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Can Too Much TV Ground You for Life? Television Viewing and Child Outcomes

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Abstract

The number of hours a typical child watches the television is almost double the suggested guideline by American Academy of Pediatrics (AAP). A very large number of studies have claimed an adverse effect of television on children and teenagers. In this paper, we use The National Longitudinal Survey (NLS), a rich, nationally representative data set that allows us to observe the inter-temporal variations in television viewing behavior and the child outcome measures. Unlike the previous studies, we account for unobservables at the family and the child level, and find that hours of television viewing does not have any effect on Body Mass Index, or reading and mathematics test scores. Only in case of behavioral problems television does have an adverse effect, but the magnitude is small. Despite the conventional wisdom and the ongoing populist movement towards proactive policies, these findings suggest that an emphasis on policies based on existing studies may be premature.

Keywords: Television, child development, test score, behavioral problem, body mass index, overweight, obesity, unobservable characteristics.

JEL Classification: I0, I1, I2, J2

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I. Introduction

In 1950 only 10 percent of the households in the United States had a television set; by 1980 it rose to 98 percent. American children of ages 2 to 17 watch an average of 25 hours of television each week, with one in five watching for more than 35 hours [Gentile and Walsh, 2002]. The daily estimated television hours of a typical child is almost double the suggested guideline by American Academy of Pediatrics (AAP); their recommendation is 2 hours or less of quality programming in a given day for children of age two and above, and for children under age two, they suggest that television be avoided altogether.[1]

It has become a conventional wisdom that television in general, and higher exposure to television, in particular, has an adverse effect on children. Television has been blamed for childhood obesity, lower cognitive achievement and deteriorating school performance, violence and aggressive behavior, and for glorifying (and thereby encouraging) smoking, drinking and teenage sex.[2] In this paper, we ask whether it is television viewing *per se* that negatively affects the child's development or are there intervening factors such as family income, parental education, family structure, and unobserved child or family characteristics that explain the observed negative relationship. Throughout this paper, for brevity, we use the generic word 'child' instead of 'child, preteen and teenager'.

The most common argument regarding the ill effects of television on children is *Time displacement*: television takes away time from physical activities (such as play activities),

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1. American Academy of Pediatrics (AAP): http://www.aap.org/family/tv1.htm.

2. Some of the media coverage on these issues and on some of the popular movements such as *Turn Off Your TV* can be found in the following sources: *Kill Your Television* at turnoffyourtv.com; *WebMD* report at FOXNews.com; CNN reporting, "*Study Links TV Viewing among Kids to Later Violence*", at http://archives.cnn.com/2002/HEALTH/parenting/03/28/kids.tv.violence/index.html; *Children and Watching TV* at http://www.aacap.org (Official website of American Academy of Child and Adolescent Psychiatry); *AAP News* (the official news magazine of the American Academy of Pediatrics, or AAP), March 1998, at http://www.aap.org (for the full article check http://www.aap.org/advocacy/hobbs398.htm); Federal Communications Commission (FCC), Fact Sheet. 1995. "*Children's Television Programming*," http://www.fcc.gov/Bureaus/Mass_Media/Factsheets/kidstv.txt. Another popular source often cited by a number of organizations and web-logs is http://www.csun.edu/science/health/docs/tv&health.html.

learning activities (such as reading and doing homework), and socializing activities with friends and family, and thereby causes poorer health, cognitive and behavioral outcomes. Researchers have also posited a number of different effects of television with respect to specific child outcomes that may be at work in addition to time displacement. In case of child health the arguments are the following: resting energy expenditures are lower when the child is watching television than if the child was doing nothing at all [Klesges, Shelton, and Klesges 1993], and high-caloric-density foods are often accompanied – and promoted (via advertising) – by television viewing [Dietz and Gortmaker 1985].[3] In case of cognitive development, television is often considered a poor learning device vis-à-vis the traditional devices such as books and structured play activities [Huston and Wright 1998]. Besides, some skills such as gross and fine motor skills simply cannot be learnt from television. As for behavioral problems, a number of theories that we discuss in Section II hypothesized that exposure to violence, aggression, sexuality, substance abuse, etc., that television provides may promote similar behavior among children and teenagers [Huesmann et al. 2003]. Having mentioned a variety of hypotheses that are present in the existing literature, it is not our intention to identify these individual effects and their relative strengths. We want to examine if television has *any* effect on child outcomes and, to that end, we study the overall effects of television on each of the child outcome measures that we use.

Despite an extensive list of hypotheses about the ills of television, there is no denying that television is an intrinsic element of the modern life. In 1980 television ownership of American households rose to ninety-eight percent and has not declined since. In 2000, seventy-five percent of the households owned two or more television sets. In the same year sixty-two percent of the households had wired cable (Table I). Virtually every family with children has a

[3] Resting energy expenditure represents the amount of calories required for a 24-hour period by the body during a non-active period.

working television set and for most families it is an unavoidable baby-sitting tool.[4] There also is a significant voice that argues that television *per se* need not be harmful and that it can, in fact, be a useful tool in the child's learning and overall development.[5] Today's children enter kindergartens with a larger vocabulary than the pre-television generations.[6] It is, therefore, important to contest the commonly held perceptions that cannot withstand intensive empirical tests, especially since it indicates that the policy discussions claiming large benefits of reduced television exposure is somewhat premature.[7]

Despite a rather large volume of existing academic research – predominantly in pediatrics, adolescent psychiatry, and child development – we believe that this paper makes several contributions. *First*, econometric studies on the effects of television on child outcomes with a large, nationally representative sample are rare. Gorely, Marshall, and Biddle [2004] reviewed 68 primary studies and found that the median sample size in these studies was only 444. Only eight of these studies use longitudinal data.[8] Our paper uses data from a publicly available longitudinal survey, *The National Longitudinal Survey* (NLS). With equal proportions of male and female children, the age range we cover is 2 to 18 years. The time span for our

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4. A number of comprehensive descriptive studies by Kaiser Family Foundation find that seventy-four percent of all infants and toddlers have watched television before age two, and twenty-seven percent have a television in their bedroom.[4] Seventy seven percent of the children turn on the television by themselves, sixty-two percent use the remote to change channels, sixty-seven percent ask for specific shows, and seventy-one percent ask for their favorite videos or DVDs.

5. See Huston and Wright [1998], Singer and Singer [1998], for detailed discussions. Volume 557 of *Annals of the American Academy of Political Science*, Children and Television, May 1998, has a number of studies on related issues.

6. Consumer Guide, Office of Education Research, U.S. Department of Education (http://www.ed.gov/pubs/OR/ConsumerGuides/tv.html).

7. There is an emerging movement to steer policy makers to focus on television exposure and initiate proactive policies. Grants are available for "TV-free America" from *Cursor.org* and *MediaTransparency.org*, who are backed by some of the largest philanthropies in the country (http://www.mediatransparency.org/recipientgrants.php?recipientID=6805). Since 1995, more than 24 million people have participated in TV-Turnoff Weeks (http://www.screentime.org), which is also endorsed by American Academy of Pediatrics (AAP).

8. Even among the studies employing longitudinal analysis, the sample is often restricted. Robinson et al. [1993], and Schmitt [1993] focus only on girls, while Gordon-Larsen, McMurray and Popkin [1999] is restricted to children between the age of 7 and 12.

usable data runs from 1990 to 2002. The numbers of observations vary for different outcome measures, but in each case we have over 6,000 child respondents.

Second, most of the existing studies focus on a single child outcome. While informative, this does not allow us to assess the effect of watching television on the overall development of the child. We measure cognitive development with mathematics and reading test scores, behavioral problems with Behavioral Problem Index (BPI), and health outcomes with Body Mass Index (BMI). By using a multitude of outcome measures that capture different dimensions of development, we hope to assess how watching television affects the overall development of the child.

Third, a common limitation of the existing studies is that they do not take into account a number of economic and demographic characteristics that could be the intervening factors that explain the observed negative relationship between watching television and child outcomes.[9] Examples of such characteristics include family income, parental characteristics, and family structure. In this study we use a wide spectrum of economic, demographic, and location information that are available for the children and their families.

Finally, and most importantly, the existing research does not establish a causal link between television viewing and child outcomes. In all probability, they are merely explaining the negative *correlation* between watching television and child outcomes because there are unobserved child and parent characteristics (e.g., the child's innate ability, how ambitious and motivated the parents are, etc.) that might explain the observed negative relationship.[10] In our study, we calculate fixed-effect estimates to eliminate the potential bias caused by unobserved time-invariant child and parent characteristics. We have repeated observations on a child's daily

[9.] Robinson, Chen and Killen [2000] is an example of one of the widely cited longitudinal studies that is subject to this limitation.

