely involves measurement error no matter how that composite is constructed.

There is positive intercorrelation among these several behaviors that proxy caring. Collectively, they are shown to exhibit a statistical and relatively strong positive relationship with the child's reading and math test scores, controlling for the family's resources. In the child's skill production context, the outcome – the test score – is higher where the family resources are greater but they are also higher where this index of caring is higher. The statistical association is clear and it is consistent with the idea that as family caring increases, the family inputs into the production process are increased, controlling for the levels of available resources, and so the child's test scores are increased. The skill is produced by the inputs and they are greater if the family has more resources or if the family is inclined to expend more of its resources on the child. While the empirical findings may not be sufficiently compelling to warrant policy making on the strength of this evidence, it is, I suggest, strong enough to merit much more attention and research.

A second reason for caution is statistical in nature. Even if family caring is measured reasonably well here, it may be endogenous in the sense that the parents may be more "caring" (in the ways measured here) toward a child who is inherently more inclined to be better at reading and math. That, of course, would bias the estimated coefficients: it would bias them upward if the omitted variable, the child's innate inclination to do well on these tests (because of either ability or interest), is positively

correlated with the parents' response. To address this concern, the few elements in the G2 caring index that occur pre-birth (i.e., not smoking during pregnancy and initiating prenatal care in the first trimester) or in very early infancy (i.e., breastfeeding and the length of time breastfed) were used exclusively in a sensitivity analysis. It is not credible to think these actions by the mother were influenced by the child's (later) interests in reading or math, so the concerns about endogeneity are much lessened here. When these four elements are included, one-by-one or all four simultaneously or their sum, they performed very similarly to the results shown in Tables 6 and 7.[12] The reason for this robust partial association between the parent's behavior and the child's test scores several years later is not a simple feedback causality from the child to the parent that might be biasing the coefficient.

7. Interactions between resources and caring in G2

The simple correlation between G2 family income and family caring is positive but not overwhelming: 0.38 for the two indices. Table 9 arrays the 2,509 observations by family income and by family caring and one sees that among children whose family income is low (Incindex of 0-3), about 8% have high-caring parents (G2care= 5 or 6), so some of the poorest families are in fact among the most committed to the care of their children as measured by the index used here. Similarly, of the children whose family income is high, some 12% of them have low-caring parents. So having income does not automatically imply a large commitment to expending time and energy caring for the children. Viewed from the other perspective, the same top panel of Table 9 shows that not all those children in families with a low level of caring have low incomes – some 26% have high incomes. Similarly, of the children in families with a high caring index, about 5% have low income. The lower panel of Table 9 shows that the same qualitative dispersion exists between the parent's education level and the index of caring. There too, while the proportion with the highest levels of caring does rise with education (from 11% among those with less than their O-levels to 48% of those with higher education), there is substantial variation in each index controlling for the other.

This should not be surprising since the attributes that generate income or that are associated with education are not necessarily those that reflect a strong commitment to children. But it is not often emphasized in economic thinking that having sufficient resources to make a large investment does not necessarily imply that it will in fact be made, nor that resources of money or parental abilities are not the sole factors of importance in the promotion of skills in the family's children. The relatively modest correlation between family resources and family caring, and the distributions reflected in Table 9 emphasize that the two concepts are not the same phenomenon and do not vary in lockstep.[13]

The dispersion in caring among families at any given level of money resources, or conversely the dispersion in income among families at a given level of caring, offers an opportunity to re-estimate the basic model from Tables 6 or 7, fully interacting the levels of family resources and family caring. The result of doing so is summarized in Table 10 where model #4 is re-estimated for subsets of families, selected either by family income (Panel A) or by family caring (Panel B). Each of these subsets

provides much smaller range over which the other constraint might operate and many fewer observations. The table shows only three coefficients from each estimate of model #4, the alternative resource index and for comparison the parent's own reading and math test scores. Partitioned by income (Panel A), the caring index exhibits a strong effect at low levels of income for both reading and math, no effect at mid-levels of income, and a significant effect on only the math score at the high level of income. Partitioning by the caring index (Panel B), income has a significant effect on both reading and math at the low level of caring, a smaller but still significant effect at the mid-level of caring, and no relationship with reading but a small, statistically significant relationship for the math score at the high level of caring. A suggested interpretation of this pattern is that at sufficiently high levels of either caring or income, the variation in the other is less important for the development of the child's skills, particularly in reading. At relatively low levels of either, however, variation in the other has a relatively strong compensatory influence on the child's skills.[14]

8. Cross-Generational Consistency in Family Resources and Family Caring

Intergenerational mobility has long been a major focus of social policy discussion. The fact that the resources of a family are strongly correlated from one generation to the next is seen as alternately reflecting the advantages of social station and of family investments in the next generation, or the inequity of access to opportunity that comes with family wealth. In the two data files used in this study, we can document the degree of social mobility by looking at the correlation of the family resources around the time of the birth of the G2 children and a generation later when those same G2 children have grown up and are interviewed at age 33. Table 11, Panel A shows the simple correlation matrix of G2's family resources at birth and a generation later at age 33.. These measures are not the same from the one generation to the next, so the pattern is not a simple one to interpret, yet one sees here a strong positive relationship between the level of economic well-being of the two generations: home-ownership by G1 is correlated with the income index of G2 (0.1756) while G1 eligibility for free school lunches is negatively correlated with G2's family level of income (-0.2035). The age at which the G1-dad left schooling is positively correlated with the schooling level of the G2-cohort member and the G2-spouse's age at school leaving. For children from in 1958, coming from an advantaged family is decidedly correlated with their own children being in an advantaged family in 1991. Substantial stability of social and economic status from one generation to the next is a reality of the UK in this time interval.

What is of much greater novelty is the pattern of correlations seen in Table 11, Panels B and C: there is similarly strong correlation from generation to generation in measures of family caring. To put the point at its strongest: for the two composite indicators of family caring by G1 and by G2, the simple correlation is 0.1911. To not overstate the magnitude of the cross-generational relationship the full correlation matrix is reported in Table 11 Panel B and there are many, quite weakly (unrelated) pairs, even where the same behavior is measured (i.e., in not smoking during pregnancy, in the use of medical care in the early stages of the pregnancy, in family

time spent together), but overall, and in some instances such as breast feeding, those correlations are strong and again, overall they are substantial. Families that are measured to have relatively great levels of family caring by G1 also do so by G2.

