Income Shocks and Investments in Human Capital*
(Job Market Paper)

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January 2010

Abstract

How well can parents insure their children's future? This paper aims at answering this question by studying the link between income shocks and parental investments in children in terms of time and goods. The paper presents three main contributions: (1) it estimates the degree of response to income shocks in families with young children, without imposing an a priori insurance setup; (2) it analyzes empirically the mechanism behind the degree of insurance found, in particular, the role of wealth and public transfers, and heterogeneity in responses to shocks by education and family structure; (3) finally, it proposes a useful way to use common information in the NLSY79 and the Consumer Expenditure Survey (CEX) and the American Time Use Survey (ATUS) to combine these three data sets and construct a panel of income, expenditures and time use.

I use local business cycles as exogenous variation to families' resources. These are an unpredictable component of county unemployment rate, which I obtain after removing year and county effects from the time-series of county unemployment rate.

I find that (1) families only partially insure against income shocks, but expenditures in education of children respond less to shocks than household consumption, as parents try to shield them against shocks because investments may be complements across children's life-cycle; (2) income elasticity of investments in terms of time is larger in families with young children than in families where there are only school-age children, because at early ages there is a larger substitutability between different uses of time; and (3) better off families use savings to buffer against shocks whereas poor families resort on public transfers.

JEL Codes: D12, D91, I30.
Key words: Insurance, human capital, consumption.

*I would like to thank Pedro Carneiro for helpful discussions and detailed comments on this paper. I also benefited from the comments of Michael Amior, Orazio Attanasio, James Banks, Samuel Berlinski, Richard Blundell, Andrew Chesher, Emanuela Galasso, Karthik Kalyanaraman, Guy Laroque, Costas Meghir, Lars Nesheim, Renata Narita, Nicola Pavoni, Hugo Reis, Marcos Vera Hernandez and Jelmer Ypma and seminar participants at UCL and CEMMAP. I acknowledge the support of Fundacao para a Ciencia e Tecnologia and Royal Economic Society.

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1 Introduction

Parents influence their children through genetic inheritance but also by the time and financial resources dedicated to them. While genes are hard to change, resources may vary over time. The main question addressed in this paper is the following: how well do parents shield children from fluctuations in family resources? This involves understanding whether time investments and goods expenditures in children change substantially with income shocks; whether the effects on child specific expenditures are different than effects on nondurable consumption; and whether income shocks are transferred to a child's human capital.

Understanding how parental investments in children respond to income shocks is important because parents may face imperfect insurance against shocks (see Cochrane, 1991, Blundell, Pistaferri and Preston, 2008, for example). Furthermore, if imperfect insurance is coupled with a technology of skill formation where the timing of investments matters (Cunha and Heckman, 2007), then income shocks at the beginning of a child's life can have irreversible effects on her human capital. Therefore, learning about households' reaction to shocks is informative for the design of policies targeting more disadvantaged families with young children.

Although there has been work documenting the relation between changes in income distributions and consumption, and substantial evidence on differences in the educational attainment of children from different socioeconomic backgrounds[1], there are virtually no studies on the effects of changes in income on parental investments in children[2]. One of the reasons for this gap in the literature is the lack of data sets that include simultaneously information on family income and use of financial and time resources (respectively, consumption and time use) and measures of human capital at several stages of a child's development[3]. In this sense, this paper has a dual contribution for the literature: (1) it evaluates the degree of insurance of parents with respect to investments in their children's future, and (2) presents a practical method to combine three widely used American data sets: the National Longitudinal Survey of the Youth 1979 (NLSY79), the Consumer Expenditure Survey (CEX) and the American Time Use Survey (ATUS).

The role of imperfect insurance is well studied in the literature of consumption[4], but the addition of parental investments in children to the model poses new challenges. First, investment decisions have important dynamic implications. Parents are forward-looking and anticipate the effects of the allocation of time and expenditures on their children 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. The relevant theoretical model has features of a life-cycle model of consumption with nonseparability of utility over time, such as in models with habit persistence and durable goods[5]. Those investments that are complements over time have characteristics of habit persistence; investments that are substitutes have characteristics of durable goods (see Heaton, 1993, Cunha and Heckman, 2007).

Second, investments in human capital can take the form of expenditures (in the form of school tuition,

[1] See Duncan and Brooks-Gunn (1997) or Carneiro and Heckman (2003) for evidence.

[2] Leibowitz, 1974, is one of the first papers studying parental investment in children. It uses indicators of time instructing children and reading, finding a positive relation between investments and children's IQ.