[10.] For instance, Johnson et al. [2002], a study that spans over a 17-year interval in a community sample of 707 individuals, does account for a number of family and child characteristics but not for family or child level unobservables.

television viewing hours and outcome measures, allowing us to compute child fixed-effect estimates. We also have information on sibling's hours of television viewing and outcome measures that allows us to compute family fixed-effect estimates.[11]

Based on our preferred child fixed-effect estimates we conclude that, while television viewing modestly increases children's behavioral problems, it does not affect their Body Mass Index, and reading and mathematics test scores. We carry out a series of robustness checks that include addressing the issues of non-linear effects of television, lagged effects of television, and measurement errors. The fact that we accommodate an extensive set of explanatory variables to control for the intervening factors, account for unobservables, and that our estimates are robust to a wide range of checks and perturbations, give us confidence that our estimates show causal effects of television viewing on the child outcome measures.

One clarification that we would like to make at the onset is that despite a heightened interest in new media (e.g., computers, video games, etc.), television remains by far the dominant screen media (Table II). The impact of computers and video games on sedentary behavior is not very large compared to television; they comprise of only about ten percent of the average daily media budget of children aged 2 to 18.[12]

The rest of the paper is divided into the following sections. Section II reviews the literature and discusses some of the existing empirical studies. Section III discusses the econometric issues and section IV explains the data used in this study. Section V presents the

[11.] A considerable amount of studies with experimental settings, while improve upon the cross-sectional studies, suffer from some of the same limitations discussed above. Johnson *et al.* [2002] emphasize the limitation of short observation period, or age spans, of the existing experimental studies. Also, most of these experiments are not fully random but subject to parental consent. In Robinson [1999], 198 third and fourth grade students who obtained parental consent constituted the sample. In Krcmar and Cooke [2001], only 23 percent of the children returned with a consent form. Last but not the least, most of these studies do not account for family or mothers characteristics.

[12.] Since our data period ends in 2002, the likely increase in computer use and video gaming in the subsequent years will not affect our analysis. Also, note that there is some evidence that over time the incidence of television viewing may have somewhat declined. Hofferth and Sandberg [2001] report that over the period 1981-1997, television viewing has declined by 4.1 hours a week among the children of ages 3 to 12. The NLS data, however, does not show any specific time trend over the period 1990-2002, but does show a decline since 1998.

results and findings, which is followed by extensions and robustness checks in Section VI. Section VII concludes.

II. The Generation of TV Children: Literature Review

2.1. Television and Child Health

To examine the effect of television on children's health, we specifically focus on the effect of watching television on children's Body Mass Index (BMI). We do this for two reasons. First, there is great interest in the public policy arena regarding BMI as a summary measure of health in general and a measure of overweight/obesity in particular [Thomas, Lavy, and Strauss 1996]. Secondly, BMI is the most extensively used health outcome measure in the literature on television viewing [Robinson 1999, Dietz and Gortmaker 1985, Gordon-Larsen, McMurray and Popkin 1999, Proctor et.al. 2003].[13]

There are different reasons as to why television could affect child BMI. First, if energy intake exceeds energy output then the extra calories are stored and weight is gained [Katzeff 1988]. Secondly, there is a time displacement effect because television displaces physical activities. Dietz and Gortmaker [1985] show that children who watch an excessive amount of television are not involved in more energy-expensive activities.[14] Klesges, Shelton and Klesges [1993], in fact, find that resting energy expenditures are lower from watching television *vis-à-vis* doing nothing at all.[15]

[13.] Robinson [1999] focuses on childhood obesity and uses, in addition to BMI, a few other measures such as triceps skinfold thickness, waist circumference, hip circumference, and waist-to-hip ratio. We stick to child BMI, especially since incidence of overweight and obesity are most commonly measured in terms of child BMI (adjusted for gender and age). Check the Center for Disease Control (CDC) website for details, http://www.cdc.gov/growthcharts.

[14.] The reason why researchers focus on metabolic rates is that most studies find evidence of the following: obese children do not eat more than their normal-weight peers [Weil 1977], the obese do not under-report intake [Klesges, Shelton, and Klesges, 1993], and the resting energy expenditures of obese children appear to be the same as or higher than those of normal-weight children [Molnar et al. 1985, Klesges, Shelton, and Klesges, 1993].

[15.] They, however, do not provide a physiological explanation.

Thirdly, while watching television children are exposed to food advertisements – most of which are high-caloric-density foods – and adolescents are more prone to developing unhealthy dietary habits that are likely to carry over into adulthood.[16] And, finally, the sedentary nature of television viewing encourages children to snack and these snacks are more likely to be the high-caloric-density foods advertised on television [Dietz and Gortmaker 1985]. Television viewing by children also correlates with between meal snacking, consumption of foods advertised on television, and the children's attempts to influence their mother's food purchases [Dietz and Gortmaker 1985].

The relationship between television viewing and obesity has been examined in a large number of cross-sectional epidemiologic studies [Dietz and Gortmaker 1985, Gortmaker et al. 1996, Andersen et al. 1998, Crespo et al. 2001]. A handful of longitudinal studies that do examine the effect of television on obesity do not account for unobserved child and mother characteristics that are likely to bias the observed relationship. These studies also allow for none or very few family economic and demographic characteristics [Gordon-Larsen and McMurray 1999, Proctor et al. 2003, and Hancox, Milne and Poulton 2004]. Most researchers using cross-sectional or longitudinal data find a positive correlation between television and overweight/obesity.

2.2. Television and Child Learning

The arguments that are made against television of having an adverse effect on children's cognitive development have the following premise.[17] Suppose that television is not a learning device. In that case, watching too much television (regardless of content) takes time away from learning (e.g. reading or active play) and may have an adverse effect on test scores. This is the

[16.] Chou, Rashad, and Grossman [2005] test the specific hypothesis whether fast-food restaurant advertising on television feeds into childhood obesity, and find evidence to support it.

[17.] Anderson et al. [2001] has a detailed discussion and literature review of the issues of television and child cognitive development.

usual time-displacement argument. Now, even if television is considered a learning device, the argument is that it is a poor learning device because, first, the same skills can be learnt by some other devices (e.g. books), and secondly, a large number of skills such as fine motor skills and gross motor skills cannot be learnt from television at all [Borden 1997].

The criticisms of television as an educational medium include passivity and lack of interaction of the viewer, and lack of control of the learner on content, pace, and ordering of the material. Since television provides both visual and auditory presentation of the content, it does not stimulate the learner and suppresses imagination and creativity. The rapid pace and short segments style of presentation of television is processed at a superficial and perceptual level by children. And finally, the strong association of television with leisure and relaxation may have a profound effect in that they may lower the intellectual involvement in processing the information presented in a television programs.[18]

Existing studies on the effect of television on the child's cognitive development are often limited to specific aspects of development such as measures of creativity, divergent thinking, and ideational fluency [Anderson et al. 2001], not on comprehensive measures such as test scores.[19] These studies find a negative correlation between hours of television watched and cognitive skills. However, it is difficult to draw causal inference from these studies because they do not address the issue of unobservable child/family characteristics that are correlated with both television viewing and cognitive skills.

2.3. Television and Child Behavioral Outcome

In case of behavioral outcomes television, first, has a time displacement effect – while watching television the child has to give up socializing with parents, family members, and other

[18.] See Salomon [1983], Huston and Wright [1998], and Singer and Singer [1998] for more detailed discussions of these issues.

[19.] One notable exception is Zavodny [2004] who uses test scores of adults to study the effect of television on adult cognitive achievement.

children.[20] Interacting and socializing with family, friends, relatives, and other social contacts help the child bond and strengthen these personal and social relationships. Olken [2006] study adults and find that exposure to television (and radio) lowers levels of participation in social activities and self-reported measures of trust. Just as adults do, children also develop their social skills, and social competence through socializing [Borden 1997].[21]

The second link between television and children's behavioral outcomes is the content of television programs. Theories of *observational learning* emphasize that observing specific aggressive behaviors around them increases children's likelihood of behaving the way they observe behaviors [Comstock and Paik 1991, Gerbner et.al. 1994, Huesmann et al. 2003]. Extensive observation of violence around them biases children's world schemas toward attributing hostility to others' actions and, in turn, increases their likelihood of behaving aggressively. As children mature, normative beliefs about what social behaviors are appropriate take shape. However, this development is not neutral to observational learning; the observations of the behaviors of those around them, including those in the mass media, do influence their normative beliefs. In a survey of 750 children between the age of 10 and 16, more than two-thirds responded that their contemporaries are influenced by what they see on television [FCC Fact Sheet, 1995].

An alternative theory explaining long-term effects of exposure to violence and aggression is *Desensitization Theory*. This theory is based on the empirical fact that most humans seem to have an innate negative emotional response to observing blood, gore, and violence. These exposures are often accompanied by increased heart rates, perspiration and discomfort [Cline, Croft, and Courier 1973, Moise-Titus 1999]. However, with repeated exposure, this negative

[20.] Note that because of data limitations we do not distinguish between watching television alone and getting together with other kids and watching television as a group (which clearly is itself a socializing activity). We, however, include a variety of controls to capture the child's association. These controls represent socio-economic location as well as physical location (urban/rural etc.) that could capture differences in association across children.

