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Partial Insurance and Investments in Children

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Partial Insurance and Investments in Children

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Abstract

This paper studies the impact of permanent and transitory shocks to income on parental investments in children. We use panel data on family income, and an index of investments in children in time and goods, from the Children of the National Longitudinal Survey of Youth. Consistent with the literature focusing on non-durable expenditure, we find that there is only partial insurance of parental investments against permanent income shocks, and we cannot reject the hypothesis full insurance against temporary shocks. Nevertheless, the magnitude of the estimated responses is small. A permanent shock corresponding to 10% of family income leads, at most, to an increase in investments of 1.3% of a standard deviation.

JEL Codes: D12, D91, I30.

Key words: Insurance, human capital, consumption.

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1 Introduction

According to the National Center for Children in Poverty at Columbia University, 15 million children in the United States live in families with incomes below the federal poverty line. This means that more than one in every five children is poor. In the United Kingdom, the Office of National Statistics puts the number of children in poverty at 2.3 million (or 18% of all children). Child poverty at the center of the debate about social policy, and the main reason is that growing up in poverty is strongly associated with future disadvantage.

For many families poverty is not a permanent condition, and we need to distinguish episodic from the much more severe permanent poverty (e.g., Brooks-Gunn and Duncan, 1997). For those experiencing permanent poverty the question is how to address the structural problems behind their permanent condition. But for those going in and out of poverty, the question is how well can they insure against fluctuations in in come. This is especially important because the timing of investments in children could be as important as the total amount invested (e.g., Brooks-Gunn and Duncan, 1997, Cunha, Heckman and Schennach, 2010, Carneiro, Lopez, Salvanes and Tominey, 2012).

Our paper measures the reaction of parental investments in children in time and goods to permanent and transitory income shocks. We use panel data on family income and measures of investments in children from the Children of the National Longitudinal Survey of Youth (CNLSY). We find that there is only partial insurance of investments against permanent income shocks, and we cannot reject the hypothesis full insurance against temporary shocks. However, the magnitude of the response to permanent shocks is quite small. A permanent shock corresponding to 10% of income leads to an increase in parental investments by (at most) 1.3% of a standard deviation of the distribution of parental investments. Therefore, in terms of parental investments in children, families in the US are not far from full insurance.

The role of partial insurance in explaining the relationship between consumption and income inequality is well studied in the literature.[1] However, the addition of parental investments in children to the standard life-cycle model poses new challenges, because investment decisions have important dynamic implications. Forward-looking parents anticipate the effects of current and future spending in time and money on their children's adult behaviors and human capital. Childhood experiences accumulate over the life cycle and evolve into skills, work habits, or engagement in risky behaviors when individuals reach adulthood.

[1]The hypothesis of complete markets (that consumption is insured against both permanent and transitory shocks) has been rejected for U.S. data (see Attanasio and Davis, 1996, and Hayashi, Altonji and Kotlikoff, 1996). Cochrance, 1991, presents mixed evidence on the rejection of full insurance hypothesis. The permanent income hypothesis assumes that savings are the sole mechanism for income smoothing, thus these can be used to smooth transitory, but not permanent income shocks (Deaton, 1992). More recently, Blundell, Pistaferri and Preston, 2008, uncover the degree of insurance in the U.S. against income shocks of different degree of persistency and they find imperfect insurance against permanent shocks and full insurance of transitory shocks, except among poor households.

Therefore the relevant framework to study this question should have features of a life-cycle model of consumption with nonseparability of utility over time, such as in models with habit persistence and durable goods.[2] Investments which are complements over time have characteristics of habit persistence. Investments which are substitutes have characteristics of durable goods (e.g., Hayashi, 1985, Heaton, 1993, Attanasio, 1999).

Our paper is related to the literature studying consumption responses to income shocks (e.g., Cochrane, 1991, Mace, 1991, Hayashi et al., 1996, Blundell, Pistaferri and Preston, 2008, Heathcote et al, 2009, Kaplan and Violante, 2009, among others). Consistent with that literature, we find some but not perfect insurance against income shocks (in particular, permanent shocks).

Beyond that, we also relate to the large literature assessing the impact of income on home environments and child development (e.g., see the reviews in Duncan and Brooks-Gunn, 1997 and Carneiro and Heckman, 2003; see also the recent work by Yeung, Livers and Brooks-Gunn, 2002, Dahl and Lochner, 2012, and Carneiro, Garcia, Salvanes and Tominey, 2012). Several papers in this literature do not find effects of family income on child outcomes (e.g., Mayer, 1997), although this is not true of more recent papers (e.g., Dahl and Lochner, 2012). Relatively to that literature, we pay special attention to investments in children, and decompose income shocks into permanent and transitory components (see also Carneiro, Salvanes and Tominey, 2010).

Another strain of the literature to which we relate investigates the response of parents to public investments in children. While we study parental responses to income shocks, these other authors study parental responses to shocks to public investments. Some recent examples are Das et al. (2011) and Gelber and Isen (2012). One important addition relatively to what we study in this paper is that public investments are an input to human capital formation which is external to the family, and which can be a substitute or a complement to parental investments.

Ferreira and Schady (2009) review the large empirical literature on the effects aggregate shocks on child human capital, and potential mechanisms mediating the results in that literature. They show that, in the United States, child health and education outcomes are counter-cyclical (improving during recessions), but in poorer countries, these outcomes are pro-cyclical (with infant mortality rising, and school enrollment and nutrition falling during recessions). Their idea is that a recession is associated to an income and a substitution effects. The income effect associated with the reduction in resources works toward a deterioration of outcomes (through less child schooling and higher infant mortality). The substitution effect is associated with the decrease in relative wage, that is the opportunity cost of time spent in school (for children) or in health-promoting activities (for parents), and this could work in the opposite direction resulting in improved education and health status. They explain the findings in literature by the

[2]Becker and Murphy, 1988, analyze a model for addictive behavior to rationalize the consumption of substances. In their model, as in the context of skill formation, there is a large effect of past consumption of the good on current consumption.

competing income and price effects, with (broadly) the income effect associated with pro-cyclical child outcomes dominating in poorer economies.[3]

Finally, there is a very large literature on investments in children and child development, too long to mention here. Especially relevant to us are recent papers emphasizing the dynamic nature of the process of skill formation, and the importance of the timing of investments in children (e.g., Carneiro and Heckman, 2003, Cunha, Heckman and Schennach, 2010, Caucutt and Lochner, 2012, Carneiro, Garcia, Salvanes and Tominey, 2012).

This paper is, to the best of our knowledge, the first attempt to estimating how parental investments in children respond to income shocks, using data on changes in income, and changes in an index of goods and time dedicated to children. Possible insurance mechanisms are financial markets, social and family networks, labor supply, and welfare transfers[4]. Therefore, our analysis can potentially inform the design of the welfare system.

We start by documenting associations in the raw data between changes in income, and changes in indices of expenditure and time with children. We show that, in the whole sample, fluctuations in income are not strongly associated with fluctuations in investments in children. However, changes in income are positively related to changes in investments in children for i) families with young children (aged 0-9 years of age) and for ii) non-black families (white or hispanic). We then decompose income shocks into permanent and transitory components, and examine their impact on parental investments, using the empirical framework of Blundell, Pistaferri and Preston (2008).

We find that the association between changes in income and changes in investments observed for the families mentioned in the previous paragraph are driven by the reaction of these investments to permanent shocks. However, the magnitude of the estimated responses is quite small, indicating that families are not far from being able to fully insure parental investments against permanent shocks. In addition, we cannot reject that investments in children are fully insured against temporary shocks to income.

This paper proceeds as follows. In the next section we present the simple theoretical framework that guides our thinking on the topic. Then we present our empirical strategy, and describe our data. Finally, we discuss our empirical results and conclude.

[3]Concerning the US, both Chay and Greenstone, 2003, and Dehejia and Lleras-Muney, 2004, find countercyclical patterns in infant mortality, with more babies dying during economic expansions. Chay and Greenstone, 2003, show that pollution falls during recessions and using variation over time and across counties in pollution levels, they show that lower pollution levels result in fewer infant deaths. Dehejia and Lleras-Muney, 2004, use state-level data to show a decrease in the incidence of low and very low birth-weight babies and in infant mortality during recessions.

[4]Literature has shown that families may resort on several mechanisms of insurance: by changing the timing of durable purchases (Browning and Crossley 2003), government public policy programs, such as unemployment insurance (Engen and Gruber 2001), Medicaid (Gruber and Yelowitz 1999), AFDC (Gruber 2000), and food stamps (Blundell and Pistaferri 2003). Recent work by Blundell, Preston and Pistaferri (2008) present evidence on the role of welfare transfers and assets; Blundell, Pistaferri and Saporta-Eksten (2012) focus on family labor supply.

2 Theoretical Framework

As a benchmark, consider the standard life-cycle model of consumption and savings, where consumers have access to a single risk-free bond. The individual's problem is:

$$\begin{aligned} V^t(A_t) &= \max_{c_t, A_{t+1}} u(c_t) + \beta E_t V^{t+1}(A_{t+1}) \\ & s.t. \\ A_{t+1} &= (1+r_t)[A_t + y_t - c_t] \end{aligned} \tag{1}$$

where c_t is consumption in period t, A_t is assets, y_t is income, and r_t is the interest rate.