[3] Todd and Wolpin, 2003, develop a framework for estimating the relation between child achievement and family and school investments under different levels of data availability. In this paper I focus on how changes in family resources change family inputs and try to assess the extent to which these changes are passed onto children outcomes.

[4] The hypothesis of complete markets has been rejected by data: see Attanasio and Davis, 1996, and Hayashi, Altonji and Kotlikoff, 1996. Cochrance, 1991, presents mixed evidence on the rejection of full insurance hypothesis.

[5] 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.

books, clothing or toys) or time (spent reading or teaching children, helping with homework or trips to museums and theaters). These different investments may generate different returns[6] and respond to different incentives. The opportunity cost of time spent in recreational or educational child care is market wage; children's goods can be acquired in the market.

The desirability of social policies (e.g., cash transfers for families with children, free preschool school programs or food assistance programs) depends crucially on how well households can privately insure against idiosyncratic income shocks, which in turn depends on the access to financial markets. For example, if parents cannot secure the resources to invest in their children early in their life, effects of negative idiosyncratic shocks may be transferred to the following periods. Policies can be designed to overcome, at least partially, the effects of negative shocks[7]. However, it is important to study empirically what actual households do when they receive income shocks for the effectiveness of policies. This paper is, to the best of my knowledge, the first attempt of evaluating how families respond to income shocks using data on changes in income, consumption, time dedicated to children and measures of child human capital.

To study the link between income shocks and parental investments in children I construct a new panel data set combining information on family income from the Children of the NLSY79 (CNLSY) with expenditures from CEX and time use measures from ATUS. I match multiple measures of parenting behavior, materialized in financial and time investments in children available across each child's life cycle and family characteristics on the CNLSY with expenditures and time use measures obtained from cross-sectional data. The method is based on the use of two data sets: (i) a primary data set where incomplete measures of investment in human capital are observed, (ii) an auxiliary data which contains both the incomplete and aggregated measures of investments. I, then, indexes that are interpretable in terms of uses of financial resources and time of parents.

Idiosyncratic income shocks are identified through local business cycles. More specifically, shocks are constructed using the Bureau of Labor Statistics' county unemployment rate after accounting for year and county effects. The persistence of the shock is inferred by studying its time series properties. The use of this variation has several advantages over statistical decomposition of income residuals. First, idiosyncratic variation in income is identified by unpredicted shocks on county's labor demand and does not rely on specification assumptions. Second, most of the evidence of responses to income shocks relying in decomposition of income residuals using U.S. data is based on samples of annual earnings or average hourly wages for continuously working, continuously married males, ignoring risk associated with job loss or illness[8]. However, using narrowly defined samples is likely to understate effects of the shocks confronted by agents, limiting the scope to study effects of policies to alleviate negative effects of shocks among poorer families. Finally, this method allows to distinguish between the effect of positive and negative shocks. This distinction is useful to study nonseparabilities in investments across periods. In particular, if life-cycle/permanent income model (LC/PIH) fails because of liquidity constraints, then households will be more likely to violate the LC/PIH when income is expected to growth (see Altonji and Siow, 1987, and Deaton, 1991): temporary high income draws are smoothed by saving but negative shocks are not smoothed unless household has wealth. If early investments complement later investments then parents increase investment in children if they face a pos-

[6] Guryan, Hurst and Kearney, 2008, show that high educated parents spend more time with their children.

[7] For example, using the same data of the current paper, Currie and Thomas, 1995, and Carneiro and Ginja, 2008, show that Head Start (a U.S. preschool program for poor children) may partially compensate effects of early deprivation. The first paper finds positive effects of the program on measures of cognitive skills; the later shows that the effects on schooling achievement and crime persist until later adolescence.

[8] See for example, Lillard and Weiss, 1979, Macurdy, 1982, Meghir and Pistaferri, 2004, Blundell, Pistaferri and Preston, 2008

itive shock whereas smooth effects of temporary income declines (which is similar to behavior in savings). Then, if families face negative shocks it is expected larger sensitivity on nondurable consumption (if credit constrained) than in investments in human capital (unless some investments can be substituted by others).

The identification strategy used does not come without costs, in particular, it does not allow to study the effect of shocks with different persistency and the instrument used has a larger predictive power for changes in earnings of more disadvantaged groups in the population.