[21.] Note that television could also have a negative effect on socializing. Kids with no exposure to pop culture references and popular media events may have difficulty fitting in and connecting with other kids.

emotional response habituates, and the observer becomes desensitized. Thus, proactive-instrumental aggressive acts become easier to commit.[22]

While the above theories hypothesize direct effects of television one of the theories that has attempted to explain the long-term relations between exposure to violence and aggression without hypothesizing any direct effect of watching aggression and violence suggests that aggressive children feel happier and more justified if they believe they are not alone in their aggression; violence in media provides them with that reassurance [Huesmann 1998].

A theory that contest these hypotheses of causal effects, often described as the "third variable" theory, suggests that the observed long-term positive relations between aggression and exposure to media violence are spurious and are derived from their joint association with one or more of these third variables such as demographic, family, and individual characteristics [Comstock and Paik, 1991]. This emphasizes the importance of child and family characteristics and unobserved heterogeneity that we take into account in our analysis and the existing studies fail to account for.[23]

Research has shown primarily negative effects of television on children's behavior in the form of violent and aggressive behavior, sexuality, and substance use and abuse patterns.[24] Comstock and Strasburger [1993] argue that as much as 10 to 20 percent of real-life violence may be attributable to media violence. Robinson, Chen, and Killen [2000], a longitudinal study, found a positive correlation between television and music video viewing, and alcohol consumption among teens. FCC Fact Sheet [1995] that refers to a survey of 10 to 16 year old

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[22.] Note that the underlying assumption of this theory is that lack of a negative emotional response to observing violence also indicates a similar desensitized or flat response to planning violence or thinking about violence.

[23.] There is another theory, *Catharsis theory* [Fowles 1999], that also negates the link between media violence and aggressive behavior. It predicts that violence viewing should be followed by reductions in aggression (for amusement, we would like to call it the "Clockwork Orange Hypothesis" because the character Alex in the movie *Clockwork Orange* faces a treatment that seems to follow this theory!). The empirical evidence for any such negative relation, however, has not been established [see Huesmann, Eron, Berkowitz, and Chaffee, 1991; Paik and Comstock, 1994].

[24.] See Committee on Public Education, American Academy of Pediatrics [2001], for a complete list of literature studying these effects.

children highlights that 60 percent of the children in that survey indicated that television encourages notions such as disrespect for parents and having sex at too young an age.

III. Econometric Methodology

We start with a general production function for skills/health [Aaronson 1998; Hanushek 1979, Todd and Wolpin 2003]:

(1) $$Y_{ijt} = \beta_0 + \beta_1 TV_{ijt} + \beta_2 C_{ijt} + \beta_3 F_{ijt} + \beta_4 L_{ijt} + \alpha_i + \alpha_j + \varepsilon_{ijt},$$

where, Y_{ijt} is a child outcome, namely, reading/mathematics test scores, behavioral problems, or body mass index for child $i = 1, 2, ..., N$, of family $j = 1, 2, ..., M$, at time period $t = 1, 2, ..., T$. The measure of television viewing, TV_{ijt}, is the average hours of daily television watched by child *i* of family *j* at time *t*. Vector *C* includes child characteristics such as age, sex, race, etc. *F* contains mother/family characteristics such as mother's education, family income, family structure; *L* is geographic information such as whether the child lives in central city or suburbs.[25] α_i represents time-invariant unobservable traits of the child such as innate ability and α_j represents the time-invariant unobservable traits of mother/family that affects all children in the household in a similar way (e.g., parental motivation, ambition, work ethics, etc., that do not vary over time). And, finally, ε_{ijt} captures all time-varying unobservables.

The key problem in identifying β_1, the effect of television on the child outcome measures, is the possible correlation between time-invariant unobservables (α_i and α_j) and TV_{ijt}. For example, a child with lower innate ability (α_i) is more likely to both watch more television and score poorly in a mathematics test. A negative relationship between hours of television viewing and lower mathematics test scores will then also pick up the effect of low α_i

[25.] For full description of these variables please refer to Section IV.

and not the effect of watching more television *per se*. Similarly, a child who lives in a household where parents are unmotivated and not very ambitious (a lower α_j) is likely to watch more television than a child whose parents are ambitious and highly motivated (a higher α_j). In this case a difference in the mathematics test scores between these two children can be attributed to the difference in α_j and not to the hours of watching television *per se*.

We use a data set that has information on hours of television watched by a child over time and the hours of television watched by her siblings. These unique features of the data set allow us to exploit both the within-child variations and within family variations in the hours of television watched to identify the causal effect of television viewing on different child outcomes. A reason for using both these approaches is that we do not know, *a priori*, what type of unobservables (if at all) play a bigger role in explaining the relationship between hours of television watched and child outcomes. This is important because researchers often work with either a cross-section with information on siblings or a longitudinal data set that follows only one child from a household over time. Our analysis would provide an improved understanding of the type of data set needed to identify the causal effect of television viewing on child outcomes.

Our identification strategy is to estimate fixed effect regressions. In our *family- fixed* effect regressions, we utilize information on different siblings in the household. For the key independent variable – hours watching television – this essentially boils down to taking a difference between the mean hours of television watched in the household and the child's hours of television watched, over all the observed periods. The other variables in equation (1) are adjusted thusly. What this does is it removes the effect of unobserved variable α_j from equation (1) and the correlation between *TV* and α_j that affects the estimate of β_1 is no longer present.

The underlying assumption behind the family fixed effect regression is that either $\alpha_i = 0$ or $\text{cov}(TV, \alpha_i) = 0$, which is questionable. The longitudinal information on each child allows us to relax this assumption and exploit the within-child variation to estimate a *child- fixed* effect regression. This essentially involves, for a given child, taking a difference between the mean hour of television watched by the child over the observed period and the child's hour of television watched in a given year. The other variables in (1) are adjusted the same way. One advantage of using the child fixed effect is that it also removes the family-specific unobservables (α_j).

It can be argued that the effect of the hours of television watched on child outcomes is non-linear [Williams *et.al.* 1982, Zavodny 2004]. That is, the effect on child outcomes of a marginal increase in the hours of television watched is not the same for a child who watches, say, two hour of television *vis-à-vis* the child who watches six hours of television; we expect the effect to be larger for the child who watches six hour of television. To detect the presence of such non-linear effects we estimate the following version of regression equation (1),

$$(2) \qquad Y_{ijt} = \delta_0 + \delta_1 DTV_{1,ijt} + \delta_2 DTV_{2,ijt} + \delta_3 DTV_{3,ijt} + \delta_4 C_{ijt} + \delta_5 F_{ijt} + \delta_6 L_{ijt} + \alpha_i + \alpha_j + \varepsilon_{ijt},$$

Where, DTV_1 is a dummy variable that takes on the value of 1 if the child watches television for more than 2 hours but less than or equal to 4 hours, and 0 otherwise; DTV_2 is a dummy variable that takes on a value of 1 if the child watches television for greater than 4 hours but less than equal to 6 hours, and 0 otherwise; and DTV_3 is a dummy variable that takes on a value 1 if the child watches greater than 6 hours of television (The omitted category is the group of children who watches less than equal to 2 hours of television). The cut-off points – two, four, and six hours – come from the following: the American Association of Pediatrics recommends less than or equal to 2 hours of television viewing for a typical child, children in the United States watch approximately 4 hours of television, and mean plus one standard deviation is approximately 6

hours of television in our sample. Thus, DTV_1, DTV_2 and DTV_3 attempt to capture "moderate", "excessive" and "extreme" television viewing behaviors, respectively. Similar to our analysis of the linear effect of television viewing, we estimate $(\delta_0, \delta_1, \delta_2)$ by OLS, family fixed effect, and child fixed effect regressions.

It is important to recognize the potential limitations of our estimation strategy. First, our fixed effect model identifies the causal effect of hours of television watched only if the television viewing is exogenous, conditional on the fixed effect α_i and α_j. If the time-varying unobservables are correlated with television viewing, then estimates from the fixed effect models will be biased in the sense that they will reflect the effect of such unobservables. We discuss this issue in Section VI.

Second, the fixed effect estimators are particularly susceptible to the measurement errors problem. Under the assumption of classical measurement errors in a regressor, the use of only within-child/family variation in the fixed effect estimates increases measurement error bias relative to the OLS estimates [Griliches 1979]. In particular, it will be potentially increasing the measurement error bias when the endogeneity bias is reduced by using the fixed effect estimates. Since we are primarily concerned with measurement errors in our key explanatory variable, daily television hours, in Section VI we carried out a robustness check to examine how important this problem of measurement errors actually is.

Finally, the fixed effect model uses only within-child/family variation in the data, whereas the OLS uses both within and between-child/family variation. The extent of efficiency loss depends on the amount of within-child/family variation present in the data. The higher the proportion of within-child variation in the data, the lower is the loss in efficiency. We discuss within-child/family variations in the data in Section IV (Table III).

IV. Data

We use data from the 1979 National Longitudinal Survey of Youth (NLSY79) and the NLSY79 Child Survey. The NLSY79 began in 1979 with a sample of 12,686 respondents (6,283 female respondents) born between 1957 and 1964. They were interviewed annually until 1994 and biennially thereafter. We use data up to the 2002 survey year. This survey provides information on family structure, family income, mothers' education, mother's employment, the number of children in the household, and some characteristics of the location of residence.