Log income, y, can be decomposed into a permanent component, p, and a transitory shock, v (assuming for the time being that income is measured without error):

$$y_{it} = p_{it} + v_{it} \tag{2}$$

Throughout the paper we assume that the permanent component p_{it} follows a martingale process of the form

$$p_{it} = p_{it-1} + \eta_{it} \tag{3}$$

where η_{it} is serially uncorrelated, and the transitory component v_{it} follows an $MA(q)$ process, where the order q is to be established empirically:

$$v_{it} = \sum_{j=0}^{q} \theta_j \varepsilon_{it-j} \tag{4}$$

with $\theta_0 = 1$. It follows that (unexplained) income growth is

$$\Delta y_{it} = \eta_{it} + \Delta v_{it} \tag{5}$$

The Euler equation for this model is:

$$E_t \left\{ \frac{\beta(1+r_{t+1}) u_c(c_{t+1})}{u_c(c_t)} \right\} = 1 \tag{6}$$

Although in general one cannot obtain analytical expressions for the solution to this problem, Blundell, Pistaferri and Preston (2008) show how to derive the following approximations:

$$\Delta c_{it} = \phi_{it}\eta_{it} + \psi_{it}\varepsilon_{it} + \xi_{it} \tag{7}$$

where ξ_{it} could be, for example, measurement error or preference shocks. They proceed by jointly estimating the parameters of equations (5) and (7). Of particular interest are ϕ and ψ, which

measure the degree of insurance of consumption to permanent and temporary shocks to income. This framework is extended to include labor supply in Blundell, Pistaferri and Saporta-Eksten (2012). In contrast, Kaplan and Violante (2009) solve the model numerically.

Consider now an extension to the model in equation (1) where each individual has a child and chooses how to allocate income between consumption, savings, and investments in the human capital of her children. Let h_t be the stock of the child's human capital at time t, g_t be investments in children, and q_t be the price of investments. Then one can write the decision problem of the individual as:

$$\begin{aligned} V^t(A_t, h_{t-1}) &= \max_{\substack{c_t, g_t, A_{t+1} \\ s.t.}} u(c_t, h_t) + \beta E_t V^{t+1}(A_{t+1}, h_t) \\ A_{t+1} &= (1+r_t)[A_t + y_t - c_t - q_t g_t] \\ h_t &= f(g_t, h_{t-1}) \end{aligned} \tag{8}$$

where $f(.)$ is the production function of skill (which is assumed to depend only on g_t and h_{t-1}, although this assumption could be relaxed).[5] In this specification h_t is allowed to directly affect utility at time t, as well as future utility through the production of future human capital (which again could directly affect the utility of parents in each period, or affect it only in the terminal period after the child becomes an adult and leaves the household).

After some manipulations and simplifying assumptions (see Appendix A) one can write the Euler equation for this problem as:

$$E_t \left\{ \frac{\beta(1+r_{t+1}) u_h(h_{t+1}) \frac{\partial h_{t+1}}{\partial g_{t+1}}}{u_h(h_t) \frac{\partial h_t}{\partial g_t}} \right\} = 1. \tag{9}$$

Although this equation looks remarkably similar to equation (6), notice that while c_t is a flow, h_t is a stock which reflects the history of all past investments in human capital. In that sense it is as if we had a commodity (g) for which utility is not time separable. Hayashi (1985) first derived equation (9) for a life-cycle model with durable consumption.

Because of intertemporal non-separabilities it is no longer possible to derive the same approximation to the solution of this problem as the one in equation (7). Nevertheless, this equation still provides a useful empirical framework for examining the data.

Notice however that equation (9) indicates that the change in consumption should depend not only on current permanent and temporary shocks to income, but on the whole history of these shocks (so in principle we would expect lagged permanent and temporary shocks to income to appear in this equation). Again, this is well known from the literature examining the life-cycle

[5] In principle the production function at time t could depend on the whole history of investments (and shocks to the technology) up to that period.

model with non-separabilities (e.g., Hayashi, 1985, Meghir and Weber, 1995). We come back to this point below.

3 Empirical Model

We assume that income has a permanent-transitory representation, as in equations (2)-(5). We change equation (2) slightly to include a deterministic component, and we take the relevant time dimension in the model to be the age of the child (a) instead of calendar time (t):

$$Y_{ia} = Z_{ia}\mu_a + p_{ia} + v_{ia} \tag{10}$$

where Y_{ia} is real log family income at age a, and Z_{ia} is the set of observable income characteristics observable and known to families. These characteristics include demographic, education, ethnic, and other variables (see Section 5). We allow the effect of such characteristics to change with the age of the child, and we also allow for cohort effects for mothers. We regress Y_{ia} on Z_{ia}, and define $y_{ia} = Y_{ia} - Z_{ia}\mu_a$ as the log of real income net of predictable individual components. Similarly, let G_{ia} be an index of parental investments in children. We regress G_{ia} in Z_{ia}, take the residuals, and we call them g_{ia}. We focus on y_{ia} and g_{ia} in the rest of our analysis.

The first important equation of our empirical model is equation (5), which we rewrite here:

$$\Delta y_{ia} = \eta_{ia} + \Delta v_{ia}.$$

Then, we include an additional equation (analogous to equation (7)) describing how investments in children (g_t) react to income shocks.

$$\Delta g_{ia} = \phi\eta_{ia} + \psi\varepsilon_{ia} + \xi_a \tag{11}$$

ϕ and ψ measure how much parental investments in children react to permanent and transitory shocks to income.

From the model given by equations (5) and (11), we want to identify the insurance parameters (ϕ, ψ, and the variances of all shocks: σ_η, σ_ε and σ_ξ), which are assumed to have mean zero. The identification of these parameters follows Blundell, Pistaferri and Preston (2008) and Blundell, Pistaferri and Saporta-Eksten (2012), and it is discussed in Appendix B.[6]

However, equation (11) is likely to be misspecified. As mentioned in section 2, changes in parental investments at each point in time should depend not only on the shock that the family faces in that moment, but on the whole history of shocks. This is because the process of skill

[6] We model the transitory component as an i.i.d. component, but this choice is justified by empirically studying the matrix of autocovariances of growth in residual income in our sample. These results are available from the authors.

formation implies that the objective function of the agent exhibits intertemporal non-separability in investments in children.

Therefore, in addition to equation (11), we also estimate:

$$\Delta^2 g_a = \phi^0 \eta_a + \psi^0 \varepsilon_a + \phi^1 \eta_{a-1} + \psi^1 \varepsilon_{a-1} + \phi^2 \eta_{a-2} + \psi^2 \varepsilon_{a-2} + ... \tag{12}$$

Identification of the model given by equations (5) and (12) is discussed in Appendix B. In practice, we limit ourselves to two lags of each type of shock.

Our empirical strategy can be summarized as follows. First, we construct the differences for Δy_{ia} and Δg_{ia} after regressing them on a of observable characteristics. Second, we estimate the variances for the permanent and transitory income shocks and parameters ϕ and ψ. We use a GMM strategy, in particular, we use diagonally weighted minimum distance, but we obtain similar results if we use an identity matrix as weighting matrix.[7]

4 Data

The data used in our analysis comes from female respondents in the National Longitudinal Survey of the Youth of 1979 (NLSY79) and their children, the Children of the National Longitudinal Survey of Youth of 1979 (CNLSY), for the period 1986-2008. The NLSY79 is a panel of individuals whose age was between 14 and 21 by December 31, 1978 (of whom approximately 50 percent are women). The survey has been carried out annually since 1979 and interviews have become biannual after 1994. The CNLSY is a biannual survey which began in 1986 and contains information about cognitive, social and behavioral development of individuals (assembled through a battery of age specific instruments), from birth to early adulthood. The original NLSY79 comprises three subsamples (1) a representative sample of the US population, (2) an oversample of civilian Hispanic, black, and economically disadvantaged non-black/non-Hispanic youth, and (3) a subsample of respondents enlisted in one of the four branches of the military (which is not included in the analysis).

The CNLSY is the best dataset to study how changes in parental inputs react to fluctuations in family income. The information in the data includes demographic characteristics, education and labor market information for parents of a child, together with information on home environments, and children's education, health, cognitive and behavioral outcomes.

Our main measure of income is disposable family income. In particular, the NLSY79 reports many components of family income, including (1) respondent and her spouse's wages, commissions, or tips from all jobs, income from farm and non-farm business or income from military

[7]Empirically in our minimum distance estimation the longest panel we can construct includes children present in eight consecutive surveys (ie, to whom we can construct seven second differences). This is because parenting information is collected for children 0-14.

services received in past calendar year (before taxes and other deductions; annual measure); (2) transfers from the government through programs such as unemployment compensation, AFDC payments, Food Stamps, SSI, and other welfare payments, (3) transfers from non-government sources such as child support, alimony, and parental payments, (4) income from other sources such as scholarships, V.A. benefits, interest, dividends, and rent. We, then, obtain the family's disposable income by adding these four groups of income sources and subtracting federal income taxes. To impute each family's federal tax payments we use the TAXSIM program (version 9a) maintained by the NBER (see Feenberg and Coutts (1993) and `http://www.nber.org/taxsim`).[8]

In our analysis, we focus on measures of parental inputs, which in the CNLSY are gathered under the HOME - Home Observation Measurement of the Environment (Short Form). These set of measures are used to assess the cognitive stimulation children receive through their home environment and are applied between ages 0 and 14. Table 1 includes the measures of parental inputs used throughout the paper. Notice that not all components are surveyed at every age of the child, and due to the sample restrictions and to the CNLSY's biannual nature, each child has these measures collected at most 8 times. Our main outcome variable is the HOME score, however, in Appendix D we also present results with the individual items included in table 1. Finally, a few of the items in this table are not part of the HOME score, and these have the letters (**NH** - "not part of HOME score") in front of their description, but we also used them as outcome since they represent parent-child interactions.[9]

To ensure that the same sample is used throughout the paper, a number of selection criteria are imposed. Out of the 11495 children data we exclude 180 children (and their families) to without any information on the area (county) of residence. We drop some income outliers, that is, we drop 1582 children that faced throughout their sampling period an income growth above 500 percent, below -100 percent. We further drop 1124 children to whom a HOME score was never constructed, and to whom it was not collected information on family income in any two consecutive surveys (we impose this data restriction because we will construct below differenced measures of income). Finally, we drop 804 children without information in important control variables (mother's AFQT and maternal grandmother's education). We are then left with a final sample of 7805 children who are observed at least twice (of these 3960 are boys).