My main findings can be summarized as follows. When there are surprise increases in the local unemployment rate (1) there are little changes on expenditures in children's education (even though families can only partially insure the effects of income shocks), (2) families substitute time spent in children's educational activities for leisure activities; and, (3) the effects of shocks on measures of child human capital (are imprecisely estimated but) suggest that effects of shocks are more likely to be transferred to noncognitive skills than to cognitive skills. I study different responses to shocks by type of shock (positive or negative), structure of age of children in family and mothers' education. In particular, (i) families of college of educated mothers rely on accumulated assets as buffer to shocks, whereas the non-college group uses welfare income, and (ii) transmission of shocks to human capital only occurs if shock takes place before child turns 10 and in families of less educated mothers. When facing a negative shock parents spend more time in leisure activities with their children, however, there is no evidence of changes in time spent in education related activities. If I allow the effects of shock to vary with the age of child I find that parents of children under age 5 are more likely to change their allocation of time in response to shocks, substituting time in education by leisure with their children.[9] This reaction is driven by the group of families of non-college mothers and can be explained by a larger substitutability in parents' use of time with children when these are younger: school age children have a more rigid distribution of their daily time. In terms of policy, parents re-allocation of time when facing negative suggests that cash-transfers may be insufficient to compensate for the effects of negative shocks in early childhood, so that they should be coupled with in-kind programs such as Head Start or Perry Preschool Program (which have been shown to have lasting effects[10]).

The paper proceeds as follows. Section 2 presents a brief review of relevant literature. Section 3 includes the predictions of a life-cycle model augmented to allow for altruistic parents that invest in their children. Section 4 develops a unique panel data of children's family income, labor supply, expenditures, time allocation and measures of child human capital to quantify the effects of unexpected changes in family income. Section 5 describes the empirical approach to analyze the link between income shocks and investment decisions. I discuss the econometric assumptions on families' information set that allow the use of local labor market shocks as exogenous variation for idiosyncratic shocks. Section 6 carries out several tests of formal tests of consumption insurance. Section 7 concludes.

2 Related Literature

There is a growing literature that tries to assess how poverty affects children's well-being and the role of anti-poverty programs ameliorating the effects on negative shocks suffered by their parents. In parallel, there has been an increasing amount of empirical work that rejects the hypothesis of full insurance by testing

[9] The measure of time spent instructing children is broad, and varies across children's life cycle. See Appendix A.

[10] See evidence on the effects of early interventions surveyed in Cunha, Heckman, Lochner and Masterov, 2006.

implications of the life-cycle model (e.g., Cochrance, 1991, Mace, 1991, Townsend, 1994, Hayashi et al., 1996, Blundell, Pistaferri and Preston, 2008). This paper links these two streams of the literature by analyzing one possible channel that links family's resources to children development: how well can parents insure their children when they face shocks to their resources? And, try to analyze to which extent are these shocks transmitted to child's human capital.

There has been work trying to income to children outcomes. Most studies suggest that income at early years have effects on adult ability and schooling outcomes. Permanent income has strong effect on children outcomes, and income is specially important for disadvantage children in their early years (see Duncan and Brooks-Gunn, 1997, Dahl and Lochner, 2008, Tominey, 2009). Cunha and Heckman, 2007, estimate a multistage technology of formation of cognitive and noncognitive skills. They present evidence of sensitive periods for parental investments: productivity of parental investments is higher at early ages for cognitive skills, and productivity is higher at later ages for noncognitive skills. Their results may explain the important of income at years.

However, less is known about the effects of income fluctuations on parents income on their decisions to allocate financial resources and time to their children. In a recent paper Cawley and Liu, 2007, show that employed mothers spend less time reading to their children, helping them with school work and in other activities related with children education.

Furthermore, evidence on the effects of maternal employment (which reduces the availability of time mothers can allocate to their children) in child development is mixed[11]. Blau and Grossberg, 1992, find that maternal employment has negative impact during first year of a child's life, but positive effects on the two subsequent years. James-Burdumy, 2005, finds that employment in the first three years of a child's life is associated with a decrease in tests scores. Bernal and Keane, 2007, show that children of working mothers who attend one year full day care have lower test scores between ages 3-5.

This paper draws from consumption literature that empirically assesses full insurance, and tests to which extent parents are able to insure their children. Because decisions of investing in children will build their human capital, which will be translated in their adult earnings and their well-being, there are nonseparabilities in decisions across periods. The next section sketches the testable implications of a life-cycle model with altruistic parents, that allocate time and financial resources to their children.