The biological children of the NLSY79 female respondents have been interviewed every two years in the NLSY79 Child Survey, starting in 1986. As of 2002, a total of 11,340 children have been identified as having been born to 4,890 of the 6,283 NLSY79 female respondents. As part of the Child Survey, children are administered various tests measuring their cognitive ability, temperament, motor and social development, and self-competence [Center for Human Resource Research 2002]. Mothers answered questions on behavioral problems of their children as part of the NLSY79 Child Survey. At each survey round mothers also provide information on height and weight of their children. These mother and child responses provide the child outcomes used in our study.

4. 1. Dependent Variables

Below we present brief descriptions of the dependant variables. Detailed descriptions are presented in Table A1 of the Appendix.

Body Mass Index. We use the information on height and weight to construct BMI for each child which is our summary measure of child health.[26] For the Child BMI analysis we restricted our sample to rule out underweight children (about 14 percent of the sample). This helps focus on the

[26] Metric BMI Formula, $\text{BMI} = \frac{\text{Weight in Kilograms}}{\text{Height in Meters}} \times \text{Height in Meters}.$

question if television contributes children of 'normal' weight to be at-risk-for-overweight, overweight or obese.[27]

Mathematics and Reading Test Scores. We use mathematics and reading recognition assessments from the Peabody Individual Achievement Test (PIAT) as our measures of cognitive skills. These tests are administered to all children of female NLSY79 respondents aged five and above. We use the standard scores reported in the Child Survey for both these tests.

Behavioral Problem Index. Mothers of children aged four and above (themselves respondents in the NLSY79) are asked 28 questions about their children's behavioral problems during the previous three months. This index can take a maximum value of 28 (representing maximum behavioral problems) and a minimum value of 0 (no behavioral problems). We use the standard scores reported in the Child Survey.

4.2. Explanatory Variables

The key explanatory variable, the average number of hours a day the child watches television, is obtained from information provided by the mother of the child each survey year. In the NLS, television viewing increases steadily with age. As discussed in Section III, we also intend to capture any non-linear effects of watching television by using television-hours categories (DTV_1, DTV_2, DTV_3).

To identify the variables that are likely to be correlated with both a given child outcome and television viewing behavior we take into account the following issues: observed differences in child characteristics, observed differences in mother/family characteristics, variables that explain differences across children in the content of television programs watched, child's association and parental control, location, and macroeconomic characteristics.

[27.] We are testing the hypothesis that television has an adverse health effect on children. If television causes weight gain for normal weight kids that can be interpreted as an adverse effect, whereas for underweight children weight gain will be a beneficial effect. Dropping the underweight kids helps an unambiguous interpretation of the effect of television. For the test scores and the BPI, we do not drop the underweight children.

We ran separate regressions for each of the four outcome measures (BMI, reading scores, mathematics scores, and the BPI). In each case, we began with a basic set of child characteristics – child's age, sex, if the child had a low birth-weight. Low birth-weight has been known to affect test scores and the BPI [McCormick, Gortmaker and Sobol 1991]. We included number of siblings which could affect the television viewing habits and the outcome variables. For the BMI regressions we also included variables indicating if the child is covered by health insurance, if the Child has any medical condition that impedes normal activities (a sick child is likely to spend more time in front of a television).

The next set of variables we included is mother's characteristics: her own education, education of her parents, household income,[28] race, and whether she is a first or second generation immigrant. These variables are important determinants of the child outcome variables. At the same time, they also proxy for television viewing patterns in the household and the social association of the child. We include mothers Armed Forces Qualification Score (AFQT)[29] in the regressions of reading and mathematics scores and the BPI. The AFQT scores measure mother's ability which could be strongly correlated with the child's ability. A lower ability child may spend more time watching television, and is also more likely to have lower test scores and greater behavioral problems. An additional variable included in the BMI regressions is mothers BMI which is an important predictor of child BMI. Besides, if the mother is overweight and obese and not physically active, it may also make the child less physically active and spend more time in front of the television.

We have included the following variables that proxy for parental control of television viewing and monitoring: whether the child has a single mother, hours per week the mother

[28.] Total family income is the sum of wages and salaries including tips, income from farm and businesses, military income, unemployment benefits, AFDC and SSI receipts, food stamps, and other income received by the mother and her spouse (partner), measured for the past calendar year.

[29.] The AFQT is a general measure of trainability on a scale of 1 to 99. Normed scores (adjusted for age differences) are reported in the survey. The test includes as components: arithmetic reasoning, word knowledge, paragraph comprehension, and numerical operations.

works, mothers own television viewing behavior, and whether parents monitor the child's television viewing.[30, 31] These variables essentially control for differences in content of television viewing. Of course, family income and parental background (education, etc.) also control for content, but they do so indirectly. The importance of including parental control stems from the conjecture that parents with less control over children's television viewing may also have less control over their food habit, academics, and behavior. The importance of eliminating the difference in content is important because watching 'good' television for an hour is could have a different impact compared to watching 'bad' television for the same amount of time.

To capture any difference in television viewing and child outcomes across different geographic locations we have included dummy variables for regions (Northeast, North Central, South, and West), and for central cities, suburbs, and rural areas.[32] To capture macroeconomic effects (if any) we added regional unemployment rates. Descriptive statistics of all dependent and explanatory variables are presented in the Appendix in Table A2.

In Table III we present evidence of the amount of within-child and within-family variation in the data. We report the amount of within-child and within family variation in BMI, mathematics, reading and BPI scores and hours of television watched variables. Although the between family or between child variation for all our dependent variables is greater than within family or within child variation, the later is of significant amount. For our key independent variable, average hours of television watched, there is also a significant amount of within-child/family variation.

30. In 1981 when they were between 16 and 24 years of age, the mothers were asked about their own television viewing. We include it along with their age in 1981.
31. The specific question about monitoring television viewing behavior is "Do Parents Discuss TV Programs with Child?".
32. One argument often made is that in the central city areas, due to higher crime rates, children may have less opportunity to spend time outdoors [Anderson et al. 1998].

V. Results

For each of our four outcome variables we estimate four different versions of equation (1) described in Section II. The results are summarized in Table IV (detailed regression results are in Tables A3–A6 of the Appendix). In the first column we present results from a cross-section regression that includes only child characteristics, location and macroeconomic variables, and year dummies (Cross-sec 1). In the next column we add mother's characteristics to child characteristics (Cross-sec 2). The last two columns add mother/family fixed effects (Family-FE) and child fixed effect (Child-FE), respectively. Focusing on the BMI outcome and the cross-section regressions (Cross-sec1 and Cross-sec2 in Table IV and Table A3), we find support to the claim that hours of television watched positively affects BMI. This finding is consistent with what other researchers have found. This effect, however, is very small – an increase by an hour of daily television will lead to an increase of 0.071 points or 0.01 of a standard deviation in the BMI (Cross-sec2). Comparing between Cross-sec1 and Cross-sec2, we find that the effect of hours of television watched decreases by nearly fifty percent (0.133 *vs* 0.071) once mother/family characteristics are included. Important mother/family characteristics include mother's BMI, family income, weeks worked by the mother, mother's race, and mother's television viewing behavior (Table A3 of the Appendix).

We find that the family fixed-effect specification also predicts a positive relationship between hours of television watched and BMI (Family-FE) but the effect is much diminished compare to the cross-section regressions; an increase in one hour of television watched in a day will lead to an increase of only 0.038 points in the BMI. This indicates that once the effect of the time-invariant mother/family unobservables that contaminate the relationship between hours of television watched are eliminated the effect of television viewing dropped by nearly fifty percent (0.071 *vs* 0.038 points). Of course, there could be unobserved differences even across siblings which would not be eliminated in our family fixed-effect regressions. Our preferred estimate,

child fixed-effect regression (Child-FE), eliminates both the effect of (time-invariant) unobserved child characteristics and mother/family characteristics. The Child-FE result shows that an increase in one hour of daily television viewing will lead to an increase of only 0.018 points in BMI and this increase in not statistically different from zero. The fact that the effect of hours of daily television on BMI is diminished (and becomes statistically insignificant from zero) once we move from family fixed-effects to child fixed-effect regression, underscores the importance of child-specific unobservable in explaining the relationship between television viewing and BMI.

The results for the mathematics and reading test scores, reported in Table IV and appendices A4 and A5, are not much different from the BMI results. The cross-section regression that includes only child specific characteristics (Cross-sec1) show that an hour increase in daily television leads to 0.728 points decrease in the reading test scores and it is statistically different from zero. The Child-FE estimates, on the other hand, show that this effect is only -0.046 points and is not statistically different from zero. Results for the mathematics test scores are very similar to the reading test scores; we do not find any statistically significant effect of hours of daily television on the mathematics test scores.

Finally, results of the Behavioral Problem Index (BPI) regressions are reported in Table IV and Table A6. Perhaps more than any other outcome, parents are most worried about the possibility that television may cause or increase behavioral problems of children. We do find that hours of daily television significantly increases a child's behavioral problems (note that a positive coefficient means that the behavioral problem increases as hours of television increases). The effect, however, is very small and declines as we move from the cross-section specification (Cross-sec1) to the child fixed effect specification (Child-FE). Based on the Child-FE estimates, an increase in daily television watched by an hour leads to only (0.189/14.84 =) 0.01 of a standard deviation increase in the BPI.