We now turn to clarify the exact timing of family income (which is recorded by the NLSY79) and parental inputs measures (obtained from the CNLSY). Individuals are asked about their income in the year prior to the survey. Income measures collected in year t refer to year $t-1$. The timing of parental inputs, measured by the HOME score, is less clear. Some of the components

[8] All monetary values are deflated to 2000 US dollars, using CPI-U (see Economic Report of the President, 2009). See Appendix C for further details on construction of income data.

[9] In the data, the total raw score for the HOME is simply a summation of the individual item scores, which varies by age group, as the number of individual items varies according to the age of the child. Then, the scores were standardized by age, having a mean of 100 and a standard deviation of 15. In practice, we used these values to normalize the HOME to have mean 0 and standard deviation 1 per each age.

of the home refer to the year prior to the survey (for example, "how often was child taken to museum last year?", "how often was child taken to any performance last year?"), and some refer instead to behaviors in which the household engages frequently (for example, "about how many magazines does your family get regularly?", and "does child get special lessons/extracurricular activities?"). Under the assumption that these frequent behaviors are also there the year prior to each survey round, we can say that the HOME score collected at time t concerns parental investments at time $t-1$. The consistency of timing of investments and income is important given the assumptions on family's information set to ensure that the identification strategy is valid.

4.1 Descriptive Statistics

Table 2 shows mean and standard deviations for the variables used in our analysis. The table includes three panels. The first includes our main measure of parental inputs; the second panel includes characteristics of children which we use as controls in our specification (gender, race, age of child, age of mother at child's birth and number of siblings in each period). Finally, the third panel includes characteristics of family, some of which are related to the mother's background (such has maternal education, ability (AFQT - Armed Forces Qualification Test), whether mother lived with both parents ar age 14, education of maternal grandparents), others related to characteristics that vary over time, as mother marital status, number of children, family size, disposable income, residence in a big city, mother's (and her spouse, if present in household) labor market participation, presence of other income recipients other than mother and her spouse and indicator for whether the family receives welfare income.

The table includes three columns (number of observations, mean and standard deviation). The average HOME score for the children present our sample is -0.21, which is below the sample mean of 0, about half of sample are boys, 1/3 are Black and 19% are Hispanic children. The low mean of the HOME score and the high proportion of Black and Hispanic children in our sample is due the oversample of disadvantaged individuals in the NLSY79[10] Mothers of children were around 25 years old at birth, and the mean of child in our sample is 7.5 years old. Most children in data have 2 or more siblings.

[10]Note that about half of the children in the sample used in the analysis are part of the over-sample of Hispanic, Black, and economically disadvantaged white.

5 Empirical Results

5.1 OLS estimates

Before we estimate the models laid out in section 3, we start with a basic look at the raw data. This is useful because, with very few exceptions, the relationship between income fluctuations and investments in children has not been studied in the literature.

In particular, we examine associations between changes in income and changes in investments in children, measured by the HOME score, by estimating the following equation:

$$G_{ia} = \gamma Y_{ia} + Z_{ia}\beta + \alpha_i + \varepsilon_{ia} \tag{13}$$

Z_{ia} is a vector of controls for child i at age a, α_i is an individual fixed effect, and ε_{ia} is the residual which is independent of everything else in the model. The vector Z_{ia} includes the following variables: year fixed effects, maternal characteristics (year of birth, education, race, highest grade completed of mother's mother and father and maternal AFQT[11]), dummies for age of child, family size, current region of residence, an indicator for whether the family lives in a big city, mother marital status, indicators number of children for the number of sibling the child has and for the total number of children in family. We include interactions of the following variables with year effects: child's race, region of residence, residence in big city, maternal AFQT, and education of maternal grandmother and grandfather. Y_{ia} is log disposable family income for individual i at age a, as defined in section 4. G_{ia} is the HOME score. γ measures the association between changes in log income and changes in parental investments in children.

The results are presented in table 3. We start by presenting results for the whole sample in column 1. In the remaining columns of the table we divide the sample into groups according to four criteria: i) whether the child is 0-9, or whether the child is 6-15 (columns 2 and 3);[12] ii) whether the child is Black or non-Black, in which case she is either white or Hispanic (columns 4 and 5); iii) whether the mother attended college or whether she does not (columns 6 and 7); iv) whether the child is a boy or a girl (columns 8 and 9).

Column 1 shows that, for the whole sample, we cannot reject the hypothesis that $\gamma = 0$. In fact, we present many ways of cutting the sample, and with one exception we cannot reject that the coefficient is equal to zero. This exception is in column 5 (for non-Blacks), where the coefficients on Y_{ia} is statistically different from zero. These results suggest that these parents may be close to fully insured to income shocks.

[11] These variables are subsumed by the child fixed effect, thus we include them interacted with year effects (with the exception of mother's year of birth).

[12] Notice that the two age groups are overlapping. The reason is that to identify the model of section 3 one needs four income and investment differences per child, which means five observations per child, and the only way to do this with our measures is with this division of the data.

These results are interesting because they show patterns which can be observed with a very minimal treatment of the data. Since we cannot reject the hypothesis that $\gamma = 0$ for some of most of the subsamples we examine, when we implement the model of section 3 we do not expect ϕ and ψ in equation (11) to be different from zero in those same subsamples (although the estimates in columns 2, 4, 6 and 8 have fairly large standard errors). However, since we can reject that $\gamma = 0$ in at least one column of table 3, we expect that when we implement the model with permanent and transitory shocks in this subsample either ϕ or ψ (or both) should be different from zero.[13]

In table 4 we show what happens to the results we just presented when we add lagged income as well as current income to the model, as suggested in section 2. The results in this table show that when we consider the cumulative effect of shocks in current period and in the two previous periods, the effects of income changes in three consecutive periods are associated to significative changes to parental inputs for whole sample (which holds when the sample is divided by children's age), and for the following subgroups: non-Black families, among children whose mother has completed at most high school and girls. The size of the cumulative effect, although statistically significant, it is fairly small and it ranges between 5.6% of a standard deviation (among non-Blacks) and 7%SD among girls.

5.2 Permanent and Transitory Shocks

We then proceed to estimate the model laid out in section 3, which is the main task of this paper. The first step is to construct Δy_{ai} (and Δg_{ai}) by taking (respectively) the residuals of a regression of Y_{ai} (G_{ai}) on Z_i, as explained above.

Once we have Δy_{ai} and Δg_{ai}, we can jointly estimate equations (5) and (11). We report estimates of the variances of each shocks (η_a, ε_a, ξ_a), as well as the insurance coefficients (ϕ, ψ). For estimation purposes, we assume that the variances of the shocks do not vary with the child's age, although this assumption could be relaxed. We also try to estimate a model where we include lagged permanent and transitory shocks, as in equation (12).

Recall that the data is biannual and Δy_{ai} and Δg_{ai} are effectively second differences, since parental inputs and income are only observed jointly every other year. Therefore, the original procedure of Blundell, Pistaferri and Preston (2008) is be slightly adapted (see Appendix B and Blundell, Pistaferri and Saporta-Eksten, 2012).[14]

[13] Table D.1 includes estimates for model 13 for the two subscores of the HOME (Congnitive Stimulation and Emotional Support) and for its individual components. Out of the 29 components included in the table, we can only reject the null of no effect of income changes for seven items: on whether the family receives daily newspaper, whether the child gets special lessons/extracurricular activities, whether the mother reads at least 3 times a week to the child (the coefficient on log income is negative in this case), whether the child see father(-figure) daily, whether the child eats with both parents at least once a day, whether the child gets out of the house several times a month and if she is encourage to clean her room.

[14] In empirical application we consider not only unobserved heterogeneity in parental inputs, ξ_a, but also measurement error, which Blundell, Pistaferri and Preston (2008) show it is identified by the covariance between

Our main results are presented in table 5. Again there are several columns, depending on whether we are using the whole sample or just one of the subsample. The structure of the columns is exactly the same as in table 3. However, here we report many more parameters.

The first two rows show estimates of the variances of the permanent shock and transitory shock to income. Across columns, we see that the variances of both the permanent component and the transitory shock are fairly stable across specifications. As shown in columns 2 and 3, our assumption that the variance of these variables does not vary with age seems to be quite reasonable. Notice also that the transitory component has a much higher variance than the permanent component of income, which is consistent with what is reported by Blundell, Pistaferri and Preston (2008), who use the PSID. The estimates presented in their paper range between 0.02,0.03 and 0.03,0.05 for the permanent and transitory shocks, respectively; we estimate variances for permanent and transitory shocks of 0.09 and 0.25, respectively. This could be to our sample selection, which unlike Blundell, Pistaferri and Preston (2008), does not restrict the study to families of continuously married mothers. Instead, we control for mother marital status, since our interest is not to model marriage decision.[15]

The second panel shows the insurance coefficients. These coefficients are not very precisely estimate. Nevertheless, we can see that these coefficients are clearly different from zero in columns 2, 5, and 7, but we cannot reject that they are zero in the remaining columns of the table. The coefficients on the transitory shocks are also not statistically different from zero but, in this case, their magnitude is also quite small. This means that, as in Blundell, Pistaferri and Preston (2008), there is partial insurance of expenditures in children against permanent shocks, but we cannot reject that there is full insurance against temporary shocks.