3 Theoretical Framework

In this section I present a simple life-cycle model to illustrate predictions of the theory when the textbook model is extended to account for altruistic parents. The model draws on Becker and Tomes (1979, 1986), and Cunha and Heckman (2007) who extended the model to include multiple periods of parental investment.

Consider one parent - one child family in a partial equilibrium framework. The parent has to decide how to divide (possible stochastic) income in each period among several alternatives. In each period t parent decides to allocate resources to his own consumption, c_t, the child's specific goods, g_t, and the amount of assets to leave for the next period, A_{t+1}. Parent's consumption good is the numeraire and q_t is the relative price of child's goods. The parent also allocates his time between the market, where he earns w_t per hour, leisure and child care activities, which include either outdoors activities with child or time spent developing

[11] See review in Bernal and Keane, 2006

child's cognitive skills including reading, helping with homework or attending school meetings[12].

The parent is altruistic and forward looking trying to anticipate the future outcomes of each period's t decision. He cares about child's welfare when she reaches adulthood, which is a function of her total human capital at age T h_T, when she leaves the house. There is no depreciation in child's human capital, and bequests must be nonnegative, $A_{T+1} \geqslant 0$. The child does not take any decision and the parent's investments are based on altruism.

The parent's utility in each period t, u_P, depends on the consumption of period t, c_t, and leisure, l_t. It is separable across periods and it depends on a vector of observable variables $\mathbf{z}_t$ and an unobservable variable ξ_t. The parent's problem may be written as:

$$\text{Max } E_0 \left[\sum_{t=j}^{T} \beta^t u_P \left(c_t, l_t, \mathbf{z}_t, \xi_t \right) + \varphi u_C \left(h_T \right) | I_j \right] \tag{1}$$

where β is the discount rate, and φ is the altruism parameter. $E_j [.]$ is the expectation operator and I_j is the information set of the parent at time j, $j = 0, ..., T$.

The technology of skill formation is generally specified as:

$$h_T = f \left(g_0 ... g_T, i_0 ... i_T, p_0 ... p_T, \varepsilon_0 ... \varepsilon_T, h'_T \right) \tag{2}$$

where h_T is the child's human capital when she leaves the parent's house, $\{g_0 ... g_T\}$ is the history of child consumption (or investments in children in the form of books, child care, or other goods), $\{i_0 ... i_T\}$ is the history of parental time investments in children, $\{p_0 ... p_T\}$ is the history of public investments in children, $\{\varepsilon_0 ... \varepsilon_T\}$ is the history of technological shocks and h'_T is parent's human capital.

In each period t there is also a time and a budget constraint. Time endowment is $\tau = i_t + n_t + l_t$, where n_t is time at work, l_t is parent's leisure, and i_t is time spent developing child's cognitive and noncognitive skills. There is a single asset in the economy which pays r_t in all states of the world and A_t denotes beginning of period assets. Assets evolve according to:

$$A_{t+1} = (1 + r_t) \left[A_t + y_t - c_t - q_t g_t \right] \tag{3}$$

where y_t is family income, which includes earnings, $n_t w_t$, and transfers, $\overline{y}_t$. Borrowing might be restricted, so that

$$A_{t+1} \geq 0. \tag{4}$$

Define λ_t and μ_t as the multipliers on the budget and credit constraints, respectively. The first-order conditions of maximizing (1) subject to (2), (3) and (4) are:

[12]It is possible to extend the model to include several types of time-investment in the child, including activities more related with leisure and other concerning child's education.

$$
\begin{aligned}
c &: \beta^t \frac{\partial u_P\left(c_t, l_t, \mathbf{z}_t, \xi_t\right)}{\partial c_t} = \lambda_t && (5)\\
A &: \lambda_t = E_t\left[\lambda_{t+1}\left(1 + r_{t+1}\right) + \mu_t\right] && (6)\\
g &: \varphi E_t\left[\frac{\partial u_C\left(h_T\right)}{\partial h_T}\frac{\partial f}{\partial g_t}\right] = \lambda_t q_t && (7)\\
i &: \varphi E_t\left[\frac{\partial u_C\left(h_T\right)}{\partial h_T}\frac{\partial f}{\partial i_t}\right] = \lambda_t w_t && (8)
\end{aligned}
$$

where $\frac{\partial u_P(c_t, l_t, \mathbf{z}_t, \xi_t)}{\partial c_t}$ is the marginal utility parent derives from own consumption when child is t years old, λ_t is the marginal utility of wealth. If the borrowing constraints are not binding, $\mu_t = 0$. Equation (5) is the usual textbook FOC for nondurable consumption; it states that marginal utility of consumption is equal to the marginal utility of wealth at time t. Conditions (7) and (8) are similar to optimality conditions in models with home production (see Becker and Ghez, 1975). These conditions state that parents' expected marginal utility of investing in child in terms of goods, g_t, or time, i_t, at age t should equate the forgone return of investing in the asset.