To summarize, based on our preferred child fixed effect estimates we do not find evidence in favor of the hypothesis that hours of television watched have a causal effect on child health as measured by the Body Mass Index and cognitive development as measured by reading and mathematics test scores. We do find statistically significant effects of hours of television viewing on the behavioral problem of children but it is not economically significant. Although the cross-section regression results support the hypothesis that hours of television watched has large and statistically significant adverse effects on BMI, test scores and BPI, the Child-FE regressions do not support that. We believe that the inability to eliminate the effects of child-specific unobservables from the relationship between hours of television watched and the child outcome measure by previous researchers led them to inaccurately conclude that television has large adverse effects on child outcomes.

A natural question that arises from our finding is the following. Since hours of television watched do not affect child outcomes, does that mean that children who are watching less television are not being benefited in terms of these outcomes? It is certainly true that those who are watching less television have more time for studying or doing physical activities. However, whether they actually do so is another issue; the extra time may simply be wasted in some other unproductive way. To examine how exactly time allocation affects child outcome we need to have detail time use information (such as a time diary). Our results do not necessarily shed lights on the question "what will happen if the television time is replaced with physical activities, structured learning activities and socializing?"

VI. Discussion: Extensions and Robustness Checks

6.1. Nonlinear Effects of Television

The results discussed in Section 5 are based on the assumption that the relationship between hours of television watched and child outcomes is linear. However, some studies

suggested that the relationship may be non-linear [Williams *et.al.* 1982, Zavodny 2004]. To examine this we estimate regression model (2) discussed in Section III. Results are reported in Table V. We do not find non-linear effects of hours of daily television on mathematics and reading test scores. However, we do find some evidence of very small non-linear effects of television on BMI and the Behavioral Problem Index (BPI). Focusing on the child fixed effect estimates (Child-FE), we observe that the "negative" effect of watching television increases monotonically from "television viewing between 2 to 4 hours" to "television viewing for more than 6 hours". Compare to the base category of less than 2 hours of daily television per day, viewing more than 6 hours of television per day increases the BMI by 0.188 points (about 4 percent of a standard deviation) and the BPI by 1.384 points (about 9 percent of a standard deviation).[33]

6.2. Lagged Effects of Television Viewing

Our primary specification (1), discussed in Section III, identifies the "contemporaneous" effect of watching television on child outcomes as measured by the coefficient β_1. What if, the effects of television work at a lag? Therefore, as a robustness check, we have also examined whether there is any "non-contemporaneous" effect of watching television on child outcomes. To do this we include a lagged television viewing variable in specification (1). That is, we estimate the following regression for each of our outcome variables,

(3) $$Y_{ijt} = \beta_0 + \beta_1 TV_{ijt} + \beta_2 TV_{ij(t-1)} + \beta_3 C_{ijt} + \beta_4 F_{ijt} + \beta_5 L_{ijt} + \alpha_i + \alpha_j + \varepsilon_{ijt}.$$

Our results are qualitatively unchanged from what we reported in the Table V.[34] Based on the child fixed effect estimates, for BMI, and reading and mathematics test scores, both the lagged and the contemporaneous effects of hours of daily television are statistically insignificant

33. We have also used alternative specifications such as including a squared term of daily hours of television watched. The results are qualitatively similar to what we find in Table 6. The squared term is not significant for BMI, reading and mathematics test scores but is significant for BPI scores.

34. These results are not reported but available on request.

and small in magnitude. For BPI, although the lagged effect of hours of daily television is positive (i.e. increases behavioral problems) and statistically significant, the magnitude is about half the contemporaneous effect. We conclude that non-contemporaneous effect of hours of television watched per day is not significant for the outcome measures used in this paper.

6.3. Measurement Errors and Time Varying Unobservables

Our measure of daily hours of television watched by a child is based on what mothers report. However, for a sub-sample of children aged between 10-14 years we have information on daily hours of television watched obtained directly from the child. Average hours of television watched, based on mothers' report (for children aged 10-14 years), are statistically indistinguishable from what has been reported by children themselves. Although we do not have such information for children of other age groups, we feel confident that the mother's report on hours of television watched by her child is not subject to severe measurement error problems.

Time varying unobservables that are correlated with our measures of television viewing will bias the estimated coefficients from our fixed effect specifications.[35] This is probably the single-most important criticism of fixed effect estimation methodology. Although we can never be sure that there are no time varying unobservables that are correlated with key independent variables, one way to mitigate this potential problem is to incorporate a rich set of time-varying covariates in the analysis. In our paper, we have included a large number of time-varying observables in both our OLS and fixed effect regressions.

6.4. The Issue of Content

An important issue of the effect of television is the content of the television programs. The viewing experiences might be very different across children that are not captured by hours of daily television viewing. In case of child BMI, content might matter in terms of advertising

35. To test the exogeneity assumption underlying the fixed effect estimation methodology, researchers use a test proposed by Heckman and Hotz [1989] (also see Wooldridge [2003]). However, this test is shown to have very low power and therefore often not very useful.

and its subsequent effects in food habits. We believe that the family/mother's characteristics such as mothers BMI, mother education, family income, etc. will capture the differences in food consumption patters across children/families.

In case of test scores, the issue of content is somewhat more involved. Some researchers have argue that educational television programs such as *Sesame Street* and *Mister Rogers' Neighborhood* have significant positive effect on children's learning [Huston and Wright, 1998]. A similar issue also arises with respect to a child's behavioral problems (BPI). Is the child watching violence, drug use, etc., or programs more suitable for children? Ideally we would like to have information on the actual content. Lacking this data, we attempt to control for difference in the television content by including variables that are likely to be correlated with the content. Examples of such variables include mother's education, family income, parent-child interaction as measured by the variable whether parents discuss television program with their children, etc. Of course, these variables are likely to be imperfect proxies for the content of television programs watched. Given the variables that control for differences in content across children, our estimated coefficients measure the time displacement effect and the effect of typical content. For those who watch disproportionately higher amount of "good" or "bad" television, the additional effects (if any) have been 'controlled' for.

VII. Concluding Remarks

In this paper we use a longitudinal data set to examine the relationship between hours of television watched by a child and different child outcomes. In particular, our objective was to determine whether there is a causal relationship between hours of television exposure and child's Body Mass Index (BMI), reading and mathematics test scores, and Behavioral Problem Index (BPI). Although we find evidence that hours of television watched is negatively *correlated* with our various child outcome measures, we do not find evidence in favor of the overwhelming

public perception that this effect is *causal*. Once we eliminate the effect of unobservable child and family characteristics, the negative effect of hours of television disappears for the BMI, and mathematics and reading test scores. Only exception is the behavioral problem (as measured by the BPI) where we find negative effects of hours of television watched; the magnitude of this effect, however, is very small.

A reduced television regime in a household could be modestly beneficial for reducing the behavioral problems of children. A policy emphasis on children's television viewing to improve children's cognitive achievements or to fight the rapidly growing incidence of childhood obesity, however, is not likely to yield any measurable success and may, instead, lead to misplaced priorities and misallocation of resources.

It is quite possible that although hours of television *per se* does not affect child outcomes – which is what we found in this paper – a few specific programs could have beneficial impacts on child outcomes that are indeed economically significant. Most of the current and existing research is not directed towards this direction. This paper emphasizes the need to have large and more extensive studies of the content analysis and rigorous experiments with larger and more representative pool of subjects. Once such program contents are identified and substantial causal effects are established, only then it may be prudent to think about proactive policies targeted towards specific program types and not simply targeted towards turning off the television.

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Table I: Television Set Ownership: 1950 – 2000

Year	TV households (as % of total household)	Percentage of TV households					
		Multi-set	Color	VCR	Remote control	Wired pay cable	Wired cable
1950	10	--	--	--	--	--	--
1955	67	4	--	--	--	--	--
1960	87	12	--	--	--	--	--
1965	94	22	7	--	--	--	--
1970	96	35	41	--	--	--	7
1975	97	43	74	--	--	--	12
1980	98	50	83	--	--	--	20
1985	98	57	91	14	29	26	43
1990	98	65	98	66	77	29	56
1995	98	71	99	79	91	28	63
2000	98	76	99	85	95	32	68

Source: http://www.tvhistory.tv/facts-stats.htm

Table II: Media Use Among U.S. Youths (Hours per Day), 1999

Medium	2-18 year-olds	2-7 year-olds	8-18 year-olds
Total media exposure	7:00	4:29	8:43
Television	3:16	2:16	3:46
Taped television shows	0:12	0:00	0:19
Videotapes	0:28	0:28	0:28
Movies	0:16	0:02	0:25
Video games	0:22	0:14	0:31
Print media	0:42	0:42	0:41
Radio	0:43	0:26	0:48
CDs and tapes	0:43	0:19	1:07
Computer	0:19	0:05	0:28

Source: The Henry J. Kaiser Family Foundation; 2003 [Updated 2003 Dec 10; cited 1999 Nov 15]. URL: http://www.kff.org/entmedia/1535-index.cfm.