Notice however that even in columns 2, 5, and 7, where we can reject that $\phi = 0$, the magnitudes of ϕ are relatively small: 0.118 for the sample with children ages 0 to 8, 0.088 for the sample of non-Black children, and 0.133 for the sample of children of college mothers. What this means is that, at most, a positive permanent shock corresponding to a 10% increase in income (or an increase in log income of 0.1), leads to an 0.013 standard deviations increase in the HOME score. Therefore, even though these families cannot insure investments in children perfectly against income shocks, there is a very small response of investments to permanent shocks. In other words, the magnitude of the partial insurance problem is relatively unimportant.

When we experiment with lagged shocks, in table 6, once again, the results are too imprecise to be conclusive.

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growth in inputs in periods t and $t-1$. See Appendix B for details.

[15] When we estimate the variances of permanent and transitory shocks imposing sample restrictions closer to Blundell, Pistaferri and Preston (2008) we obtain the following variances: 0.036 (0.024) and 0.053 (0.018) for the permanent and transitory shocks, respectively (standard errors in parenthesis). To estimate these variances we use just the males from the NLSY79 who are continuously married between 1985 and 2008 and drop those with an income growth above 500 percent, below -100 percent (they use -80 percent), or with a level of income below $50 in a given year.

In summary, our estimates show that parents are able to insure investments in their children only partially against permanent shocks to their income, which is consistent with what was found before in the literature for non-durable consumption. Notice that this did not have to happen since investments in children are not likely to enter the objective function of parents in a time-separable way, because we expect the technology to exhibit non-separabilities. As pointed out in many papers, such as for example Hayashi (1985), intertemporal non-separabilities can lead to very low responses of consumption to income shocks. This may in fact be an alternative explanation (to that of full insurance) to what we observe: small or no responses of HOME to either permanent or temporary shocks to income.

6 Conclusion

This paper presents the first estimates of the response of parental investments in children to permanent and transitory shocks to income. We find that investments react to fluctuations in family income. This is true whether we look at the raw data in a simple way, with a fixed effect regressions, or if we decompose income fluctuations in permanent and transitory components. This decomposition allows us to learn that investments in children react to the permanent but not to the transitory component of family income, especially when the child is younger than 9 years of age, in non-Black families, and in families where the mother attended at least some college.

Although the literature measuring the impact of income on child development is still controversial (e.g., Mayer, 1997, Dahl and Lochner, 2012), our results suggest that, if income fluctuations affect child outcomes, it is possibly through the reaction of parents to permanent income shocks.

It is important to insure families against these income fluctuations. The case for public insurance is perhaps stronger here than in the standard literature looking at overall household consumption, because investments in children can have long term negative (and potentially irreversible) consequences.

That said, although we find that insurance is less than perfect, the magnitude of the response of investments in children to income shocks is very small. In practice, insurance is close to perfect. The main differences between the outcomes of poor and non-poor children is likely to come almost exclusively from the permanent factors affecting the lives of the poor, not because of fluctuations in income over time. This is consistent with Carneiro, Garcia, Salvanes and Tominey (2012) who find that, although the adult outcomes of children are affected by the timing of income shocks, these effects are very small when compared to the role of permanent income.

There is, however, still a tremendous amount of work to do in this research area. Our paper is quite simple because it gives us a first approach to this problem, and nevertheless produced very

interesting and novel results. What we did here was just to mainly borrow the methodology used for the study of non-durable consumption (Blundell, Preston and Pistaferri, 2008). We tried to extend it by adding lagged income shocks but the results were imprecise.

What is required is a better study of the theory laid out in section 2, possibly even with the inclusion of time explicitly in the model, and how it maps (if it maps at all) to the sort of equations we are estimating in this paper. A whole other set of issues regard the measurement of investments in children, and the distinction between time and money investments. Finally, we need a better study of dynamics, the role of the timing of different types of shocks, and the possible interactions between shocks taking place in different time periods.

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Tables

Table 1: Measures of quality of home environment.

Available at ages	0-2	3-5	6-9	10-14
(NH) Private school/care	x	x	x	x
Child has 10+ role-playing toys	x			
Child has 10+ push or pull toys	x			
Child taken at least once/week to grocery	x			
Child gets out of house at least several times a month	x	x		
The TV is on less than five hs/day on the home	x	x		
Child has more than 10 books	x	x	x	x
Child eats at least one meal a day with both parents	x	x	x	x
Child sees the father(-figure) daily.	x	x	x	x
Mother reads to the child at least once a week	x	x	x	
Family gets at least 3 magazines		x		
Child has a CD player		x		
Mother helps child learning numbers		x		
Mother helps child learning alphabet		x		
Mother helps child learning colors		x		
Mother helps child learning shapes		x		
Child was taken at least 3 times to museum		x	x	x
Child spends time with father/father-figure at least once a week	x	x		
Family receives the daily newspaper?			x	x
Family encourages hobbies?			x	x
Extracurricular activities			x	x
Is there a musical instrument that child can use at home?			x	x
Family gets together with friends/relatives once a week			x	x
Child is encouraged to make her own bed			x	x
Child encouraged to clean room			x	x
Child is encouraged (almost always) to keep living areas clean				x
Child spends time with his/her father/father-figure in outdoor activities once a week			x	x
When family watches TV, mother discusses programs with child			x	x
(NH) shopping for child at least once a month				x
(NH) Child and parents go on outings together				x
(NH) Child usually works with mother on schoolwork every week				x
(NH) Child usually goes usually to movies with parents once a month				x
(NH) Child usually goes for dinner out with parents once a month				x
(NH) Child usually does things together with parents				x

Table 2: Sample Characteristics for Children, Their Mothers, and Their Families.

	(1)	(2)	(3)
Variable	Obs	Mean	Std. Dev.
Parental Inputs			
HOME score	38673	-0.21	1.06
Child Characteristics			
Male	7805	0.51	0.50
Black	7805	0.31	0.46
Hispanic	7805	0.19	0.40
Mother's age at child's birth	7805	25.30	5.89
Age of child	38673	7.57	3.98
No siblings	38673	0.09	0.29
One sibling	38673	0.37	0.48
2 or more siblings	38673	0.54	0.50
Family Characteristics			
Mother has HS degree at 22	3395	0.78	0.41
Mothers AFQT score	3433	37.14	27.07
Mother lived with both natural parents at age 14	3428	0.66	0.47
Highest grade completed by mothers mother	3433	10.57	3.12
Highest grade completed by mothers father	2981	10.51	3.90
Mother married last year	38673	0.63	0.48
Number of children	37699	2.55	1.16
Family Size	38673	4.40	1.47
Family net income	38673	42076.80	35571.25
Live in big city	38673	0.40	0.49
Mother worked last year	38673	0.73	0.44
Mother's spouse/partner worked last year	26264	0.98	0.13
Income recipients other than mother and (step-) father	38673	0.20	0.40
Receive welfare income	38277	0.24	0.43

Note: Unit of observation is a child whenever we present characteristics invariant within children (e.g., her gender), it is the mother whenever we present mother invariant characteristics (e.g., indicator for whether mother lived with both natural parents at age 14) and it is child-year for time variant characteristics. The sample is restricted to children ages 0 to 14 and to observations used in our analysis (see section 4 for the restrictions imposed in the sample). Children must have at least two years of valid observations to be included.

Table 3: OLS Estimates of the Effect of Family Income on Parental Inputs: Current Income.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Samples	All	Age 0-9	Age 6-15	Black	Non-Black	HS/Dropout	College	Boys	Girls
$\ln Y_t$	0.0074	0.0150	0.0051	-0.0120	0.0175*	0.0040	0.0078	-0.0004	0.0168
	[0.0084]	[0.0122]	[0.0111]	[0.0178]	[0.0095]	[0.0121]	[0.0114]	[0.0122]	[0.0115]
Observations	32,714	21,093	21,609	8,802	23,912	13,107	19,607	16,636	16,078
R-squared	0.6215	0.6698	0.7134	0.5870	0.6009	0.5916	0.6108	0.6249	0.6223
Mean	-0.139	-0.154	-0.131	-0.616	0.0362	0.162	-0.341	-0.190	-0.0868
SD	1.039	1.050	1.030	1.096	0.960	0.921	1.065	1.053	1.022

Note: The table presents OLS regression of parental inputs on family disposable income. The controls included in regressions and not presented in the table include the following: a set of observable family time varying characteristics (family size, current region of residence, an indicator for whether the family lives in a big city, mother marital status, indicators number of children for the number of sibling the child has and for the total number of children in family). We include interactions of the following variables with year effects: child's race, region of residence, residence in big city, maternal AFQT, and education of maternal grandmother and grandfather. We include the following fixed effects: year, age of the child, and child fixed effect. The unit of observation is child-year.