The production function of human capital plays a similar role in this model to stock equations in models of consumption with durable goods and habit formation. Complementarity of investments across periods is a feature of models of habit persistence.[13] In a model with durable goods[14] services of investments in one period last for subsequent periods (similar to the concept of self-productivity of investments in Cunha and Heckman, 2007). Depending on the functional form for h_T, the first order conditions for optimal investment will potentially depend on a large number of terms. Testing theoretical implications of such model impose extreme data requirements: in each period parents' decision depends on past investment decisions, through child's current human capital, and future decisions, which will be materialized in child's total human capital, h_T. The dynamics of the child's accumulation of human capital is related with parent's consumption in each period t through the marginal utility of wealth λ_t.

The Euler equations for human capital investments can be obtained by combining (6), (7) and (8):

$$
\begin{aligned}
E_t\left[\frac{\partial u_C\left(h_T\right)}{\partial h_T}\frac{\partial f}{\partial g_t}\right] &= E_t\left[\frac{\partial u_C\left(h_T\right)}{\partial h_T}\frac{\partial f}{\partial g_{t+1}}\frac{q_t}{q_{t+1}}\left(1 + r_{t+1}\right) + \mu_t\right] && (9)\\
E_t\left[\frac{\partial u_C\left(h_T\right)}{\partial h_T}\frac{\partial f}{\partial i_t}\right] &= E_t\left[\frac{\partial u_C\left(h_T\right)}{\partial h_T}\frac{\partial f}{\partial i_{t+1}}\frac{w_t}{w_{t+1}}\left(1 + r_{t+1}\right) + \mu_t\right] && (10)
\end{aligned}
$$

And the Euler equation for parent's consumption can be written as:

$$
\frac{\partial u_P\left(c_t, l_t, \mathbf{z}_t, \xi_t\right)}{\partial c_t} = E_t\left[\beta\frac{\partial u_P\left(c_{t+1}, l_{t+1}, \mathbf{z}_{t+1}, \xi_{t+1}\right)}{\partial c_{t+1}}\left(1 + r_{t+1}\right) + \mu_t\right] \quad (11)
$$

Without borrowing constraints, marginal utility of parent's consumption follows a martingale. In this case, consumption and investments do not depend on current resources. If period t credit constraint is binding, $\mu_t > 0$, the family under-invests in period t compared to $t+1$. Condition $A_{T+1} \geqslant 0$ is biding if

[13] See for example, Pollack, 1970, or Constantinides, 1990. Heaton, 1993, considers a model in which there are both stocks of durable goods and habits.

[14] See Mankiw, 1982, or Eichenbaum and Hansen, 1990.

parents want to borrow against child future income; this will be the case if parent expect child to have high future earnings.

Within period allocation of resources between expenditures and time-investments is independent of (short-term) credit constraints (Meghir and Weber, 1996). The parent equates expected marginal productivity of both types of investments, $E_t\left[\frac{\frac{\partial f}{\partial g_t}}{\frac{\partial f}{\partial i_t}}\right] = \frac{q_t}{w_t}$. Investments in any period only depend on the relative price between any two goods and is independent of the interest rate. Credit market imperfections will appear on intertemporal conditions: conditions (9) and (10) depend on interest rate, specific price appreciation and are not robust to credit market imperfections.

The technology of skill formation and excess sensitivity/smoothness to income shocks I now describe the implications on the investments patterns using a version of the above model solved for two periods, with one type of investments (g_t) and without uncertainty.

Figure 1A presents predictions for a model without uncertainty, no credit constraints and with equal relative productivity of investments across periods, so that the only sources of heterogeneity across families are first period income and degree of complementarity of investment across child's life cycle, ρ. The larger the complementarity of investments across periods (smaller ρ), the larger the proportion of period 1's income, y_1, spent in the child's investment. Complementarity implies that spending is balanced across the two periods of life; but if income in first period is low and investments are more substitutable across periods, parents will spend a smaller fraction of income y_1 in human capital. In both cases, parent smooths consumption across periods (see panel for parent's consumption). Relative productivity of investments across periods θ_2 plays role similar to the elasticity of substitution, $\varepsilon = \frac{1}{1-\rho}$, reinforcing dynamic complementarity across periods.