A more stringent test of this notion of carry-over from generation to generation can be performed with these two files, by re-estimating the relationships from Tables 6 and 7 on the G3 test scores for reading and math, replacing the G2-parents' own caring behaviors by the G1-grandparents' caring behaviors. Doing so is not motivated by an argument that the grandparents actually care for the G3 child, but rather that their habits of child caring, of commitment to expending time, money, energy on their children, carries over to their offspring, the G2-parent, and so in these re-estimated regressions the G1 caring measures proxy the behaviors of the G2 parents. In terms of the reading test score (Table 12, Models 1 and 2), the results conform to this argument: using the grandparents', not the parents', caring composite is in fact positively and significantly associated with the child's reading test score. It is debatable whether the middle-generation's (G2's) own test scores in reading and math should be held constant in this exercise, so both ways are shown here (model 1 includes them while model 2 excludes them). For the math test scores of the G3 children, the grandparents' caring variable is only significant when the parent's own test score in math is omitted from the regression.

Using the estimated models #2 and #4 in Table 13, Table 14 shows the implied influence of the caring variable, at about the tenth and ninetieth percentiles of that variable and at specified levels of G2 family resources. As in the earlier case that used the G2 parents' own caring behaviors, the implied effects are notable, here about one-fifth of a standard deviation in the test scores on both reading and math.

9. Implications

As suggested above, the evidence here is inadequate to permit drawing policy implications. The notion of "family caring" is measured in these data with considerable potential measurement error. Moreover, while some sensitivity checks against endogeneity have been undertaken, there cannot yet be confidence that one might take these coefficient estimates as unbiased or that the mechanism of causation motivating the paper has been established. That said, the evidence is much more than just "suggestive" and the potential for policy guidance is at least intriguing and arguably real. If either family resources or family caring can supplement an insufficient level of the other, as suggested by Table 10, that fact would provide important potential as a guide to behavior and to social policy. Both the income and the caring indexes show statistically significant and nontrivial relationships with the children's skills in reading and math, and they do seem to supplement each other and to act additively, even compensatorily. If so, one important potential policy implication derives from the fact that the caring, as measured here, does not "cost money." Stopping smoking, attending to the pregnancy at an early stage, breastfeeding and even going on outings and holidays with the children are not, of themselves, expensive efforts, however demanding and restricting they may be. Doing most of these caring behaviors is within the grasp of nearly all parents. So unlike the observation that the parent's own ability in math can

contribute to the child's math skills – a fact that does not easily translate into a policy instrument – parental caring can be modified relatively inexpensively (but not necessarily easily or quickly). If the evidence is that caring behaviors pay dividends in terms of the children's skills, it may be feasible to persuade many parents of the importance of providing that care and attention.

The evidence suggests that caring for children – by the behaviors reflected in the caring indexes used here – has a substantial correlation with the children's measured skills in reading and math, and this relationship is separable from the advantages of family resources. Evidence of that association, if persuasive of a causal relation, should encourage parental caring since it is a behavioral strategy that is feasible for almost any parent. Unlike the Norway rat, where the genomic evidence outlined above tracts the physical links between the maternal care-giver's behavior and the epigenetic modification in the pup's gene expression that then links to its behavior later on, human parents can be persuaded by information. Caring appears to matter quite a lot. The evidence here should, at a minimum, encourage more effort to nail down this association.

Table 1: Descriptive Statistics, G1 Parents and G2 Children, NCDS (1958-1969)

Variable Description	Mean	Std. Dev.	Min-Max
G2's Test Scores (1969)			
Age-11 reading	16.13	5.48	0-33
Age-11 math	16.91	9.41	0-40
G2-Child's Characteristic			
Gender (girl=1)	0.59	0.49	0-1
G1 Parent's Resources (1958)			
Socioecon level 1 (highest)	0.04	0.18	0-1
SES2	0.10	0.31	0-1
SES3	0.66	0.47	0-1
SES4	0.11	0.32	0-1
SES5(lowest)	0.09	0.28	0-1
Own home (buying)	0.40	0.46	0-1
Rent home	0.12	0.30	0-1
Council home	0.43	0.46	0-1
Child "free school lunch" [welfare]	0.14	0.33	0-1
G1-mom's age at birth	27.3	5.56	14-46
G1-dad's age at birth	30.3	5.97	16-57
G1-mom single at birth	0.02	0.15	0-1
Biological G1-mom	0.98	0.15	0-1
Biological G1-dad	0.94	0.24	0-1
Number of children in family	2.04	0.85	0-7
G1-mom's age at school leaving	15.4	1.32	11-24
G1-dad's age at school leaving	15.3	1.51	11-24
English spoken in home	0.91	0.29	0-1
G1 Parent's Child-Nurturing behaviors: Pregnancy (1958)			
G1-mom didn't smoke pre-preg	0.54	0.50	0-1
G1-mom stopped smoking in preg	0.08	0.27	0-1
First prenatal visit < 16 weeks	0.46	0.50	0-1
Freqency of prenat visit >16	0.25	0.43	0-1
G1 Parent's Child-Nurturing behaviors: Post-preg, pre-school age			
G1-mom breastfeed	0.59	0.49	0-1
G1-dad read to child	0.30	0.46	0-1
G1-mom outings w/ child	0.75	0.44	0-1
G1 Parent's Child-Nurturing behaviors: During school years			
G1-mom big interest	0.32	0.47	0-1
G1-dad big interest	0.21	0.41	0-1
G1 parents' high aspirations	0.72	0.45	0-1
G1 Parent's Child-Nurturing behaviors: Composites			
G1care-preg	0.00	1.00	-0.81 – +1.77
G1care-post	0.00	1.00	-1.63 – +1.39
G1care-school	0.00	1.00	-2.06 – +1.50
G1-CARE	4.22	2.03	0-9
N=2,565			

Table 2: Regressions on G2-Child's Reading Test Score at Age 11 (1969)