Table III: Within and Between Group Variation of the Key Variables

	Overall		Family level		Child level	
	Mean	Std dev	Between group std dev	Within group std dev	Between group std dev	Within group std dev
Child BMI	18.92	4.73	3.67	3.39	4.23	2.53
Reading score	103.82	14.72	12.21	9.10	13.96	5.89
Mathematics score	100.83	13.88	11.21	8.89	12.71	6.38
BPI	105.33	14.84	12.25	9.27	13.61	6.88
Average daily TV	3.86	2.54	2.04	1.74	2.20	1.54
0-2 hours of TV	0.26	0.44	0.34	0.30	0.36	0.27
2-4 hours of TV	0.39	0.49	0.33	0.39	0.37	0.35
4-6 hours of TV	0.19	0.40	0.26	0.32	0.31	0.28
6 hours or more TV	0.16	0.37	0.27	0.28	0.30	0.25

Table IV: OLS and Fixed Effect Coefficients of Hours of Television Watched on Various Child Outcome Measures, based on Equation (1)

	Child BMI				Reading test scores			
	Cross-sec 1	**Cross-sec 2**	**Family-FE**	**Child-FE**	**Cross-sec 1**	**Cross-sec 2**	**Family-FE**	**Child-FE**
Average daily television viewing	0.133	0.071	0.038	0.018	-0.728	-0.063	-0.013	-0.046
	(0.018)***	(0.018)***	(0.015)**	(0.012)	(0.055)***	(0.058)	(0.048)	(0.038)
Child time invariant characteristics	*yes*	*yes*	*yes*		*yes*	*yes*	*yes*	
Child time varying characteristics	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Family time invariant characteristics		*yes*				*yes*		
Family time varying characteristics		*yes*	*yes*	*yes*		*yes*	*yes*	*yes*
Regional variables, year dummies	*yes*	*yes*			*yes*	*yes*		
Observations	12441	12441	14358	15210	16418	14156	16391	17412
Groups			3150	6576			3226	6888
MSE	16.00	14.67	6.98	2.73	199.41	176.17	81.25	35.08

	Math test scores				Behavioral Problem Index (BPI)			
	Cross-sec 1	**Cross-sec 2**	**Family-FE**	**Child-FE**	**Cross-sec 1**	**Cross-sec 2**	**Family-FE**	**Child-FE**
Average daily television viewing	-0.749	-0.048	0.03	0.017	0.664	0.443	0.29	0.189
	(0.051)***	(0.052)	(0.046)	(0.041)	(0.056)***	(0.062)***	(0.053)***	(0.047)***
Child time invariant characteristics	*yes*	*yes*	*yes*		*yes*	*yes*	*yes*	
Child time varying characteristics	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Family time invariant characteristics		*yes*				*yes*		
Family time varying characteristics		*yes*	*yes*	*yes*		*yes*	*yes*	*yes*
Regional variables, year dummies	*yes*	*yes*			*yes*	*yes*		
Observations	16461	14197	16434	17461	17086	14529	17056	18133
Groups			3229	6897			3362	7219
MSE	174.21	148.13	78.82	41.03	211.95	206.32	86.89	48.26

Notes: (a) Robust Standard Errors in parenthesis. (b) Standard Errors adjusted for intra-group correlations. Observations within each family constitute a group in the Family-FE and observations of each child constitute a group in the other regression. (c) *, **, and *** indicate significance levels at 10%, 5%, and 1%, respectively. (d) Detailed regression results are reported in Tables A3-A6 in the Appendix.

Table V: OLS and Fixed Effect Coefficients of Hours of Television Watched on Various Child Outcome Measures, based on Equation (2)

	Child BMI				Reading test scores			
	Cross-sec 1	**Cross-sec 2**	**Family-FE**	**Child-FE**	**Cross-sec 1**	**Cross-sec 2**	**Family-FE**	**Child-FE**
Television viewing between 2-4 hours	0.677	0.358	0.254	0.054	-1.621	0.311	0.395	0.076
	(0.095)***	(0.093)***	(0.084)***	(0.071)	(0.338)***	(0.346)	(0.282)	(0.231)
Television viewing between 4-6 hours	1.184	0.707	0.39	0.122	-3.915	-0.301	-0.01	-0.2
	(0.135)***	(0.133)***	(0.114)***	(0.094)	(0.409)***	(0.438)	(0.362)	(0.291)
Television viewing more than 6 hours	1.132	0.654	0.455	0.188	-4.813	-0.158	-0.122	-0.421
	(0.141)***	(0.142)***	(0.120)***	(0.098)*	(0.430)***	(0.466)	(0.393)	(0.305)
Child time invariant characteristics	*yes*	*yes*	*yes*		*Yes*	*yes*	*yes*	
Child time varying characteristics	*yes*	*yes*	*yes*	*yes*	*Yes*	*yes*	*yes*	*yes*
Family time invariant characteristics		*yes*				*yes*		
Family time varying characteristics		*yes*	*yes*	*yes*		*yes*	*yes*	*yes*
Regional variables, year dummies	*yes*	*yes*			*Yes*	*yes*		
Observations	12441	12441	14358	15210	16418	14156	16391	17412
Groups			3150	6576			3226	6888
MSE	15.93	14.64	6.98	2.73	192.63	176.16	81.23	35.07
F-statistic	11.63	5.68	2.12	1.1	63.06	1.71	1.76	2.04
p-value	0.000	0.003	0.120	0.332	0.000	0.180	0.172	0.130

	Math test scores				Behavioral Problem Index (BPI)			
	Cross-sec 1	**Cross-sec 2**	**Family-FE**	**Child-FE**	**Cross-sec 1**	**Cross-sec 2**	**Family-FE**	**Child-FE**
Television viewing between 2-4 hours	-2.1	0.048	0.227	-0.042	2.03	1.4	0.51	0.548
	(0.324)***	(0.314)	(0.283)	(0.250)	(0.329)***	(0.365)***	(0.295)*	(0.263)**
Television viewing between 4-6 hours	-4.224	-0.329	0.489	0.113	4.182	3.413	1.48	0.972
	(0.376)***	(0.395)	(0.356)	(0.311)	(0.405)***	(0.469)***	(0.376)***	(0.344)***
Television viewing more than 6 hours	-5.13	-0.173	0.266	0.047	4.333	3.259	2.043	1.384
	(0.394)***	(0.413)	(0.376)	(0.326)	(0.435)***	(0.499)***	(0.423)***	(0.372)***
Child time invariant characteristics	*yes*	*yes*	*yes*		*Yes*	*yes*	*yes*	
Child time varying characteristics	*yes*	*yes*	*yes*	*yes*	*Yes*	*yes*	*yes*	*yes*
Family time invariant characteristics		*yes*				*yes*		
Family time varying characteristics		*yes*	*yes*	*yes*		*yes*	*yes*	*yes*
Regional variables, year dummies	*yes*	*yes*			*Yes*	*yes*		
Observations	16461	14197	16434	17461	17086	14529	17056	18133
Groups			3229	6897			3362	7219
MSE	168.01	148.15	78.82	41.03	205.99	205.99	86.91	48.27
F-statistic	66.29	0.72	0.45	0.20	42.32	18.69	11.99	3.89
p-value	0.000	0.488	0.637	0.820	0.000	0.000	0.000	0.021

Notes: (a) Robust Standard Errors in parenthesis. (b) Standard Errors adjusted for intra-group correlations. Observations within each family constitute a group in the Family-FE and observations of each child constitute a group in the other regression. (c) *, **, and *** indicate significance levels at 10%, 5%, and 1%, respectively.

Appendix

Table A1: Description of Dependent Variables

Variables	Description
Body Mass Index (BMI)	The BMI method works differently with children and teens than it does with adults. Children's body fatness changes over the years as they grow. Also, girls and boys differ in their body fatness as they mature [Hammer et al. 1991; Pietrobelli et al. 1998]. It is, therefore, crucial that both the age and gender of the child appear as control variables in the regressions. In children and teens, the body mass index criteria used to assess underweight, at-risk-for-overweight, overweight or obesity are also age and gender specific and provided by the growth charts developed by the National Center for Health Statistics (Source: http://nhlbisupport.com/bmi/bmicalc.htm). We use these criteria to restrict our sample to rule out underweight children (about 14 percent of the sample).
Behavioral Problem Index (BPI)	Mothers of children aged four and above are asked 28 questions about their children's behavioral problems in the previous three months. These questions capture six domains of behavioral problems: antisocial behavior, anxiousness/depression, headstrongness, hyperactivity, immaturity, dependency, and peer conflict/social withdrawal. Three response categories were used: (1) often true; (2) sometimes true and (3) not true. Each question answered "often true" or "sometimes true" is given a value of one while each question answered "not true" is given a value of zero. Then, these dichotomized values were added up to construct the overall BPI.
Mathematics test scores	These are the mathematics assessments from the Peabody Individual Achievement Test (PIAT). This is administered to children aged five and over. It measures a child's attainment in mathematics as taught in mainstream education. It consists of 84 multiple choice questions of increasing difficulty and measures skills ranging from recognizing numerals to advanced concepts in geometry and trigonometry.
Reading test scores	These are the reading recognition assessments from the Peabody Individual Achievement Test (PIAT). The reading subscale also contains 84 multiple choice questions. Skills assessed include matching letters, naming names and reading single words aloud.