Figure 1B adds credit constraints to the model. The constraint is binding for all families with $y_1 < \frac{y_2}{1+r}$,. The parent is no longer able to smooth his consumption if he is credit constrained. Credit constraints imply a discontinuous behavior of consumption and investment decisions around $y_1 < \frac{y_2}{1+r}$ and the propensity to save out of period's 1 income increases faster for families where investments g_1 and g_2 are more substitutable. Constrained families with $\rho = -0.5$ invest a higher proportion of period's 1 income to compensate for low substitutability of investment across periods and children suffer more damages in their final human capital due to credit constraints.

If investments in children are complements over time in the production of human capital then they have characteristics of consumption goods with habit formation. This feature induces excess smoothing, specially, if families face shocks early in the child's life, when some investments might be critical (see Deaton, 1987). If investments are substitutes over time then one may expect some excess sensitivity in reaction to income shocks with parents postponing investments that are less sensitive to child's development and smooth nondurable consumption (see Browning and Crossley, 2009).

What about substitutability of investments within periods? A labor market shock may change the relative price of time if families become unemployed or if they face a reduction in their hourly wages. Therefore this shock induces a price and an income effect, even if total family resources are not affected by the shock. If time and goods investments are normal goods, a decrease in wage decreases the relative price of time-investments. Both time and expenditure investment decrease by income effect. Substitution effect implies a substitution of expenditures by time-investments. Then, expenditures decrease and effect on time use depends on whether substitution or income effect dominates. However, for poorer families investments in terms of time are inferior

goods (see Section 4.1), and a decrease in wage is associated with an increase in time with children.

It is possible that parents choose different types of activities with children: spending time predominantly developing their cognitive (e.g., reading to children or helping them with the school work) or noncognitive skills (e.g., taking children out to visit relatives or encouraging hobbies). Within period substitution of these types of investments may vary across families and with children life-cycles (they can be more substitutes when children are younger).[15]

4 The data

For the primary analysis, I use data on females from the National Longitudinal Survey of the Youth of 1979 (NLSY79) combined with the panel of their children, the Children of the National Longitudinal Survey of Youth of 1979 (CNLSY) covering the years of 1979-2006. 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 cross-sectional sample representative of the noninstitutionalized individuals that comprises half of the sample, (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. For most of the paper I exclude the oversample of disadvantaged families and supplemental military sample and I consider robustness checks including these groups of families.

Although CNLSY is rich in measures of parental investments in human capital, these have some disadvantages. First, these measures might be too disaggregated to make inferences about effects of income changes on the use of resources and time[16]. Second, being categorical it is difficult to interpret them as use of financial resources and time. Finally, one could use aggregated indexes of parenting variables available from the CNLSY. However, equations (9), (10) and the intratemporal condition suggest that investments in terms of time and goods depend on different relative prices. A shock to county unemployment rate (the exogenous variation used in this paper) will likely change the relative price of investments in time-goods, $\frac{w}{q}$, and an aggregated measure of investments will be uninformative about the effects of income shocks caused by unexpected unemployment. Therefore, I re-scale investment variables in the CNLSY by expenditures and time measures available from complementary data sets: Consumer Expenditure Survey (CEX) and America Time Use Survey (ATUS).

[15]Parents' expectations about a child are another determinant of investments. If parents are altruistic and predict high future earnings for a child, they will try to borrow against her income to invest in her future. This is not possible and these type of constraints are operative at child level and will determine reactions towards specific children within the family (depending on each child's production function). If parents have very low expectations about a child's future they may regard investment in children as nondurable consumption: investments do not accumulate over time, and because parents are altruistic they may leave her a bequest. In the CNLSY I do not observe transfers between parents and children, but it is possible to test for the effects of shocks on parents' expectations about children's future. I will address this issue in future research.

[16]See, for example, "the number of push toy child has before turn three years old".

4.1 Descriptive analysis of the data

A number of selection criteria were imposed in the sample. I exclude children (and their families) for whom there is no information on the county of residence and observations for which it is not possible to infer mother's marital status or family size.[17] Also, observations with missing information on welfare or mother's labor supply are selected out, as welfare is a source of insurance for poor families and because mother's labor supply provides an indicator of time use. Finally, I exclude from the sample those children without a complete HOME score, from which the majority of measures used as investment in human capital are obtained. After imposing these restrictions, the remaining sample is a unbalanced panel of children that are observed at least twice. This sample selection is replicated in the CEX and ATUS (see Tables A1-A3 in Appendix A). More details are provided in Appendix B.