	Model #1	Model #2	Model #3	Model #4
Child is female	**-0.46 (-2.23)**	**-0.54 (-2.74)**	**-0.50 (-2.54)**	**-0.49 (-2.43)**
G1 Parents' Resources				
SES1	**2.04 (3.46)**	**1.41 (2.47)**	**1.62 (2.84)**	**1.71 (2.96)**
SES2	**1.37 (3.88)**	**0.82 (2.38)**	**1.02 (2.99)**	**0.95 (2.75)**
SES4	**-0.88 (-2.70)**	**-0.78 (-2.47)**	**-0.72 (-2.30)**	**-0.82 (-2.59)**
SES5	**-1.72 (-4.72)**	**-1.49 (-4.22)**	**-1.46 (-4.14)**	**-1.64 (-4.58)**
Own home (buying)	**1.42 (5.77)**	**0.93 (3.83)**	**0.85 (3.48)**	**1.03 (4.20)**
Rent home	0.53 (1.50)	0.43 (1.26)	0.34 (1.00)	0.47 (1.36)
"free school lunch"	**-1.62 (-5.20)**	**-1.14 (-3.76)**	**-1.05 (-3.45)**	**-1.24 (-4.03)**
G1-mom's age at birth	0.02 (0.74)	0.01 (0.40)	0.01 (0.40)	0.02 (0.69)
G1-dad's age at birth	0.03 (1.13)	0.04 (1.61)	0.04 (1.53)	0.04 (1.58)
Biological G1-mom	-0.39 (-0.52)	-0.60 (-0.81)	-0.54 (-0.74)	-1.00 (-1.34)
Biological G1-dad	0.08 (0.16)	0.02 (0.03)	-0.04 (-0.08)	0.10 (0.22)
G1-mom's age leaving school	**0.44 (4.71)**	**0.30 (3.27)**	**0.33 (3.65)**	**0.33 (3.55)**
G1-dad's age leaving school	**0.35 (4.18)**	**0.36 (4.38)**	**0.33 (3.99)**	**0.37 (4.48)**
English spoken in home	**-0.81 (-2.32)**	-0.59 (-1.75)	-0.67 (-1.99)	-0.50 (-1.48)
Total number of children	**-0.54 (-4.56)**	**-0.43 (-3.73)**	**-0.47 (-4.12)**	**-0.48 (-4.12)**
G1 Parents' Child Caring				
G1-mom didn't smoke pre-preg			0.07 (0.34)	
G1-mom stopped smoking in preg		0.12 (0.30)		
First prenat visit < 16 weeks		**0.73 (3.61)**		
Freq. prenatal visits >16		-0.15 (-0.64)		
G1-mom breastfeed		0.14 (0.64)		
G1-dad read to child		-0.03 (-0.15)		
G1-mom outings w/ child		0.03 (0.11)		
G1-mom big interest		**1.50 (5.10)**		
G1-dad big interest		**1.53 (4.59)**		
G1-pars' high aspirations		**0.86 (3.35)**		
Composites				
G1Care-Preg			-0.05 (-0.54)	
G1Care-Post			**0.24 (2.39)**	
G1Care-School			**1.31 (12.49)**	
G1-CARE				**0.55 (10.69)**
Intercept	**4.49 (2.61)**	**4.76 (2.83)**	**6.70 (4.00)**	**3.68 (2.18)**
N	2,564	2,564	2,564	2,564
R^2	0.14	0.20	0.20	0.18

Table 3: Regressions on G2-Child's Mathematics Test Score at Age 11 (1969)

	Model #1	Model #2	Model #3	Model #4
Child is female	**-0.88 (-2.49)**	**-0.99 (-2.89)**	**-0.93 (-2.72)**	**-0.93 (-2.68)**
G1 Parents' Resources				
SES1	**3.35 (3.29)**	**2.26 (2.27)**	**2.56 (2.59)**	**2.83 (2.82)**
SES2	**3.54 (5.79)**	**2.63 (4.39)**	**2.93 (4.92)**	**2.88 (4.77)**
SES4	-0.54 (-0.96)	-0.39 (-0.72)	-0.28 (-0.51)	-0.45 (-0.82)
SES5	**-2.86 (-4.51)**	**-2.50 (-4.07)**	**-2.41 (-3.92)**	**-2.72 (-4.37)**
Own home (buying)	**2.90 (6.80)**	**2.05 (4.87)**	**1.90 (4.49)**	**2.28 (5.36)**
Rent home	1.16 (1.90)	1.03 (1.73)	0.87 (1.46)	1.07 (1.78)
"free school lunch"	**-2.46 (-4.56)**	**-1.73 (-3.27)**	**-1.58 (-2.98)**	**-1.86 (-3.47)**
G1-mom's age at birth	0.02 (0.50)	0.00 (0.04)	0.01 (0.13)	0.02 (0.44)
G1-dad's age at birth	0.03 (0.74)	0.06 (1.30)	0.05 (1.23)	0.05 (1.15)
Biological G1-mom	0.14 (0.11)	-0.12 (-0.09)	-0.15 (-0.12)	-0.81 (-0.63)
Biological G1-dad	0.25 (0.30)	0.23 (0.29)	0.22 (0.27)	0.30 (0.36)
G1-mom's age leaving school	**0.47 (2.91)**	0.24 (1.51)	0.29 (1.84)	0.29 (1.82)
G1-dad's age leaving school	**0.54 (3.67)**	**0.56 (3.92)**	**0.50 (3.51)**	**0.57 (3.93)**
English spoken in home	-0.96 (-1.59)	-0.61 (-1.04)	-0.78 (-1.34)	-0.48 (-0.81)
Total number of children	**-0.75 (-3.69)**	**-0.58 (-2.91)**	**-0.65 (-3.25)**	**-0.66 (-3.26)**
G1 Parents' Child Caring				
G1-mom didn't smoke pre-preg			**0.87 (2.36)**	
G1-mom stopped smoking in preg			-0.08 (-0.11)	
First prenat visit < 16 weeks			**0.97 (2.75)**	
Freq prenatal visits>16			-0.24 (-0.61)	
G1-mom breastfeed				-0.06 (-0.16)
G1-dad read to child				-0.27 (-0.68)
G1-mom outings w/ child			-0.32 (-0.70)	
G1-mom big interest				**2.80 (5.49)**
G1-dad big interest				**1.97 (3.41)**
G1-pars' high aspirations			**1.79 (3.99)**	
Composites				
G1Care-Preg				**-0.46 (-2.69)**
G1Care-Post				0.14 (0.79)
G1Care-School				2**.18 (11.94)**
G1-CARE				**0.87 (9.71)**
Intercept	1.14 (0.38)	1.19 (0.41)	4.67 (1.61)	-0.15 (-0.05)
N	2,564	2,564	2,564	2,564
R^2	0.13	0.18	0.18	0.16

Table 4: Implied Influence of G1 Parent's Resources and Caring on G2-Child's Reading and Math Test Scores (based on Models #4, Tables 2 & 3)