Source: Center for Human Resource Research [2002].

Table A2: Descriptive Statistics for Dependent and Explanatory Variables

Variable Label	N	Mean	Std	Min	Max
Child BMI	13517	18.92	4.73	0.00	62.90
Standardized reading score	13512	103.82	14.72	65.00	135.00
Standardized mathematics score	13546	100.83	13.88	65.00	135.00
Standardized BPI	13826	105.33	14.84	75.00	149.00
Average daily television viewing	14388	3.86	2.54	0.00	12.86
Television viewing between 0-2 hours	14388	0.26	0.44	0.00	1.00
Television viewing between 2-4 hours	14388	0.39	0.49	0.00	1.00
Television viewing between 4-6 hours	14388	0.19	0.40	0.00	1.00
Television viewing more than 6 hours	14388	0.16	0.37	0.00	1.00
Child age (months)	14388	122.29	30.31	32.00	216.00
Parent discusses television with the child	14388	0.81	0.39	0.00	1.00
Number of siblings	14388	2.63	1.15	0.00	9.00
Child female	14388	0.49	0.50	0.00	1.00
The child had a low birth weight	14388	0.08	0.27	0.00	1.00
Child covered by private/public insurance	14388	0.75	0.43	0.00	1.00
Child has a health condition	14388	0.12	0.32	0.00	1.00
Mother's BMI	14388	26.85	6.29	7.62	91.41
Single mother	14388	0.31	0.46	0.00	1.00
Family income ($10,000)	14388	4.55	5.99	0.00	487.57
Hours/week worked by mother	14388	25.42	20.46	0.00	100.00
Highest grade completed by mother	14388	12.72	3.34	0.00	95.00
Mother's AFQT score	14388	36.88	27.22	1.00	99.00
Highest grade completed by mother's parents	14388	11.25	3.36	0.00	20.00
Mother's race is white	14388	0.50	0.50	0.00	1.00
Mother's race is Black	14388	0.30	0.46	0.00	1.00
Mother's race is Hispanic	14388	0.17	0.38	0.00	1.00
Mother is first generation immigrant	14388	0.05	0.21	0.00	1.00
Mother is second generation immigrant	14388	0.02	0.14	0.00	1.00
Number of TV hours by mother (1981)	14388	2.45	2.48	0.00	13.85
Mother's age in 1981	14388	19.51	2.19	16.00	24.00
Rural	14388	0.17	0.38	0.00	1.00
City residence other than central city or suburb	14388	0.34	0.47	0.00	1.00
Central city residence	14388	0.17	0.38	0.00	1.00
Suburbs	14388	0.31	0.46	0.00	1.00
Regional unemployment rate	14388	5.59	1.23	3.63	8.23
Residence in the north central region	14388	0.14	0.34	0.00	1.00
Residence in the northeast region	14388	0.27	0.44	0.00	1.00
Residence in the southern region	14388	0.39	0.49	0.00	1.00
Residence in the western region	14388	0.20	0.40	0.00	1.00
Year dummy: 1990	14388	0.09	0.28	0.00	1.00
Year dummy: 1992	14388	0.18	0.38	0.00	1.00
Year dummy: 1994	14388	0.17	0.38	0.00	1.00
Year dummy: 1996	14388	0.16	0.37	0.00	1.00
Year dummy: 1998	14388	0.16	0.37	0.00	1.00
Year dummy: 2000	14388	0.12	0.32	0.00	1.00
Year dummy: 2002	14388	0.12	0.33	0.00	1.00

Table A3: OLS and Fixed Effect Estimates of Equation (1), Outcome is Body Mass Index (BMI)

	Cross-sec 1	Cross-sec 2	Family-FE	Child-FE
Average daily television viewing	0.133	0.071	0.038	0.018
	(0.018)***	(0.018)***	(0.015)**	(0.012)
Child age	0.061	0.058	0.064	0.073
	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Parent discusses television with the child	-0.295	-0.059	0.016	0.036
	(0.122)**	(0.115)	(0.100)	(0.084)
Number of siblings	-0.19	-0.242	-0.154	-0.171
	(0.044)***	(0.044)***	(0.089)*	(0.068)**
Child female	0.405	0.339	0.34	
	(0.109)***	(0.104)***	(0.116)***	
The child had a low birth weight	-0.451	-0.297	0.015	
	(0.209)**	(0.200)	(0.238)	
Child covered by private/public insurance	-0.196	0.068	0.184	0.076
	(0.119)	(0.116)	(0.103)*	(0.088)
Child has a health condition	0.606	0.379	0.14	0.11
	(0.159)***	(0.148)**	(0.131)	(0.102)
Mother's BMI		0.172	0.059	0.031
		(0.010)***	(0.017)***	(0.015)**
Single mother		0.065	0.181	0.107
		(0.121)	(0.136)	(0.107)
Family income ($10,000)		-0.017	0.001	-0.017
		(0.007)**	(0.011)	(0.009)*
Hours/week worked by mother		0.006	0.004	0.001
		(0.002)***	(0.002)*	(0.002)
Mother's highest grade completed		-0.029		
		(0.018)*		
Mother's parent's highest grade completed		-0.021		
		(0.019)		
Mother Black		0.446		
		(0.156)***		
Mother Hispanic		0.158		
		(0.185)		
Mother is first generation American		-0.041		
		(0.246)		
Mother is second generation American		0.187		
		(0.350)		
Number of TV hours by mother (1981)		0.021		
		(0.023)		
Mother's age in 1981		0.045		
		(0.026)*		
Central city residence	-0.115	-0.098	0.962	0.636
	(0.162)	(0.156)	(0.173)***	(0.132)***
City residence other than central city or suburb	0.286	0.036	1.086	0.551
	(0.186)	(0.184)	(0.213)***	(0.167)***
Suburbs	-0.1	0.054	0.6	0.442
	(0.150)	(0.141)	(0.170)***	(0.130)***
Regional unemployment rate	0.068	0.071	-0.075	0.064
	(0.115)	(0.111)	(0.030)**	(0.025)**
Residence in the northeast region	-0.049	0.049		
	(0.187)	(0.181)		
Residence in the southern region	0.473	0.294		
	(0.170)***	(0.163)*		
Residence in the western region	-0.263	-0.187		
	(0.195)	(0.186)		
Year dummy: 1992	0.0002	-0.037		
	(0.230)	(0.222)		
Year dummy: 1994	0.081	0.047		
	(0.115)	(0.115)		
Year dummy: 1996	0.185	0.177		
	(0.125)	(0.127)		
Year dummy: 1998	0.344	0.268		
	(0.192)*	(0.191)		
Year dummy: 2000	1.101	1.089		
	(0.256)***	(0.253)***		
Year dummy: 2002	1.209	1.123		
	(0.178)***	(0.182)***		
Constant	11.167	6.344	9.354	9.006
	(0.715)***	(0.924)***	(0.559)***	(0.476)***
Observations	12441	12441	14358	15210
Groups			3150	6576
MSE	16.00	14.67	6.98	2.73

Notes: (a) Robust Standard Errors in parenthesis. (b) Standard Errors adjusted for intra-group correlations. Observations within each family constitute a group in the Family-FE and observations of each child constitute a group in the other regression. (c) *, **, and *** indicate significance levels at 10%, 5%, and 1%, respectively.

Table A4: OLS and Fixed Effect Estimates of Equation (1), Outcome is Reading Test Scores