Table 1 compares NLSY79, CEX and ATUS in terms of demographics and socio-economic characteristics for the years in which the data overlap. By construction, the average age of mother is similar in all data sets. Family size is similar in all data sets, but families in the NLSY79 tend to have less children 0-2 years old than CEX and ATUS and the NLSY79's families have fewer children then CEX and ATUS. Women surveyed by the NLSY79 are more likely to have a high school degree, but less likely to be dropouts than mothers in the CEX and ATUS. The proportion of whites in the NLSY79 and CEX is similar, but ATUS over-samples whites; when the entire period of 1980-2000 is pooled together the proportion of married women is larger in CEX than in NLSY79, but it also slighter higher in this data for the years of 2004-2006 than for ATUS. The proportion of women working is similar in all three data sets, but women tend to overreport hours worked both in CEX and NLSY79 when compared to the ATUS.[18]

To understand the time mothers have available for child care, Figure 2 shows the distribution of hours worked per week by mothers: mothers tend to work either full-time (working 40 hours per week) or stay out of the labor market. Mother's labor supply and family income vary across child's life, in particular, Figure 3a shows that average number of hours worked by mothers increases with child's age and Figure 3b presents similar patterns for total family income[19].

Combination of CNLSY with CEX and ATUS To construct indexes of investment in the CNLSY I use auxiliary information available in CEX and ATUS. The goal of this procedure is to create aggregated indexes and reduce the number of measures of investment. Information in the CNLSY is in the form of categorical or dichotomic variables and CEX and ATUS contain both the information on aggregates of expenditures and time use, respectively, and it is possible to infer if expenditure/activity is undertaken.

From CEX and ATUS I recover the relationship between aggregates and individual components of indexes; this relation is used to construct aggregated indexes in the CNLSY. Given that information on the CEX and ATUS is available at household level, I start by aggregating child level variables for each family in the CNLSY. The next subsection presents the details on the data sets used. Details on assumptions and method used to combine the three data sets can be found in Appendix A.[20]

[17] Information on marital status allows me to control for risk associated with being single, divorced and widowhood.

[18] Tables D1 and D2 present the mean, standard deviation and observations available per age for measures of parenting and cognitive and noncognitive skills per age used in the empirical analysis. See Table A4 in Appendix A for the definition of each measure.

[19] Income figures are residuals of a regression on dummies of family size and year effects.

[20] I assessed if measurement error of parenting measures available in the CNLSY was severe up to the point that correlation of these variables with families' socioeconomic characteristics was random. For the following variables: number of books child

4.1.1 Evolution of consumption and time across child's life cycle

Expenditures I study how expenditures available in CEX in child specific goods, that are used to construct indexes in CNLSY, vary across child's life cycle. Since there are few families in CEX in the relevant cohort (1955-1965) with children in the early 1980s, I analyze the co-movement and variability of nondurable consumption and expenditures in education between 1983 and 2000.

The measure of nondurable consumption is the same used in Blundell, Pistaferri and Preston, 2008 (includes food - at home and away from home, alcohol, tobacco, services - heating fuel, public and private and private transports, personal care, clothing and footwear). Expenditures in education include baby sitting, day care costs, elementary and high school tuition, school books, expenditures in magazines, newspapers and toys/hobbies. This last set of variables was chosen to be matched with child care and type of school attendance indicators available in CNLSY and indicators of purchase of magazines and newspapers, number of books the child has and toys and hobbies encouraged by parents[21]. In results not reported in paper, I found that, across years, (i) expenditures in education and non-durable consumption are closely correlated and (ii) inequality in expenditures in education is five times larger then inequality in nondurable consumption.

Figure 4 presents mean and variance of expenditures by age of youngest child in household using CEX data. The scale for mean of expenditures in education is on the left hand side, whereas scale used for nondurable consumption is on the right hand side. These figures suggest (i) a large drop in expenditures after age 6 and (ii) inequality in expenditures in education across child's life is larger than in nondurable consumption. Deaton and Paxson (1994) note that, for a given cohort, consumption inequality should increase with age. However, they focus on nondurable consumption. In a model where investments in human capital are linked across periods by the production function of human capital, large inequality in investments at early ages could be transferred to large inequality in individuals' human capital later in their life. The inequality will be larger the more complements are early investments for later investments in the production human capital.