G1-Care Level	SES Low (5) Subsidized home & school lunch	SES Mid (3)	SES High (1) own home	
	Panel A: READING (age 11) [Reading: mean 16.1, st. dev. 5.5]			
1	11.3	14.4	16.8	
5	13.5	16.6	19.0	*+5½*
9	15.7	18.8	21.2	
			+4½	
	Panel B: MATH (age 11) [Math: mean 16.9; st. dev. 9.4]			
1	8.6	14.0	18.2	
5	12.1	17.5	21.7	*+10*
9	15.6	21.0	25.2	
		+7		

Table 5: Descriptive Statistics, G2 Parents and G3 Children, NCDS (1991)

Variable Description	Mean	Std. Dev.	Min-Max
G3 Child Test Scores			
PIAT-Reading Recog.	100.09	15.05	47-174
PIAT- MATH	100.14	15.01	36-187
G3 Child Attributes			
Age (years)	8.71	2.83	5-18
Gender (1=female)	0.51	0.50	0-1
Race (1=white)	0.98	0.13	0-1
G2 Parent Attributes			
Gender (1=female)	0.65	0.48	0-1
Age at first Birth	22.54	3.00	15-33
Number of Siblings of G3 child	2.44	0.89	0-7
Married	0.58	0.49	0-1
Religion-Church of Engl.	0.32	0.46	0-1
Catholic	0.10	0.30	0-1
None	0.47	0.50	0-1
Attend Religous Service often	0.16	0.36	0-1
G2 Parents' Resources			
G2's Reading compre.(age 11)	15.33	5.34	0-32
G2's Math score (age 11)	15.73	9.19	0-39
G2's Education- no educ	0.17	0.38	0-1
No-quals (cse 4/5)	0.16	0.37	0-1
O-levels	0.37	0.48	0-1
A-levels	0.11	0.31	0-1
Higher educ	0.16	0.37	0-1
G2's Spouse: age left school	16.18	1.96	14-24
Income Index	5.04	1.47	0-7
G2 Parents' Child-Nurturing Behaviors			
Not Smoking (1=yes, didn't or stopped)	0.62	0.48	0-1
Pregnancy planning status (1=planned)	0.71	0.45	0-1
Prenatal Care in first trimester (1=yes)	0.60	0.49	0-1
Child breastfed (1=yes)	0.62	0.48	0-1
Breastfed 4+ weeks (1=yes)	0.30	0.46	0-1
Family takes holidays together (1=yes)	0.74	0.44	0-1
G2 Care Composite (6)	3.60	1.42	0-6

N = 2,509

Table 6: Regressions on G3 Child's Reading Test Score

	Model #1	Model #2	Model #3	Model #4
Child's attributes				
age	**0.90 (6.38)**	**0.98 (6.62)**	**0.94 (6.60)**	**0.93 (6.59)**
girl	**1.72 (2.95)**	**1.61 (2.69)**	**1.75 (3.01)**	**1.71 (2.94)**
white	-2.82 (-1.01)	-2.33 (-0.92)	-2.80 (-1.01)	2.91 (-1.05)
Parental controls				
cm-mom	0.74 (1.05)	-0.27 (-0.38)	0.37 (0.52)	0.45 (0.64)
age parent	**0.36 (2.28)**	**0.73 (4.58)**	0.30 (1.87)	0.32 (2.00)
rel often	**1.83 (2.14)**	**2.86 (3.21)**	1.64 (1.91)	1.61 (1.88)
married	1.28 (1.92)	1.14 (1.64)	1.09 (1.61)	1.16 (1.75)
totchld	**-1.19 (-3.43)**	**-1.35 (-3.69)**	**-1.21 (-3.43)**	**-1.15 (-3.28)**
Parental resources				
cmreadts	**0.34 (4.08)**	**0.33 (4.01)**	**0.34 (4.06)**	
cmmathts	**0.18 (3.48)**	**0.16 (3.25)**	**0.17 (3.27)**	
noqual	0.65 (0.58)	0.45 (0.41)	0.50 (0.44)	
oqual	**2.72 (2.76)**	**2.44 (2.45)**	**2.45 (2.49)**	
aqual	**3.16 (2.53)**	**2.75 (2.19)**	**2.75 (2.20)**	
highqual	**3.36 (2.69)**	**3.02 (2.40)**	**2.97 (2.37)**	
sp's age left school	**0.42 (2.59)**	**0.37 (2.27)**	**0.36 (2.25)**	
incindex	**0.91 (3.79)**	**0.80 (3.32)**	**0.77 (3.19)**	
Parental Child-Caring Behaviors				
Not Smoking		**2.26 (3.32)**	0.65 (0.98)	
Preg planned		**1.90 (2.57)**	**1.79 (2.59)**	
Prenatal care 1st trimest.		0.21 (0.32)	0.11 (0.18)	
Breast fed		**3.07 (4.10)**	**1.64 (2.28)**	
Breastfed 4+ weeks		1.25 (1.61)	0.11 (0.15)	
Family holidays		1.20 (1.57)	-0.11 (-0.15)	
G2-Care (6)		**0.73 (3.16)**		
Intercept	**66.09 (10.99)**	**72.80 (13.28)**	**66.60 (11.01)**	**66.42 (11.06)**
N	2,509	2,509	2,509	2,509
R^2	0.135	0.075	0.141	0.138
F-Tests on sets of coefficients:				
8 Parental resources	**27.30**	---	**21.26**	**21.86**
6 or 1 Parental caring	---	**10.65**	**2.56**	**10.00**

*Standard errors are adjusted for the clustering of children within a family.