The standard errors are clustered by child. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 4: OLS Estimates of the Effect of Family Income on Parental Inputs: Current and Lagged Income.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Samples	All	Age 0-9	Age 6-15	Black	Non-Black	HS/Dropout	College	Boys	Girls
$\ln Y_t$	0.0305*	0.0388*	0.0314	0.0409	0.0271	0.0500*	0.0254	0.0168	0.0438*
	[0.0167]	[0.0222]	[0.0231]	[0.0315]	[0.0199]	[0.0284]	[0.0207]	[0.0244]	[0.0235]
$\ln Y_{t-1}$	0.0195	0.0190	0.0184	-0.0287	0.0414**	0.0010	0.0270	0.0269	0.0135
	[0.0150]	[0.0194]	[0.0216]	[0.0285]	[0.0175]	[0.0249]	[0.0192]	[0.0215]	[0.0213]
$\ln Y_{t-2}$	0.0060	0.0096	0.0138	0.0582*	-0.0129	-0.0020	0.0172	0.0017	0.0158
	[0.0161]	[0.0199]	[0.0252]	[0.0313]	[0.0183]	[0.0297]	[0.0194]	[0.0238]	[0.0221]
Observations	16,876	13,048	9,133	4,961	11,915	5,457	11,419	8,662	8,214
R-squared	0.6893	0.7184	0.7704	0.6541	0.6793	0.6870	0.6790	0.6911	0.6933
Cumulative Effect	0.0559	0.0674	0.0636	0.0705	0.0557	0.0490	0.0696	0.0453	0.0731
	[0.025]**	[0.033]**	[0.037]*	[0.050]	[0.029]*	[0.041]	[0.032]**	[0.037]	[0.035]**

Note: The table presents OLS regression of parental inputs on family disposable income. The controls included in regressions and not presented in the table include the following: a set of observable family time varying characteristics (family size, current region of residence, an indicator for whether the family lives in a big city, mother marital status, indicators number of children for the number of sibling the child has and for the total number of children in family). We include interactions of the following variables with year effects: child's race, region of residence, residence in big city, maternal AFQT, and education of maternal grandmother and grandfather. We include the following fixed effects: year, age of the child, and child fixed effect. The unit of observation is child-year.

The standard errors are clustered by child. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 5: Minimum-Distance Partial Insurance and Variance Estimates.

Samples	(1) All	(2) Age 0-9	(3) Age 6-15	(4) Black	(5) Non-Black	(6) HS/Dropout	(7) College	(8) Boys	(9) Girls
Variance perm. shock σ^2_η	0.093	0.090	0.105	0.0722	0.1077	0.1146	0.0866	0.1292	0.0841
	[0.014]***	[0.015]***	[0.021]***	[0.0722]	[0.016]***	[0.02]***	[0.026]***	[0.022]***	[0.026]***
Variance transit. shock σ^2_ε	0.252	0.245	0.258	0.2744	0.2286	0.2398	0.2401	0.2186	0.2414
	[0.016]***	[0.023]***	[0.023]***	[0.096]***	[0.020]***	[0.020]***	[0.039]***	[0.024]***	[0.034]***
Insurance perm. shock ϕ	0.053	0.118	0.016	-0.1056	0.0884	0.006	0.1327	0.0523	0.0538
	[0.054]	[0.064]*	[0.069]	[0.198]	[0.042]**	[0.066]	[0.070]*	[0.055]	[0.089]
Insurance trans. shock ψ	0.005	-0.014	0.018	0.0519	-0.018	0.0627	-0.0617	-0.0012	0.0016
	[0.032]	[0.046]	[0.044]	[0.066]	[0.040]	[0.051]	[0.047]	[0.052]	[0.049]
Variance unob. heterog. σ^2_ξ	0.082	0.078	0.075	0.0944	0.0787	0.1067	0.0432	0.0817	0.0815
	[0.011]***	[0.016]***	[0.011]***	[0.032]***	[0.011]***	[0.019]***	[0.013]***	[0.015]***	[0.017]***
Variance measur. error σ^2_u	0.348	0.385	0.325	0.4463	0.3111	0.3639	0.3223	0.3614	0.3342
	[0.015]***	[0.021]***	[0.013]***	[0.043]***	[0.014]***	[0.024]***	[0.017]***	[0.020]***	[0.022]***

Note: This table reports diagonally weighted minimum distance estimates of the parameters of interest: σ^2_u is the variance of the measurement error in parental inputs, σ^2_ξ is the variance of idiosyncratic tastes or innovation to the change in inputs, σ^2_η the variance of permanent shocks to income, σ^2_ε the variance of transitory shocks to income, and ϕ and ψ are the partial insurance coefficients for permanent and transitory income shocks, respectively. Asymptotic standard errors in brackets (computed as suggested in Chamberlain, 1984).

Table 6: Minimum-Distance Partial Insurance and Variance Estimates.

Samples	(1) All	(2) Age 0-9	(3) Age 6-15	(4) Black	(5) Non-Black	(6) HS/Dropout	(7) College	(8) Boys	(9) Girls
Variance perm. shock σ^2_η	0.0924	0.0902	0.1049	0.0718	0.107	0.0983	0.1326	0.1289	0.0833
	[0.014]***	[0.015]***	[0.021]***	[0.072]***	[0.016]***	[0.018]***	[0.060]**	[0.022]***	[0.026]***
Variance transit. shock σ^2_ε	0.2518	0.2444	0.2581	0.2747	0.2292	0.2216	0.2928	0.2186	0.2422
	[0.016]***	[0.023]***	[0.023]***	[0.096]***	[0.020]***	[0.020]***	[0.083]***	[0.024]***	[0.034]***
Insurance perm. shock ϕ^0	0.0667	0.1579	0.0306	-0.0721	0.0596	0.0509	0.077	0.0638	0.1423
	[0.103]	[0.134]	[0.078]	[0.324]	[0.100]	[0.104]	[0.302]	[0.096]	[0.301]
Insurance trans. shock ψ^0	-0.0027	-0.0178	-0.0015	0.0623	0.0021	-0.0059	0.0923	-0.0086	0.0202
	[0.032]	[0.046]	[0.044]	[0.067]	[0.040]	[0.040]	[0.084]	[0.052]	[0.049]
Insurance perm. shock ϕ^1	0.0019	-0.0578	0.0252	0.0229	0.0081	-0.0217	-0.07	-0.003	-0.071
	[0.114]	[0.239]	[0.097]	[0.404]	[0.104]	[0.134]	[0.396]	[0.109]	[0.394]
Insurance trans. shock ψ^1	0.0031	0.0088	0.0002	0.0361	-0.0043	-0.0004	0.0316	0.0049	0.0597
	[0.047]	[0.055]	[0.048]	[0.137]	[0.055]	[0.056]	[0.169]	[0.077]	[0.131]

Note: This table reports diagonally weighted minimum distance estimates of the parameters of interest: σ^2_η the variance of permanent shocks to income, σ^2_ε the variance of transitory shocks to income, and ϕ^0, ϕ^1, ψ^0 and ψ^1 are the partial insurance coefficients for permanent and transitory income shocks, respectively. The σ^2_u (the variance of the measurement error in parental inputs) and σ^2_ξ (variance of idiosyncratic tastes or innovation to the change in inputs) are estimated but not included in table. Asymptotic standard errors in brackets (computed as suggested in Chamberlain, 1984).

A Model

Consider one parent-one child family in a partial equilibrium framework. The parent has to decide how to divide (stochastic) income in each period among several alternatives: allocate resources to his own consumption, c_t, to the child's specific goods, g_t, and the amount of the risk-free asset to leave for the next period, A_{t+1}, with real return r_t. Parent's consumption good is the numeraire and q_t is the relative price of child's goods. I start by assuming that labor supply of parent is inelastic. Parent's within period utility is $u\left(c_t, h_t\right)$, where c_t are goods consumed by the parent and h_t is child's human capital at the end of t years of life.[16] Therefore, the parent is altruistic and he/she cares about child's welfare in each period, which is a function of her human capital in the end of period, h_t. In turn, the human capital at age t, h_t depends on previous stock h_{t-1} and current investment,

$$h_t = f\left(g_t, h_{t-1}\right). \tag{A.1}$$

The child leaves parental house at age $T+1$ and there is no depreciation in child's human capital between periods. While living with parents, the child does not make any decision and parent's decisions of investments are based on altruism.

Assets evolve according to the usual intertemporal budget constraint

$$A_{t+1} = \left(1 + r_t\right)\left[A_t + y_t - c_t - q_t g_t\right] \tag{A.2}$$

where y_t is the family's disposable income (including earnings and transfers). The bequests must be nonnegative, $A_{T+1} \geq 0$, and there exists a borrowing limit, $A_{t+1} > \overline{A}$.

Keeping implicit preferences shocks and family's characteristics that affect preferences and the production of child's human capital, such as parental education and demographic characteristics as number and age of children, the parent of a t years old child maximizes expected utility subject to the skill formation technology and inter-temporal budget constraint (A.1) and (A.2), respectively[17]:

$$V^t\left(A_t, h_{t-1}, t\right) = \max_{c_t, g_t, A_{t+1}} \left\{u\left(c_t, h_t\right) + \beta E_t V^{t+1}\left(A_{t+1}, h_t, t+1\right)\right\}$$

where E_t is the expectations operator associated with the probability distribution of future variables that are uncertain conditional on the information available at year t, that is, future prices, interest rates and income. Let $u_c(t) = \frac{\partial u(c_t, h_t)}{\partial c_t}, u_h(t) = \frac{\partial u(c_t, h_t)}{\partial h_t}$, then the first order conditions of this optimization problem for c and g are, respectively:

$$E_t\left[u_c(t) - \beta\left(1 + r_t\right)\left(\frac{\partial V^{t+1}\left(A_{t+1}, h_t, t+1\right)}{\partial A_{t+1}} + \mu_t\right)\right] \tag{A.3}$$

$$E_t\left[u_h(t)\frac{\partial h_t}{\partial g_t} + \beta\frac{\partial V^{t+1}\left(A_{t+1}, h_t, t+1\right)}{\partial h_t}\frac{\partial h_t}{\partial g_t} - q_t\beta\left(1 + r_t\right)\left(\frac{\partial V^{t+1}\left(A_{t+1}, h_t, t+1\right)}{\partial A_{t+1}} + \mu_t\right)\right] \tag{A.4}$$

where μ_t is the multiplier on the liquidity constraint. Assuming that $\mu_t = 0$, so that the liquidity constraint is not bidding, and using the Envelope Theorem it is possible to obtain $\frac{\partial V^t}{\partial A_t}$ (written

[16] In this formulation, human capital is similar accumulation of stock.