	Cross-sec 1	Cross-sec 2	Family-FE	Child-FE
Average daily television viewing	-0.728	-0.063	-0.013	-0.046
	(0.055)***	(0.058)	(0.048)	(0.038)
Parent discusses television with the child	3.685	1.193	0.119	0.012
	(0.354)***	(0.374)***	(0.309)	(0.241)
Number of siblings	-1.639	-1.182	-0.486	-0.138
	(0.144)***	(0.156)***	(0.247)**	(0.188)
Child female	2.542	2.553	2.384	
	(0.344)***	(0.347)***	(0.361)***	
The child had a low birth weight	-3.729	-2.35	-0.847	
	(0.646)***	(0.653)***	(0.826)	
Single mother		-0.745	-0.071	0.309
		(0.429)*	(0.403)	(0.326)
Family income ($10,000)		0.114	0.079	0.08
		(0.065)*	(0.036)**	(0.033)**
Hours/week worked by mother		-0.011	-0.011	-0.009
		(0.008)	(0.007)*	(0.006)
Mothers AFQT score		0.162		
		(0.010)***		
Mother's highest grade completed		0.154		
		(0.085)*		
Mother's parent's highest grade completed		0.241		
		(0.068)***		
Mother Black		-0.775		
		(0.526)		
Mother Hispanic		2.03		
		(0.610)***		
Mother is first generation American		2.191		
		(0.991)**		
Mother is second generation American		2.468		
		(1.223)**		
Number of TV hours by mother (1981)		-0.202		
		(0.076)***		
Mother's age in 1981		-0.191		
		(0.083)**		
Central city residence	0.181	-0.615	-0.927	-0.288
	(0.490)	(0.507)	(0.492)*	(0.396)
City residence other than central city or suburb	-2.167	-1.232	-1.175	-1.328
	(0.550)***	(0.579)**	(0.645)*	(0.508)***
Suburbs	0.406	-0.515	-1.127	-0.751
	(0.454)	(0.468)	(0.483)**	(0.396)*
Regional unemployment rate	-0.76	-0.644	0.058	-0.005
	(0.389)*	(0.405)	(0.095)	(0.078)
Residence in the northeast region	-3.043	-2.635		
	(0.632)***	(0.626)***		
Residence in the southern region	-3.492	-1.225		
	(0.547)***	(0.545)**		
Residence in the western region	-4.03	-2.975		
	(0.630)***	(0.651)***		
Year dummy: 1992	1.709	1.394		
	(0.779)**	(0.816)*		
Year dummy: 1994	0.86	0.008		
	(0.381)**	(0.404)		
Year dummy: 1996	1.82	0.312		
	(0.405)***	(0.426)		
Year dummy: 1998	1.634	-0.435		
	(0.639)**	(0.666)		
Year dummy: 2000	1.977	-0.442		
	(0.813)**	(0.850)		
Year dummy: 2002	3.812	1.972		
	(0.503)***	(0.547)***		
Constant	112.667	103.983	104.256	104.518
	(2.398)***	(3.114)***	(1.092)***	(0.833)***
Observations	16418	14156	16391	17412
Groups			3226	6888
MSE	199.41	176.17	81.25	35.08

Notes: Notes: (a) Robust Standard Errors in parenthesis. (b) Standard Errors adjusted for intra-group correlations. Observations within each family constitute a group in the Family-FE and observations of each child constitute a group in the other regression. (c) *, **, and *** indicate significance levels at 10%, 5%, and 1%, respectively.

Table A5: OLS and Fixed Effect Estimates of Equation (1), Outcome is Mathematics Test Scores

	Cross-sec 1	Cross-sec 2	Family-FE	Child-FE
Average daily television viewing	-0.749	-0.048	0.03	0.017
	(0.051)***	(0.052)	(0.046)	(0.041)
Parent discusses television with the child	3.888	1.193	0.27	0.052
	(0.316)***	(0.336)***	(0.292)	(0.256)
Number of siblings	-1.301	-0.722	0.084	0.155
	(0.130)***	(0.135)***	(0.228)	(0.186)
Child female	-0.599	-0.652	-0.934	
	(0.309)*	(0.302)**	(0.328)***	
The child had a low birth weight	-3.879	-2.425	-1.708	
	(0.594)***	(0.603)***	(0.779)**	
Single mother		-0.575	-0.161	-0.041
		(0.382)	(0.362)	(0.324)
Family income ($10,000)		0.104	0.033	0.003
		(0.062)*	(0.038)	(0.035)
Hours/week worked by mother		-0.002	-0.006	-0.005
		(0.007)	(0.006)	(0.006)
Mothers AFQT score		0.151		
		(0.009)***		
Mother's highest grade completed		0.196		
		(0.074)***		
Mother's parent's highest grade completed		0.273		
		(0.060)***		
Mother Black		-3.303		
		(0.457)***		
Mother Hispanic		-0.855		
		(0.533)		
Mother is first generation American		1.896		
		(0.836)**		
Mother is second generation American		1.381		
		(0.992)		
Number of TV hours by mother (1981)		-0.107		
		(0.064)*		
Mother's age in 1981		-0.205		
	(0.072)***			
Central city residence	-0.111	-0.403	0.029	0.26
	(0.432)	(0.445)	(0.447)	(0.394)
City residence other than central city or suburb	-2.053	-0.1	0.455	0.125
	(0.489)***	(0.507)	(0.561)	(0.505)
Suburbs	0.747	0.135	-0.182	-0.145
	(0.399)*	(0.408)	(0.439)	(0.391)
Regional unemployment rate	-0.807	-0.756	-0.104	-0.02
	(0.365)**	(0.376)**	(0.089)	(0.080)
Residence in the northeast region	-1.079	-1.296		
	(0.587)*	(0.561)**		
Residence in the southern region	-2.952	-0.626		
	(0.505)***	(0.488)		
Residence in the western region	-3.051	-1.861		
	(0.573)***	(0.585)***		
Year dummy: 1992	1.566	1.312		
	(0.731)**	(0.754)*		
Year dummy: 1994	1.208	0.25		
	(0.364)***	(0.378)		
Year dummy: 1996	2.452	0.873		
	(0.383)***	(0.401)**		
Year dummy: 1998	1.68	-0.623		
	(0.595)***	(0.623)		
Year dummy: 2000	2.985	0.087		
	(0.768)***	(0.795)		
Year dummy: 2002	4.608	2.421		
	(0.473)***	(0.501)***		
Constant	109.176	101.01	101.248	100.26
	(2.246)***	(2.828)***	(0.989)***	(0.840)***
Observations	16461	14197	16434	17461
Groups			3229	6897
MSE	174.21	148.13	78.82	41.03

Notes: Notes: (a) Robust Standard Errors in parenthesis. (b) Standard Errors adjusted for intra-group correlations. Observations within each family constitute a group in the Family-FE and observations of each child constitute a group in the other regression. (c) *, **, and *** indicate significance levels at 10%, 5%, and 1%, respectively.

Table A6: OLS and Fixed Effect Estimates of Equation (1), Outcome is Behavioral Problem Index (BPI)

	Cross-sec 1	Cross-sec 2	Family-FE	Child-FE
Average daily television viewing	0.664	0.443	0.29	0.189
	(0.056)***	(0.062)***	(0.053)***	(0.047)***
Parent discusses television with the child	-2.75	-1.456	-0.13	0.075
	(0.337)***	(0.373)***	(0.328)	(0.298)
Number of siblings	-0.2	-0.41	0.44	0.219
	(0.139)	(0.154)***	(0.318)	(0.254)
Child female	-2.315	-2.386	-2.447	
	(0.336)***	(0.362)***	(0.318)***	
The child had a low birth weight	1.941	1.502	-0.013	
	(0.630)***	(0.665)**	(0.646)	
Single mother		2.313	0.261	0.853
		(0.450)***	(0.430)	(0.382)**
Family income ($10,000)		-0.137	-0.02	-0.015
		(0.067)**	(0.018)	(0.016)
Hours/week worked by mother		-0.002	-0.001	0.015
		(0.008)	(0.007)	(0.007)**
Mothers AFQT score		-0.004		
		(0.010)		
Mother's highest grade completed		-0.262		
		(0.079)***		
Mother's parent's highest grade completed		-0.144		
		(0.072)**		
Mother Black		-0.638		
		(0.534)		
Mother Hispanic		-2.065		
		(0.623)***		
Mother is first generation American		-0.092		
		(0.919)		
Mother is second generation American		-0.815		
		(1.281)		
Number of TV hours by mother (1981)		0.282		
		(0.080)***		
Mother's age in 1981		-0.049		
		(0.085)		
Central city residence	0.191	0.823	-1.672	-0.724
	(0.494)	(0.539)	(0.503)***	(0.404)*
City residence other than central city or suburb	-0.124	0.379	-2.315	-0.533
	(0.544)	(0.612)	(0.644)***	(0.539)
Suburbs	-0.715	-0.094	-0.858	-0.23
	(0.458)	(0.495)	(0.476)*	(0.401)
Regional unemployment rate	0.371	0.605	0.35	0.009
	(0.391)	(0.424)	(0.095)***	(0.083)
Residence in the northeast region	0.906	0.709		
	(0.624)	(0.668)		
Residence in the southern region	1.4	1.329		
	(0.532)***	(0.580)**		
Residence in the western region	1.408	1.464		
	(0.600)**	(0.653)**		
Year dummy: 1992	0.23	0.063		
	(0.818)	(0.892)		
Year dummy: 1994	0.525	0.839		
	(0.429)	(0.468)*		
Year dummy: 1996	0.213	1.075		
	(0.435)	(0.482)**		
Year dummy: 1998	0.019	1.337		
	(0.639)	(0.700)*		
Year dummy: 2000	-3.003	-1.511		
	(0.817)***	(0.897)*		
Year dummy: 2002	-2.893	-1.599		
	(0.512)***	(0.584)***		
Constant	104.117	107.956	103.746	103.717
	(2.400)***	(3.291)***	(1.192)***	(1.002)***
Observations	17086	14529	17056	18133
Groups			3362	7219
MSE	211.95	206.32	86.89	48.26

Notes: Notes: (a) Robust Standard Errors in parenthesis. (b) Standard Errors adjusted for intra-group correlations. Observations within each family constitute a group in the Family-FE and observations of each child constitute a group in the other regression. (c) *, **, and *** indicate significance levels at 10%, 5%, and 1%, respectively.