Table 7: Regressions on G3 Child's Math Test Score

	Model #1	Model #2	Model #3	Model #4
Child's attributes				
Age	**0.56 (3.86)**	**0.63 (4.03)**	**0.58 (3.86)**	**0.60 (4.12)**
girl	-0.92 (-1.60)	-1.04 (-1.74)	-0.94 (-1.63)	-0.93 (-1.62)
white	-3.45 (-1.11)	-3.37 (-1.05)	-3.51 (-1.14)	-3.52 (-1.15)
Parental controls				
Cm mom	0.93 (1.35)	0.02 (0.03)	0.53 (0.76)	0.58 (0.84)
Age parent	-0.01 (-0.04)	**0.37 (2.19)**	-0.07 (-0.43)	-0.06 (-0.37)
Rel often	0.62 (0.71)	1.52 (1.72)	0.32 (0.36)	0.37 (0.42)
married	**2.23 (3.33)**	**2.14 (3.17)**	**2.13 (3.15)**	**2.09 (3.12)**
totchld	**-0.78 (-2.17)**	**-0.80 (-2.19)**	**-0.74 (-2.09)**	**-0.72 (-2.01)**
Parental attributes				
cmreadts	0.11 (1.27)		0.10 (1.11)	0.11 (1.25)
cmmathts	**0.30 (5.73)**		**0.29 (5.49)**	**0.29 (5.43)**
noqual	1.81 (1.63)		1.49 (1.34)	1.60 (1.44)
oqual	**2.10 (2.20)**		1.63 (1.71)	1.75 (1.83)
aqual	2.25 (1.78)		1.68 (1.32)	1.76 (1.38)
highqual	**3.95 (3.20)**		**3.26 (2.63)**	**3.44 (2.78)**
sp's age left school	**0.63 (3.61)**		**0.56 (3.23)**	**0.57 (3.30)**
incindex	**0.93 (3.71)**		**0.72 (2.92)**	**0.77 (3.08)**
Parental Child-Caring Behaviors				
Not Smoking		**2.41 (3.53)**	0.84 (1.25)	
Preg planned		0.87 (1.19)	0.60 (0.85)	
Prenatal care 1st trimest.		0.10 (0.16)	-0.04 (-0.06)	
Breast fed		**2.74 (3.63)**	1.45 (1.99)	
Breastfed 4+ weeks		**2.43 (3.17)**	1.19 (1.61)	
Family holidays		**2.43 (3.22)**	1.21 (1.70)	
G2-Care (6)				**0.90 (3.70)**
intercept	**75.84 (11.84)**	**84.31 (13.61)**	**77.47 (12.03)**	**76.16 (12.00)**
N	2,490	2,490	2,490	2,490
R2	0.121	0.064	0.128	0.126
F-Tests on sets of coefficients:				
8 Parental resources	**27.42**	---	**19.93**	**21.58**
6 or 1 Parental caring	---	**12.01**	**2.80**	**13.73**

*Standard errors are adjusted for clustering of children within families.

Table 8: Implied Influence of Family Resources and Family Caring on Reading and Math Test Scores; G3 Children NCDS

[Model #4, Tables 6 & 7]

Panel A: Reading (Mean: 100.1; St. Dev.: 15.0; range: 47-174)

	Education Level			
Income	< O-level	O-Level	Higher Educ	
2	96.0	98.4	98.9	
5	98.3	100.7	101.2	*+3*
7	99.8	102.3	102.8	
		+4		

	Education and Income			
CMCare	< O-level & Inc=2	O-Level Inc = 5	Higher Educ Inc = 7	
1	94.1	99.1	100.9	
4	96.3	101.3	103.1	*+7*
6	97.7	102.8	104.5	
		+3 ½		

Panel B: Mathematics (Mean: 100.1; St. Dev.: 15.0; range: 36-187)

	Education Level			
Income	< O-level	O-Level	Higher Educ	
2	96.2	97.9	99.6	
5	98.5	100.2	101.9	*+3 ½*
7	100.0	101.8	103.5	
			+4	

	Education and Income			
CMCare	< O-level & Inc=2	O-Level Inc = 5	Higher Educ Inc = 7	
1	93.8	97.9	101.1	
4	96.5	100.6	103.8	*+7*
6	98.3	102.4	105.6	
		4 ½		

Table 9: Cross-tabulation of Families by Income or Education and Caring (Child-NCDS; 1991)

Number of children in each cell

	Caring (g2care)			
	0-2	3-4	5-6	All
Income (Incindex)				
0 – 3	203	194	34	431
4 – 5	212	467	217	896
6 – 7	147	570	465	1182
All	562	1231	716	2509
Parent's Education				
< O-levels	292	450	90	832
O-levels	180	478	277	935
A-levels or higher ed	78	278	335	691
Missing educ	12	25	14	51
All	562	1231	716	2509

Table 10: Resource or Caring influence, conditional on the level of the other*

Panel A: Influence of Caring, controlling for Income Level

	Family Income (Incindex)		
	0 to 4.5	4.5 to 5.5	5.5 to 7
Reading Test Score			
G2-reading	0.29 (1.66)	**0.54 (2.86)**	**0.23 (2.07)**
G2-math	0.17 (1.57)	0.11 (0.92)	0.21 (3.22)
G2-Care	**1.13 (2.80)**	0.90 (1.76)	0.24 (0.70)
N, R^2	772, 0.15	555, 0.17	1182, 0.10
Math Test Score			
G2-reading	-0.01 (-0.08)	0.34 (1.79)	0.02 (0.19)
G2-math	**0.33 (3.09)**	0.22 (1.84)	**0.32 (4.58)**
G2-Care	**0.97 (2.26)**	0.56 (1.12)	**0.96 (2.69)**
N, R^2	765, 0.13	548, 0.15	1177, 0.09

Panel B: Influence of Resources, controlling for Caring Level

	Family Caring (G2-Care)		
	0 to 2.5	2.5 to 4.5	4.5 to 7
Reading Test Score			
G2-reading	0.20 (1.12)	**0.40 (3.43)**	**0.29 (2.02)**
G2-math	0.20 (1.68)	0.11 (1.49)	**0.26 (3.23)**
Incindex	**1.44 (3.49)**	**0.80 (2.36)**	-0.56 (-1.06)
N, R^2	562, 0.15	1231, 0.13	716, 0.10
Math Test Score			
G2-reading	0.12 (0.55)	0.06 (0.45)	0.21 (1.41)
G2-math	0.17 (1.27)	**0.36 (4.99)**	**0.25 (3.16)**
Incindex	**1.09 (2.28)**	**0.87 (2.58)**	**0.27 (2.56)**
N, R^2	554, 0.10	1223, 0.11	713, 0.09

*All regressions also include age, girl, white, cmmom, agepar, reloften, married, totchld, noqual, oqual, aqual, highqual, spageleftschool.