[17] Throughout the discussion, period t and age t are used interchangeable, as we are not modelling family formation, but only time and expenditures choices while young children are living with parents. Fertility decisions are accounted for by observable taste-shifters.

as λ_t below to simplify notation), $\frac{\partial V^t}{\partial h_{t-1}}$, then the optimal allocation of financial resources implies that:

$$\begin{aligned}
\frac{\partial V^t}{\partial A_t} &= E_t\left[\beta\left(1+r_t\right)\frac{\partial V^{t+1}}{\partial A_{t+1}}\right] \\
\frac{\partial V^t}{\partial h_{t-1}} &= E_t\left[u_h(t)\frac{\partial h_t}{\partial h_{t-1}}+\beta\frac{\partial V^{t+1}}{\partial h_t}\frac{\partial h_t}{\partial h_{t-1}}\right] \\
&= E_t\left[u_h(t)\frac{\partial h_t}{\partial h_{t-1}}+\beta\left(u_h(t+1)\frac{\partial h_{t+1}}{\partial h_t}+\beta\frac{\partial V^{t+2}}{\partial h_{t+1}}\frac{\partial h_{t+1}}{\partial h_t}\right)\frac{\partial h_t}{\partial h_{t-1}}\right] = ... = \\
&= E_t\left[\sum_{j=0}^{T-t}\beta^j u_h(t+j)\prod_{k=0}^{j}\frac{\partial h_{t+k}}{\partial h_{t+k-1}}+\Omega\right] = \Psi_{t-1}
\end{aligned}$$

where

$$\Omega = \frac{\partial V^T}{\partial h_T} = u_h(T)\frac{\partial h_T}{\partial h_{T-1}}+\beta\frac{\partial V^{T+1}}{\partial h_{T+1}}\frac{\partial h_{T+1}}{\partial h_T} = u_h(T)\frac{\partial h_T}{\partial h_{T-1}}$$

since $\frac{\partial V^{T+1}}{\partial h_{T+1}} = 0$, that is, the parent values the discounted value of the welfare of child with the human capital she had acquired when leaving the house. This stock determines the productivity of future own investments. Then, FOCs above can be re-written as:

$$\begin{aligned}
c &: E_t\left[u_c(t)-\beta\left(1+r_t\right)u_c(t+1)\right] = 0 \\
g &: E_t\left[u_h(t)\frac{\partial h_t}{\partial g_t}+\beta\Psi_t\frac{\partial h_t}{\partial g_t}-q_t u_c(t)\right] = 0
\end{aligned}$$

that is, current consumption and investment is a function of current, past and future expenditures. Note that the production function of human capital is generalization of the usual formula for durables or habit formation (see for example, Hayashi, 1985 or Dynan, 2000, respectively). Using $\frac{\partial V^{t+1}}{\partial A_{t+1}}$ and $\frac{\partial V^{t+1}}{\partial h_t}$ in the first order condition for periods t and $t+1$ for g it is possible to obtain the Euler equation:

$$E_t\left[u_h(t)\frac{\partial h_t}{\partial g_t}+\beta\Psi_t\frac{\partial h_t}{\partial g_t}\right] = E_t\left\{\frac{q_t}{q_{t+1}}\beta\left(1+r_t\right)\left[u_h(t+1)\frac{\partial h_{t+1}}{\partial g_{t+1}}+\beta\Psi_{t+1}\frac{\partial h_{t+1}}{\partial g_{t+1}}\right]\right\}. \tag{A.5}$$

The left-hand side of this equation is the marginal cost of forgoing one unit of expenditure on investment g. The right-hand side is the marginal benefit that accrue by using the proceeds period's t savings and increasing by $\frac{q_t}{q_{t+1}}\left(1+r_t\right)$ units investment g in $t+1$. Both sides of this expression involve the expected value of a sum from t on the left hand side (and $t+1$ on the right hand side) to T, as a change in current expenditure influences current and future investment.

Using a user cost argument (see Deaton and Muellbauer, 1980), it is possible to re-write expression (A.5) as

$$E_t\left\{\frac{\beta\left(1+r_{t+1}\right)u_h(t+1)\frac{\partial h_{t+1}}{\partial g_{t+1}}}{\frac{\left[\left(1+r_{t+1}\right)q_{t+1}-\Delta_{t+2}q_{t+2}\right]}{\left[\left(1+r_t\right)q_t-\Delta_{t+1}q_{t+1}\right]}u_h(t)\frac{\partial h_t}{\partial g_t}}\right\} = 1 \tag{A.6}$$

where $\left[\left(1+r_t\right)q_t-\Delta_{t+1}q_{t+1}\right]$ and $\left[\left(1+r_{t+1}\right)q_{t+1}-\Delta_{t+2}q_{t+2}\right]$ represent the cost of holding one unit of child's human capital in periods t and $t+1$, respectively. The the previous expression

can be obtained considering a deviation from the optimal trajectory analogous to the deviation used to price capital. That is, the parent may defer investment by one period in moment t, such that neither his/her consumption and the child's human capital after $t+1$ are affected by postponing investment one period. If parent reduces expenditures in child g by one unit, he/she saves q_t. This reduction in investment is associated with a reduction in dh_t in the child's human capital. In the following period, the parent uses the proceeding of accumulated saving $(1+r_t)\,q_t$ to invest in child Δ_{t+1}, where $\Delta_{t+1} = -\frac{\frac{\partial h_{t+1}}{\partial h_t}\frac{\partial h_t}{\partial g_t}}{\frac{\partial h_{t+1}}{\partial g_{t+1}}}$, at a unitary price of q_{t+1}, such that the stock of human capital that the child carries to next period remains unchanged, $dh_{t+1} = 0$. This one-period deviation can only be constructed under the assumption that investments are not perfect complements across periods, so that the production exhibits at least some degree of substitutability between periods, which may vary by age. The cost of obtaining such expression relies on the assumption that the parent can predict the future (real) prices and interest rates, that is, r_{t+1}, r_{t+2} and q_{t+1}, q_{t+2}, and the return of investment in human capital, $\Delta_{t+1}, \Delta_{t+2}$.[18] In practice, the deviations are constructed as follows. Suppose the parent reduces investment in education g in period t by one unit and increase next period by Δ_{t+1}. With this deviation the parent has an additional saving of q_t in period t, and the additional income in period $t+1$ is $[(1+r_t)\,q_t - \Delta_{t+1}q_{t+1}]$. This deviation leaves h_{t+1} unchanged from its optimal level and should neither decrease nor increase the objective function. Note that this deviation is only if h_t does not evolve according to a Leontieff. Therefore, this deviation reduces h_t in $\frac{\partial h_t}{\partial g_t}$, but but also $dh_{t+1} = 0$, so that:

$$dh_{t+1} = \frac{\partial h_{t+1}}{\partial h_t}\frac{\partial h_t}{\partial g_t}\underbrace{dg_t}_{=1} + \frac{\partial h_{t+1}}{\partial g_{t+1}}dg_{t+1} = 0.$$

Let Δ_{t+1} to be:

$$\Delta_{t+1} = -\frac{\frac{\partial h_{t+1}}{\partial h_t}\frac{\partial h_t}{\partial g_t}}{\frac{\partial h_{t+1}}{\partial g_{t+1}}}.$$

This is how much g_{t+1} needs to move to keep h_{t+1} fixed. If the objective function is not changing (and current consumption does not change either) then:

$$u_h(t)\frac{\partial h_t}{\partial g_t} = E_t\left\{\beta\left[(1+r_t)\,q_t - \Delta_{t+1}q_{t+1}\right]\frac{\partial V^{t+1}}{\partial A_{t+1}}\right\} \tag{A.7}$$

that is, the marginal value of my additional savings minus the cost of replenishing h_{t+1} has to equal the marginal value of the utility I lose from having less h_t.

The optimum decision rule is such that the present value of marginal utility of income should be constant across periods, so that,

$$\frac{\partial V^t}{\partial A_t} = E_t\left[\beta\,(1+r_t)\,\frac{\partial V^{t+1}}{\partial A_{t+1}}\right]. \tag{A.8}$$

Condition (A.7) one period ahead can be written as:

[18]The last assumption requires that parents have perfect knowledge of the production function of the child's human capital.

$$E_t\left\{\beta\left(1+r_{t+1}\right)u_h(t+1)\frac{\partial h_{t+1}}{\partial g_{t+1}}\right\}=E_t\left\{\beta\left(1+r_{t+1}\right)\beta\left[\left(1+r_{t+1}\right)q_{t+1}-\Delta_{t+2}q_{t+2}\right]E_{t+1}\left(\frac{\partial V^{t+2}}{\partial A_{t+2}}\right)\right\}. \tag{A.9}$$

Using (A.8) and the law of iterated expectations, the right hand side of condition (A.9) can be written as

$$\begin{aligned}E_t\left\{\beta\left(1+r_{t+1}\right)u_h(t+1)\frac{\partial h_{t+1}}{\partial g_{t+1}}\right\} &= E_t\left\{\beta\left(1+r_{t+1}\right)\beta\left[\left(1+r_{t+1}\right)q_{t+1}-\Delta_{t+2}q_{t+2}\right]\left[\beta\left(1+r_{t+1}\right)\right]^{-1}\frac{\partial V^{t+1}}{\partial A_{t+1}}\right\}\\ &= E_t\left\{\beta\left[\left(1+r_{t+1}\right)q_{t+1}-\Delta_{t+2}q_{t+2}\right]\frac{\partial V^{t+1}}{\partial A_{t+1}}\right\}.\end{aligned}$$

If in period t the parent is able to perfectly forecast the prices q_{t+1} and the marginal productivity of investments in $t+1$ and $t+2$, so that Δ_{t+1} and Δ_{t+2} are known and if, additionally,

$$\begin{aligned}\beta\left[\left(1+r_{t+1}\right)q_{t+1}-\Delta_{t+2}q_{t+2}\right] &= \beta\left[\left(1+r_t\right)q_t-\Delta_{t+1}q_{t+1}\right]\Leftrightarrow\\ \left(1+r_{t+1}\right)q_{t+1}-\left(1+r_t\right)q_t &= \Delta_{t+2}q_{t+2}-\Delta_{t+1}q_{t+1}\end{aligned}$$

that is, if the saving from deviating from optimum in period t are equal to the savings from waiting one period to deviate, then it is possible to obtain condition (9):

$$E_t\left\{\beta\left(1+r_{t+1}\right)u_h(t+1)\frac{\partial h_{t+1}}{\partial g_{t+1}}\right\}=u_h(t)\frac{\partial h_t}{\partial g_t}. \tag{A.10}$$

References

[1] Deaton, Angus and Muellbauer,John, 1980, "Economics and Consumer Behavior," Cambridge Books, Cambridge University Press, number 9780521296762, April.