Table 11: Correlations of Family Resources & Family Caring, Across Generations

Panel A: The Correlation of G1-Resources and G2-Resources

	G1 Resources					
G2 Resources	SES1 (high)	SES5 (low)	Home-owner	Freelunch	Dad's Age Left Sch.	Total Children
Noqual	-0.0768	0.0069	-0.0605	0.0162	-0.0874	0.0344
Highqual	0.1459	-0.0857	0.1852	-0.0779	0.1542	-0.0241
SpAgeLeftSch	0.1973	-0.0470	0.1572	-0.1126	0.1989	-0.0163
Income Index	0.0839	-0.0811	0.1756	-0.2035	0.1155	-0.2342
CM'sReadTest	0.1366	-0.1625	0.1963	-0.1405	0.2263	-0.0701
CM'sMathTest	0.1347	-0.1584	0.2304	-0.1249	0.1975	-0.0500

(N=2295)

Panel B: The Correlation of G1-Caring and G2-Caring (detailed Items)

	G1 Caring Measures				
G2 Caring	Not Smoke	Pre-Natal First Tri.	BreastFed	Dad Read	Mom Outings
Not Smoke	0.0451	0.0714	0.0291	0.0874	0.0511
Preg Planned	0.0412	0.0345	0.0665	0.0659	0.0578
PreNat 1st	-0.0101	0.0252	-0.0093	-0.0311	-0.0464
Breast Fed	0.0526	0.0615	0.1119	0.0622	0.0242
Brst Fed 4 wk	0.0404	0.0343	0.1124	0.0391	0.0291
Fam Holiday	0.0227	0.0118	0.0188	0.0888	0.0266

	G1 Caring Measures Cont.		
G2 Caring	Mom Interest School High	Dad Interest School High	Aspirations (at 11)
Not Smoke	0.1260	0.0953	0.0718
Preg Planned	0.0606	0.0492	0.0311
PreNat 1st	0.0189	0.0334	0.0252
Breast Fed	0.1157	0.0989	0.0900
Brst Fed 4 wk	0.0821	0.1013	0.0693
Fam Holiday	0.0794	0.0725	0.0525

(N=2509)

Table 11 (cont.)

Panel C: The Correlation of G1-Caring and G2-Caring (Composites)

	----------G1 Caring Composite Measures----------			
G2 Caring	G1 Care-Preg	G1 Care-Post	G1 Care-School	G1-Composite
Not Smoke	-0.0666	0.0747	0.1483	0.1365
Preg Planned	-0.0484	0.0940	0.0698	0.0913
PreNat 1st	0.0117	-0.0316	0.0470	0.0011
Breast Fed	-0.0755	0.0861	0.1403	0.1500
BrstFed 4 wk	-0.0614	0.0714	0.1285	0.1213
Fam Holiday	-0.0425	0.0790	0.1058	0.0826
G2-Composite (N=2509)	-0.0924	0.1208	0.2104	0.1911

Table 12: Regressions on G3 Child's Test Scores, Using G1 Family Caring

	Reading Test		Math Test	
	Model #1	Model #2	Model #3	Model #4
Child's attributes				
age	**0.90 (6.38)**	**0.91 (6.42)**	**0.56 (3.85)**	**0.58 (3.89)**
girl	**1.74 (2.99)**	**1.59 (2.72)**	-0.91 (-1.57)	-0.05 (-1.78)
white	-3.43 (-1.23)	-2.07 (-0.79)	-3.92 (-1.26)	-2.61 (-0.87)
Parental controls				
cm-mom	0.68 (0.97)	0.69 (0.98)	0.89 (1.29)	0.97 (1.39)
age parent	**0.34 (2.15)**	**0.40 (2.48)**	-0.02 (-0.14)	0.04 (0.23)
rel often	**1.81 (2.12)**	**2.25 (2.58)**	0.61 (0.70)	1.01 (1.17)
married	1.24 (1.86)	0.87 (1.28)	2.19 (3.28)	**1.95 (2.83)**
totchld	**-1.22 (-3.51)**	**-1.28 (-3.68)**	**-0.80 (-2.23)**	**-0.83 (-2.33)**
Parental resources				
cmreadts	**0.33 (3.94)**	**--**	0.10 (1.18)	--
cmmathts	**0.17 (3.35)**	**--**	**0.30 (5.60)**	**--**
noqual	0.55 (0.49)	1.64 (1.47)	1.74 (1.57)	**2.74 (2.47)**
oqual	**2.54 (2.57)**	**4.96 (5.19)**	**1.97 (2.06)**	**4.38 (4.66)**
aqual	**2.89 (2.29)**	**6.45 (5.17)**	2.07 (1.63)	**5.56 (4.32)**
highqual	**3.11 (2.48)**	**7.06 (5.98)**	**3.76 (3.03)**	**7.65 (6.48)**
sp's age left school	**0.43 (2.65)**	**0.56 (3.38)**	**0.64 (3.64)**	**0.79 (4.36)**
incindex	**0.87 (3.65)**	**0.99 (3.99)**	**0.91 (3.59)**	**0.99 (3.82)**
G1 Parental Child-Caring Behaviors				
Grcare2	**0.36 (2.25)**	**0.56 (3.42)**	0.27 (1.61)	**0.48 (2.73)**
Intercept	**66.30 (11.04)**	**65.87 (10.96)**	**76.00 (11.90)**	**73.79 (11.40)**
N	2,509	2,509	2490	2490
R^2	0.137	0.109	0.122	0.092

*Standard errors are adjusted for the clustering of children within a family.

Table 13: Implied Influence on Family Caring on Reading and Math Test Scores, Using Grandparents' (G1) Caring as a Proxy for Parents' (G2) Caring Behaviours

[Table 13, Model #2 (Reading) and #4 (Math)]

Panel A: Reading (Mean: 100.1; St. Dev.: 15.0; range: 47-174)

	Education and Income			
Grandparent Caring	< O Level & Inc = 2	O-Level & Inc = 5	Higher Educ & Inc = 7	
1	93.06	99.33	103.41	
4	94.73	101.00	105.08	*+10 ½*
7	96.40	102.67	106.75	
		+ 3 1/3		

Panel B: Math (Mean: 100.1; St. Dev.: 15.0; range: 36-187)

	Education and Income			
Grandparent Caring	< O Level & Inc = 2	O-Level & Inc = 5	Higher Educ & Inc = 7	
1	94.50	99.11	104.37	
4	95.93	100.54	105.80	*+10*
7	97.36	101.97	107.23	
		+3		

Table A1: Factor Analysis of G1's Caring Behavior

Panel A: Prenatal Behavior

Variable	Mean	Correlation Matrix				
GRSMONO*	0.54	Grmono	Grsmonon	Grsnoles	Grsnosm	Grsmomr
GRSMONON	0.08	-0.31	1.00			
GRSMOLES	0.04	-0.23	-0.06	1.00		
GRSMOSM	0.19	-0.53	-0.14	-0.11	1.00	
GRSMOMR	0.07	-0.30	-0.08	-0.06	-0.14	1.00
GRSMOK4	1.50	-0.75	-0.20	0.19	0.68	0.43

Cronbach Alpha(6) = 0.69

Principal Component Factors

Factor	Eigenvalue	Diff
1	2.438	1.247
2	1.192	0.065
3	1.126	0.073
4	1.053	0.937
5	0.116	0.041
6	0.075	--

Factor Loadings: One Factor; Scored as "G1Care-Pre"

Variable	Loading	Scoring Coef.
GRSMONO	-0.88	-0.36
GRSMONON	-0.05	-0.02
GRSMOLES	0.20	0.08
GRSMOSM	0.73	0.30
GRSMOMR	0.39	0.16
GRSMOK4	0.96	0.39

Panel B: Pre-School Caring Behavior

Variable	Mean	Correlation Matrix			
GRMREADK	0.42	Grmread	Grdreadk	Grmoutk	Grdoutk
GRDREADK	0.30	0.51	1.00		
GRMOUTK	0.75	0.39	0.29	1.00	
GRDOUTK	0.60	0.32	0.38	0.64	1.00
GRBREAST	0.59	0.18	0.12	0.31	0.22

Cronbach Alpha(5) = 0.71

Principal Component Factors "G1Care-Post"

Factor	Eigenvalue	Diff
1	2.40	1.42
2	0.97	0.18
3	0.79	0.27
4	0.52	0.21
5	0.32	--

Factor Loadings: One Factor; Scored as "G1Care-Post"

Variable	Loading	Scoring Coef.
GRMREADK	0.70	0.29
GRDREADK	0.68	0.28
GRMOUTK	0.79	0.33
GRDOUTK	0.78	0.33
GRBREAST	0.45	0.19

Panel C: Caring Behavior During Early Schooling

Variable	Mean	Correlation Matrix			
PARSCHIN	0.48	Parschin	Momintb	Momintno	Dadintb
MOMINTB	0.32	0.42	1.00		
MOMINTNO	0.13	-0.29	-0.26	1.00	
DADINTB	0.21	-0.32	0.69	-0.20	1.00
DADINTNO	0.14	-0.25	-0.25	0.71	-0.21

Cronbach Alpha(5) = 0.73

Principal Component Factors "G1Care-School"

Factor	Eigenvalue	Diff
1	2.45	1.20
2	1.26	0.55
3	0.71	0.41
4	0.30	0.02
5	0.29	.

Factor Loadings: One Factor; Scored as "G1Care-School"

Variable	Loading	Scoring Coef.
PARSCHIN	0.64	0.26
MOMINTB	0.77	0.31
MOMINTNO	-0.70	-0.29
DADINTB	0.70	0.29
DADINTNO	-0.69	-0.28

* Definitions of Variables used in the Factor Analyses (Dummy variables, 1="yes"; 0= "no")

GRSMONO	G1 did not smoke before or during pregnancy
GRSMONON	G1 did smoke before but not during pregnancy
GRSMOLES	G1 smoked less during the pregnancy
GRSMOSM	G1 smoked the same mount during the pregnancy
GRSMOMR	G1 smoked more during the pregnancy
GRSMOK4	Amount G1 smoked at 4th month of pregnancy (1=none, 2=medium, 3=heavy)
GRMREADK	G1-mom read to G2 "every week"
GRDREADK	G1-dad read to G2 "every week"

GRMOUTK	G1-mom has outings with G2 "most weeks"
GRDOUTK	G2-dad has outings with G2 "most weeks"
GRBREAST	G1-mom breastfed G2
PARSCHIN	G1-parents initiated discussion with school about G2 (teacher reported)
MOMINTB	G1-mom's interest in G2's schooling "very interested" (teacher reported)
MOMINTNO	G1-mom's interest in G2's schooling: very little interest (teacher reported)
DADINTB	G1-dad's interest in G2's schooling "very interested" (teacher reported)
DADINTNO	G1-mom's interest in G2's schooling: very little interest (teacher reported)

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[1] One piece of evidence about the extent of variation in the “resolve” across families can be found in a study of intra-household allocation of total current consumption expenditures. In a study using several of the Consumer Expenditure Surveys and two separate Current Population Surveys from different points in time from 1960 through 1980, Lazear and Michael (1988) develop an estimation method by which they attempt to allocate the household’s expenditures into those made in behalf of the children in the family and those made in behalf of the adults in the family, using theory to make an assessment of how the public goods in the family, as well as the private goods, are allocated. They focus on a parameter, φ, which is the amount of the family's total spending expended on each child per dollar spent on each adult. Using several different data sets, they estimate that on average φ is 0.40, with a standard deviation of about 0.15. In two separate CPS files they report the 10%-90% quantile range for φ among families with children to be 0.18 – 0.55 and 0.17 – 0.61. That is, some ten percent of families spend as little as $17 on each child per $100 spent on each adult, while another ten percent of families spend more than $60 on each child per $100 spent per adult. Families differ in their use of their money resources in behalf of their children. Now, the reasons are many and “tastes” or the notion of “resolve” suggested here is not the only explanation, but tastes do differ and that results in different investments of available resources in children, controlling of the levels of those resources.

[2] Saltaris et al employ a direct measure of maternal teaching, from an observational study, supplementing a 1976 longitudinal study of Montreal school-aged children at high risk, and conclude that their "findings…suggest that within a high-risk sample, quality of parenting provided to young offspring represents an important predictor of their developing competence." (Saltaris et al 2004, p.112)

[3] "Caring" is a term that has been used in the economics literature for a very different concept that should be distinguished from its use here. In Browning et al (1994), for example, "caring" is the term of choice for describing a utility function in which the 2-adults in the household express their interdependent utility. There, caring means a degree of altruism, here it means a degree of commitment or willingness to tradeoff some personal benefits in behalf of tending the needs and stimulating the interest of own children. A still different sense of caring is found in the literature on elderly parents where caregiving by adult offspring is the focus of study (i.e, Checkovich & Stern, 2002).

[4] Adult offspring who provide care for an elderly parent would be another application of this notion of "caring." One study of that subject that does not adopt the notion proposed here but does offer some suggestive evidence on the matter is the analysis of the National Long Term Care Survey by Checkovich & Stern (2002). There, they can look at the care provided by several siblings to an elderly parent, and from their focus on the residuals from their models, three intriguing results offer some support of the contention in this paper: (1) the residuals in their model are serially correlated suggesting that "the decision a child makes in one year about the level of care she will provide for an elderly parent is correlated with her decision in the following year" (p.461). That is consistent with there being an attitude toward caring that persists over time, as is also critically important to the logic of the current paper. (2) "There is a clear correlation of errors within families" across children in their caregiving of their common parent. The authors attribute this to "an unobserved characteristic of the parent," (p.462) but that unobserved characteristic might be the family's commitment to caring of the dependent family members, both as young children and as elderly parents. (3) There is a negative, not a positive, relationship between one sibling caregiving and another, suggesting tradeoff or substitution not complementarity across siblings in the care of their parent. This is an aspect of intra-family allocation that is beyond the current paper's focus, so it is less supportive of the argument offered in this paper but, for full disclosure, is mentioned here.