B Moment conditions

The CNLSY only records information on parental involvement biannually, implying that we can only construct second differences for inputs, that is, $\Delta^2 g_a = \Delta g_a + \Delta g_{a-1}$. Thus,

$$\begin{aligned} \Delta g_a &= \phi_1 \eta_a + \psi_1 \varepsilon_a + \xi_a^k && \text{(B.1)} \\ \Delta^2 g_a &= \phi_1 (\eta_a + \eta_{a-1}) + \psi_1 (\varepsilon_a + \varepsilon_{a-1}) + \xi_a^k + \xi_{a-1}^e && \text{(B.2)} \end{aligned}$$

We will assume stationarity throughout the paper.

Moments for income Meghir and Pistaferri, 2004, show that with annual income the following moments identify the variance of permanent and transitory shock

$$\begin{aligned} E[\Delta y_a(\Delta y_{a-1} + \Delta y_a + \Delta y_{a+1})] &= \sigma_\eta^2 && \text{(B.3)} \\ E[\Delta y_a \Delta y_{a-1}] &= E[\Delta y_a \Delta y_{a+1}] = -\sigma_\varepsilon^2. && \text{(B.4)} \end{aligned}$$

However, as mentioned above the CNLSY is a biannual data set, and so information on parental inputs is only collected biannually. Also, our interested lies on the child's life cycle, which implies that our reference regarding time is the child's age, a, not calendar years. Thus, in practice, this means starting at age 0 we can construct the following pairs of ages in which we observe both family income and parental inputs: 0-1, 2-3, 4-5, 6-7, 8-9, 10-11, 12-13 and 14-15. This biannual structure means that the relevant income moments to identify the variance of permanent and transitory shock are then

$$\begin{aligned} E[\Delta^2 y_t(\Delta^2 y_{t-2} + \Delta^2 y_t + \Delta^2 y_{t+2})] &= 2\sigma_\eta^2 \\ E[\Delta^2 y_t \Delta^2 y_{t+2}] &= E[\Delta^2 y_t \Delta^2 y_{t-2}] = -\sigma_\varepsilon^2. \end{aligned}$$

Variance and covariance of parental inputs

$$\begin{aligned} E\left[\left(\Delta^2 g_a\right)^2\right] &= 2\phi^2\sigma_\eta^2 + 2\psi^2\sigma_\varepsilon^2 + 2\sigma_\xi^2 && \text{(B.5)} \\ E\left[\left(\Delta^2 g_a\right)\left(\Delta^2 k_{a-j}\right)\right] &= E\left[\left(\Delta^2 g_a\right)\left(\Delta^2 k_{a+j}\right)\right] = 0, j > 1. && \text{(B.6)} \end{aligned}$$

The covariance between income and measures of parental investment in children are given by

$$\begin{aligned} E\left[\Delta^2 g_a \Delta^2 y_a\right] &= 2\phi\sigma_\eta^2 + \psi\sigma_\varepsilon^2 \\ E\left[\Delta^2 g_a \Delta^2 y_{a+2}\right] &= -\psi\sigma_\varepsilon^2 && \text{(B.7)} \\ E\left[\Delta^2 g_a \Delta^2 y_{a-2}\right] &= 0 && \text{(B.8)} \\ E\left[\Delta^2 g_a \Delta^2 y_{a+j}\right] &= 0, j > 2 && \text{(B.9)} \end{aligned}$$

Then, the parameters are identified by the following moments

$$\frac{E\left[\Delta^2 g_a\left(\Delta^2 y_{a-2}+\Delta^2 y_a+\Delta^2 y_{a+2}\right)\right]}{E\left[\Delta^2 y_a\left(\Delta^2 y_{a-2}+\Delta^2 y_a+\Delta^2 y_{a+2}\right)\right]} = 2\phi \tag{B.10}$$

$$\frac{E\left[\Delta^2 g_a \Delta^2 y_{a+2}\right]}{E\left[\Delta^2 y_a \Delta^2 y_{a+2}\right]} = \psi. \tag{B.11}$$

Finally, σ_ξ^2 can be identified using the following condition

$$E\left(\Delta^2 g_a\right)^2 - \frac{\left\{E\left[\Delta^2 g_a\left(\Delta^2 y_{a-2}+\Delta^2 y_a+\Delta^2 y_{a+2}\right)\right]\right\}^2}{E\left[\Delta^2 y_a\left(\Delta^2 y_{a-2}+\Delta^2 y_a+\Delta^2 y_{a+2}\right)\right]} - \frac{\left\{E\left[\Delta^2 g_a \Delta^2 y_{a+2}\right]\right\}^2}{E\left[\Delta^2 y_a \Delta^2 y_{a+2}\right]} = \sigma_\xi^2.$$

Measurement error in income and parental inputs As Meghir and Pistaferri, 2004, and Blundell et al., 2008, show if income and consumption measures are measured with error, then we can write them as

$$\begin{aligned} y_{ia}^* &= y_{ia} + u_{ia}^y \\ g_{ia}^* &= g_{ia} + u_{ia}^g \end{aligned}$$

where x^* denote observed measured and x is true measure. Measurement error in consumption measures induces serial correlation in consumption growth so that in the context of the NLSY where we can only second differences can be constructed $\Delta^2 g_{ia}^* = \Delta g_{ia}^* + \Delta g_{ia-1}^* = \Delta g_{ia} + \Delta g_{ia-1} + u_{ia}^g - u_{ia-2}^g$. Then σ_{ug}^2 is identified by

$$\begin{aligned} E\left[\Delta^2 g_a \Delta^2 g_{a-2}\right] &= E\left[\begin{array}{c}\left(\phi\left(\eta_a+\eta_{a-1}\right)+\psi\left(\varepsilon_a+\varepsilon_{a-1}\right)+\xi_a+\xi_{a-1}+u_{ia}^g-u_{ia-2}^g\right) \\ \left(\phi\left(\eta_{a-2}+\eta_{a-3}\right)+\psi\left(\varepsilon_{a-2}+\varepsilon_{a-3}\right)+\xi_{a-2}+\xi_{a-3}+u_{ia-2}-u_{ia-4}\right)\end{array}\right] \\ &= -\sigma_{ue}^2 = E\left[\Delta^2 g_a \Delta^2 g_{a+2}\right]. \end{aligned}$$

Finally, as Meghir and Pistaferri, 2004, and Blundell et al., 2008, show that if income is measured with error, then σ_ε^2 and σ_{uy}^2 cannot be separately identified. Also, only a lower bound for ψ is identified.[19]

B.1 Effect of past shocks

We now consider a more general model in which we allow parental inputs to respond to past shocks. Then we write:

[19]Notice that the variance for parental inputs is given by

$$\begin{aligned} E\left[\left(\Delta^2 g_a\right)^2\right] &= E\left[\left(\phi\left(\eta_a+\eta_{a-1}\right)+\psi\left(\varepsilon_a+\varepsilon_{a-1}\right)+\xi_a+\xi_{a-1}+u_{ia}^g-u_{ia-2}^g\right)^2\right] \\ &= 2\phi^2\sigma_\eta^2+2\psi^2\sigma_\varepsilon^2+2\sigma_\xi^2+2\sigma_{ug}^2. \end{aligned}$$

The variances and autocovariances of income are given by:

$$\Delta^2 g_a = \phi_1\eta_a + \psi_1\varepsilon_a + \phi_2\eta_{a-1} + \psi_2\varepsilon_{a-1} + \left(\phi_1\eta_{a-1} + \psi_1\varepsilon_{a-1} + \phi_2\eta_{a-2} + \psi_2\varepsilon_{a-2} + u^g_{ia} - u^g_{ia-2}\right)$$

Then, the variance of parental investments is then given by:

$$E\left[\left(\Delta^2 g_a\right)^2\right] = 2\sigma^2_\eta\left(\phi^2_1 + \phi^2_2\right) + 2\sigma^2_\varepsilon\left(\psi^2_1 + \psi^2_2\right) + 2\sigma^2_{ug}. \tag{B.12}$$

The covariance between income and measures of parental investment in children are given by

$$\begin{aligned}
E\left[\Delta^2 g_a \Delta^2 y_a\right] &= E\left[\begin{array}{c}\left(\phi_1\left(\eta_a + \eta_{a-1}\right) + \psi_1\left(\varepsilon_a + \varepsilon_{a-1}\right) + \phi_2\left(\eta_{a-1} + \eta_{a-2}\right) + \psi_2\left(\varepsilon_{a-1} + \varepsilon_{a-2}\right)\right) \\ \left(\eta_a + \eta_{a-1} + \varepsilon_a - \varepsilon_{a-2}\right)\end{array}\right] \\
&= \left(2\phi_1 + \phi_2\right)\sigma^2_\eta + \psi_1\sigma^2_\varepsilon - \psi_2\sigma^2_\varepsilon \qquad \text{(B.13)} \\
E\left[\Delta^2 g_a \Delta y_{a-2}\right] &= E\left[\begin{array}{c}\left(\phi_1\left(\eta_a + \eta_{a-1}\right) + \psi_1\left(\varepsilon_a + \varepsilon_{a-1}\right) + \phi_2\left(\eta_{a-1} + \eta_{a-2}\right) + \psi_2\left(\varepsilon_{a-1} + \varepsilon_{a-2}\right)\right) \\ \left(\eta_{a-2} + \eta_{a-3} + \varepsilon_{a-2} - \varepsilon_{a-4}\right)\end{array}\right] \\
&= \phi_2\sigma^2_\eta + \psi_2\sigma^2_\varepsilon \qquad \text{(B.14)} \\
E\left[\Delta^2 g_a \Delta^2 y_{a+2}\right] &= E\left[\begin{array}{c}\left(\phi_1\left(\eta_a + \eta_{a-1}\right) + \psi_1\left(\varepsilon_a + \varepsilon_{a-1}\right) + \phi_2\left(\eta_{a-1} + \eta_{a-2}\right) + \psi_2\left(\varepsilon_{a-1} + \varepsilon_{a-2}\right)\right) \\ \left(\eta_{a+2} + \eta_{a+1} + \varepsilon_{a+2} - \varepsilon_a\right)\end{array}\right] \\
&= -\psi_1\sigma^2_\varepsilon \\
E\left[\Delta^2 g_a \Delta y_{a-j}\right] &= E\left[\Delta^2 g_a \Delta y_{a+j}\right] = 0, j > 1 \qquad \text{(B.15)}
\end{aligned}$$

Then the variances of permanent and transitory shocks $(\sigma^2_\eta, \sigma^2_\varepsilon)$ are still identified by the same conditions as in the basic case. It is still true that $\frac{E\left[\Delta^2 g_a \Delta^2 y_{a+2}\right]}{E[\Delta^2 y_a \Delta^2 y_{a+2}]} = \psi_1$.With lagged shocks

$$\frac{E[\Delta^2 g_a(\Delta^2 y_{a-2} + \Delta^2 y_a + \Delta^2 y_{a+2})]}{E[\Delta^2 y_a(\Delta^2 y_{a-2} + \Delta^2 y_a + \Delta^2 y_{a+2})]} = 2\left(\phi_1 + \phi_2\right).$$

This means than only one coefficient is identified (ψ_1).

$$\begin{aligned}
E[(\Delta y_a)^2] &= E\left[\left(\eta_a + \varepsilon_a - \varepsilon_{a-1} + u^y_a - u^y_{a-1}\right)^2\right] = \sigma^2_\eta + 2\sigma^2_\varepsilon + 2\sigma^2_{uy} \\
E[\Delta y_a \Delta y_{a-1}] &= E\left[\left(\eta_a + \varepsilon_a - \varepsilon_{a-1} + u^y_a - u^y_{a-1}\right)\left(\eta_{a-1} + \varepsilon_{a-1} - \varepsilon_{a-2} + u^y_{a-1} - u^y_{a-2}\right)\right] \\
&= -\sigma^2_\varepsilon - \sigma^2_{uy} = E[\Delta y_a \Delta y_{a+1}] \\
E[(\Delta^2 y_a)^2] &= E\left[\left(\eta_a + \eta_{a-1} + \varepsilon_a - \varepsilon_{a-2} + u^y_a - u^y_{a-2}\right)^2\right] = 2\sigma^2_\eta + 2\sigma^2_\varepsilon + 2\sigma^2_{uy} \\
E[\Delta^2 y_a \Delta^2 y_{a-2}] &= E\left[\left(\eta_a + \eta_{a-1} + \varepsilon_a - \varepsilon_{a-2} + u^y_a - u^y_{a-2}\right)\left(\eta_{a-2} + \eta_{a-3} + \varepsilon_{a-2} - \varepsilon_{a-4} + u^y_{a-2} - u^y_{a-4}\right)\right] \\
&= -\sigma^2_\varepsilon - \sigma^2_{uy} = E[\Delta^2 y_a \Delta^2 y_{a+2}].
\end{aligned}$$

C Data

The NLSY79

Definition of income and assets variables from NLSY79:

1. **Earnings** include respondent's (or spouse) wages, commissions, or tips from all jobs, income from farm and non-farm business or income from military services received in past calendar year (before taxes and other deductions; annual measure). Includes money received from special payments, allowances and bonuses.

2. **Total family income** includes (i) money from working before taxes (military income, wages, salaries, tips, farm income, and business income), (ii) transfers from the government through programs such as unemployment compensation, AFDC payments, Food Stamps, SSI, and other welfare payments, (iii) transfers from non-government sources such as child support, alimony, and parental payments, (iv) income from other sources such as scholarships, V.A. benefits, interest, dividends, and rent. Family income variable includes income from all individuals related by blood, marriage, and adoption, and excludes foster relationships, partners, boarders, guardians, and other non-relatives are considered nonfamily members for the purposes of this variable. As original definition available in NLSY79 excludes income of partners are excluded, we construct a corrected measure of family income that includes partner's income.

3. **Net family income (or earnings)** is obtained subtracting federal income taxes from total family income (earnings)[20].

4. **Welfare income** includes total amount of AFDC/TANF, Food Stamps, SSI/other public assistance (such as government rent subsidies, public housing, or welfare-provided health or hospitalization coverage) income respondent or spouse received.

5. **Unearned income** includes (i) total income from alimony or child support received by the respondent from someone living outside the household, (ii) welfare income, (iii) income from other sources, (iv) total amount of income received by r/spouse from other sources in the past calendar year, (v) any money from any other source such as interest on savings, payments from social security, net rental income, or any other regular or periodic sources of income, (vi) total amount of other veteran benefits, worker compensation or disability payments received by the respondent (or spouse).

All monetary values are deflated to 2000 US dollars, using CPI-U (see Economic Report of the President, 2009).

Earnings, total family income and total welfare income are truncated at the 99th percentile; specific welfare benefits received by a family from AFDC/TANF, Food Stamps or Unemployment Insurance are set at the maximum level of benefits the family is entitled whenever they are larger than the maximum value.

[20]NLSY does not have information about the amount of taxes families pay or EITC payments. To impute each family's federal EITC or tax payments whenever necessary we use the TAXSIM program (version 9a) maintained by the NBER (see http: //www.nber.org/taxsim).

D Tables

Table D.1: OLS Estimates of the Effect of Family Income on Parental Inputs.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Panel A			
	HOME Score	Cognitive Stimulation	Emotional Support	Private school/care	Child has 10+ pull toys	Child taken once week to grocery	Child has 10+ books	Family gets at least 3 magazines
$\ln Y_t$	0.0074	0.0053	0.0141	-0.0042	-0.0100	0.0129	-0.0011	0.0241
	[0.0084]	[0.0089]	[0.0108]	[0.0034]	[0.0353]	[0.0312]	[0.0037]	[0.0332]
Mean	-0.139	-0.136	-0.103	0.406	0.133	0.795	0.726	0.380
SD	1.039	1.039	1.047	0.491	0.340	0.404	0.446	0.485
					Panel B			
	Child has CD player	Family receives daily newspaper	Hobbies	Extracurricular activities	Musical instrument	Shopping for child once a month	Mom reads to child 1+ week	Child eats at least 1 meal/day w/ parents
$\ln Y_t$	-0.0324	0.0153***	-0.0020	0.0115*	-0.0064	0.0070	-0.0104*	0.0130***
	[0.0282]	[0.0059]	[0.0040]	[0.0064]	[0.0062]	[0.0139]	[0.0057]	[0.0043]
Mean	0.766	0.461	0.919	0.608	0.497	0.796	0.709	0.589
SD	0.424	0.498	0.272	0.488	0.500	0.403	0.454	0.492
					Panel C			
	Child gets out of house	TV is on <5hs/day	Child sees father daily	Mom helps with numbers	Child taken 3+ times to museum	Child spends time w/ father once a week	Family meets friends once a week	Child does things w/ parents
$\ln Y_t$	0.0290***	-0.0137	0.0199**	-0.0004	-0.0044	0.0049	-0.0090	-0.0172
	[0.0108]	[0.0118]	[0.0081]	[0.0218]	[0.0050]	[0.0056]	[0.0062]	[0.0165]
Mean	0.726	0.599	0.843	0.923	0.346	0.763	0.559	0.508
SD	0.446	0.490	0.364	0.267	0.476	0.425	0.496	0.500
					Panel D			
	Child makes her own bed	Child cleans room	Child and father spend time outdoors once a week	Mom discusses TV prog w/ child	Child and parents go on outings	Mom works w/ child on schoolwork	Child goes to movies w/ parents	Child & parents dinner out
$\ln Y_t$	0.0073	0.0114*	0.0037	0.0060	0.0047	-0.0035	0.0016	0.0064
	[0.0062]	[0.0069]	[0.0062]	[0.0054]	[0.0168]	[0.0176]	[0.0169]	[0.0134]
Mean	0.518	0.610	0.582	0.826	0.401	0.354	0.391	0.699
SD	0.500	0.488	0.493	0.379	0.490	0.478	0.488	0.459

Note: The table presents OLS regression of several indexes of parental inputs on family disposable income. The controls included in regressions and not presented in the table include the following: a set of observable family time varying characteristics (family size, number of children, region, residence in a large city, and maternal marital status). We allow for the effect of most of these characteristics to vary with calendar time (maternal education, race, region, residence in large city). We include the following fixed effects: year, mother's year-of-birth, age of the child, and child fixed effect. The unit of observation is child-year.
The standard errors are clustered by child. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

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