[5] To be more explicit, in the psychology literature, as Belsky (1984) noted some while ago, much of the focus on intergenerational transmission of parenting was on abusive or unhealthy styles. Recent efforts focus on more supportive parenting styles as well. For a recent effort to show the transmission of constructive parenting, see Chen and Kaplan (2001), who use data from a longitudinal study begun in Houston schools in 1980 and followed up in 1988 and 1993, allowing them to compare the parenting the subjects themselves received (1980) with the parenting they gave, measured in 1993. They describe their evidence as confirming the existence of "modest intergenerational continuity of constructive parenting" (p.27) and characterize the size of the effect they find as "at best moderate." (p.28) More recently, Belsky and colleagues (2005) used data from a longitudinal study of children born in Dunedin New Zealand in 1972-73, with follow-up measures by videotaping of their parenting behaviors to 2005. They focused on what they call "warm-sensitive-stimulating" parenting behaviors . That study investigated whether the experiences as young children, and the discipline these children experienced at ages 7 and 9 predicted their parenting styles when they later had children. The evidence suggested that it did so for the mothers but not so for the fathers. (Belsky et al, 2005)

[6] The subset of these data on children of female NCDS members is one of two data files analyzed by Aughinbaugh & Gittleman (2003). They emphasize the importance of

family income on the same reading and math test scores as well as two additional cognitive tests. One finding in their paper of relevance to this study is that the income coefficients on these cognitive tests are quite similar for this UK data to comparable models estimated on US children (NLSY-Child data). Michael (2003) also reports similar UK and US patterns for these cognitive tests on children.

[7] The summary statistics on each of the nine, separately, and on the three factor analysis composites are reported in Table 1. The simple sum of the nine, called "G1-Care," is also reported there. The distribution of values of this summary index, G1-Care, is: 0-1: 11%; 2-3 25%; 4-5 37%; 6-7 23%, and 8-9 5%.

[8] The percentage who did have each of these assets was: bath: 0.98; phone: 0.90; not currently on welfare: 0.89; own home: 0.71; savings account: 0.67; never on welfare: 0.67; and have investments: 0.21.

[9] While a factor analysis may seem appropriate for these six items, as undertaken for the measures of caring by the G1 parents, these six do not have a strong intercorrelation: the Chronbach Alpha value for the six is only 0.42, and for a subset of five, dropping the first trimester care, the alpha was 0.47 so no factor analysis was used for these regressions.

[10] When the income measure, incindex, is replaced in this regression by the log of annual gross income, lnincg, its coefficient (and t-statistic) are: 0.89 (2.22) and a dummy variable for missing income is insignificant: 0.26 (0.31). When, instead, the incindex is replaced by the log of the value of the home, lnhomval, its coefficient is 0.15 (2.05). Also, the seven variables have an intercorrelation of 0.62 measured by Chronbach's Alpha, which is near the acceptable level for a factor analytic scoring, so one has been undertaken. (This procedure is similar in spirit to the use of principal component analysis of 21 asset indicators in a national survey in India to obtain a proxy measure of household wealth [Filmer & Pritchett, 2001].) The principal factors analysis suggests but one factor (the eigenvalue for factor 1 is 1.41 and the second factor's is only 0.08), so one is scored with relatively equal loadings on the seven variables. When that scored variable, "pfincome" is used in place of the other income variable in regression model #1, its coefficient is 1.72 (3.82). When the seven possessions or financial circumstances that constitute the measure incindex are entered as a set of seven dummies, only two have statistical significance: phone has a coefficient of 2.69 (2.29) and never-on-welfare has a coefficient of 1.87 (2.60).

[11] When incindex is replaced by lnincg, the measure of the family's gross annual income missing for about 16% of the cases, the coefficient on lnincg is 0.30 (0.75) and the missing value dummy has a coefficient -0.51 (-0.65). However, when incindex is instead replaced by the log of the value of the home, lnhomval, its coefficient is significantly positive: 0.19 (2.78) and when the factor loading, pfincome, is used instead, its coefficient is 1.80 (3.78). When the seven possessions are instead entered, only one is statistically significant: phone (again) is so: 2.74 (2.12).

[12] For example, when the breastfeeding variable was included as the only "caring" variable in a modified Model #3, its coefficient (t) was stronger than in the regression reported in Tables 6 and 7: 1.73 (2.71) for reading and 2.00 (2.98) for math. Similarly, when the sum of the four variables (smoking, prenatal medical care in the first trimester, breastfed and breastfed more than 4 weeks) was used in model #4, it was again strong and statistically significant: 0.68 (2.38) for reading and 0.75 (2.53) for math. This coefficient implies that the children in the families with a high value on this index (index=4; 14% of the children), had reading and math test scores that were about 3-points or one-fifth of a standard deviation higher than the children in the families with a low value on this index (index=0; 7% of the children).

[13] An intriguing parallel to the point here is found in Feinstein (2003) where he tracks the test scores of youths from about age 2 through age 3½, 5, and 10 years, using the 1970 British Birth Cohort Study (BCS70). He shows how important parental SES, or education level, is in its influence on the early test scores. But then he shows that overtime, while the correlation in test scores is surely positive (more so for reading than for math), there is considerable mobility in the test score ranking across ages and that interacts with parental SES: "although children are already stratified by social class in standard tests …at 22 months, the stratification has become more extreme by 10 years." (p.85) And, while "there is mobility… this is mainly for high or medium-SES children. Low-SES children do not, on average, overcome the hurdle of lower initial attainment combined with continued low input. Even high-SES children find it hard to escape from poor performance at 42 months." (p.87) One explanation for this could be the variation in family caring within SES levels: the few low-SES children who do well may be those whose parents would rank high in family caring if it were measured.

[14] This point is mirrored in Bynner's synthesis essay on childhood risks and protective factors when he concludes "strong parental aspirations and emotional support in the context of sustained encouragement … may override the worst effects of poverty and disadvantage." (Bynner 2001, p.287)