Figure 5 compares the re-scaled and original variable: both the left-hand and right-hand side panels show lower variability of the re-scaled variable in NLSY79 compared with original variable. This is a result of using observe cells of observed characteristics to combine the data.

Time Use Figure 6 shows how allocation of time for the two main measures used varies with the age of youngest child in household: time parents spend in educational activities and time socializing with children in ATUS[22]. This data is only available for 2003-2007 so only relations with child's life cycle are analyzed. The number of hours mothers spend teaching a child is fairly constant with the age of youngest child in family in ATUS, which can be explained by the broad nature of activities included in this variable. There is, however, larger variability at schooling age. Social activities decrease with children's age (reflecting the fact that as

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has, number of times child eats with both parents, whether child is taken on outings with friends and family, whether family encourages hobbies, whether family receives magazines and newspapers, if the child has a music instrument at home and if child gets special lessons, "investment" increases with mother's education, family income, mother's age and with being married, it decreases with family size and with age of child. Information extracted from these variables varies in expected direction.

[21] See Appendix A for description of matching of NLSY79 and CEX. See Appendix B for construction of variables of child care and school attendance from CNLSY.

[22] In ATUS *Time in Education* includes: "Teaching household children (helping, teaching and activities related with educational activities), "Talking/listening house- hold children", "Reading to household children". *Time socializing* includes "socializing", "organization and planning for household children", "arts and crafts with household children, attending household children's events", "playing with household children (includes sports and nonsport activities)".

children get older, they spend more time with friends/colleagues)[23][24].

4.1.2 Income elasticity of expenditures in children and time use

To analyze the relationship between income and investment in children I estimate Engel curves using data from the CEX and ATUS. These are important to understand the scope of variation with income shocks. A simple way to assess how shares of expenditures (and time) vary with income is to estimate kernel regressions. The shape of nonparametric Engel curves allows to infer the degree of income elasticity of children's specific expenditures and to compare it with the elasticity of other household expenditures as food consumption and transportation, which have been analyzed elsewhere (see, for example, Banks, Blundell and Lewbel, 1997). Although nonparametric estimates are informative about income elasticity, they limit the use of covariates, and budget shares allocated to children's items can be affected by age of mothers and their education, for example[25]. To overcome these problems, Tables 2 presents parametric estimates of the following model for each family f in year t using data from CEX (Panel A) and ATUS (Panel B):

$$w_{ft} = \beta_0 + \beta_1 \ln Income_{ft} + \beta_2 \ln N_{ft} + \beta_3 \mathbf{x}_{ft} + e_{ft}$$

where N is the family size and $\mathbf{x}$ is a vector of controls. Table 2 presents the marginal effect of income and this is allowed to vary with age of youngest child in household (0-2, 3-5, 6-9 and 10-14) and across the distribution of income (marginal effects are computed at percentiles 25, 50 and 75).

Expenditures For CEX, I estimate regressions of w_{ft} on $\ln TotalExp_{ft}$ (see Deaton and Paxson, 1998). As subcomponents of expenditure and total expenditure are constructed from the same measure, they are inevitably correlated. To account for measurement error in total expenditure, I instrument it with total family (after taxes) income. I control for shifters in share by including in $\mathbf{x}_{ft}$: quadratic on mother's age, number of children ages 0-2, 3-5, 6-9 and 10-14 in household, number of household members older than 16, marital status, education of mother (indicators for high school degree and college attendance), indicator for labor market participation of household head, indicator for mother being white and year effects. The specification estimated allows the share to vary with the age of the youngest child in family and to vary nonlinearly with $\ln TotalExp_{ft}$ and $\ln N_{ft}$, by including their square.

Estimated marginal effects presented in Table 2-Panel A show that it is not possible to reject the null hypothesis that the change in share of expenditures in child care, tuition, newspaper, books and toys and child cloth presented in column (1) is zero when income varies by 1%. This suggests that these are normal goods. However, the magnitude of marginal effects for families in first quartile of expenditures suggests that these might be necessity goods for these families. Expenditures related to children school (presented in columns (2) and (3)) have unit elasticity - the marginal effect of $\ln TotalExp_{ft}$ cannot be distinguished from zero. Children's clothes and hobbies and toys are inferior goods for the poorest families (at the 25^{th} percentile of

[23] Time in educational activities is increasing with the number of children (varies between 1-2.5 hours/week), whilst time socializing is constant with the number of children (and around 10-11 hours/week).

[24] Parents concentrate time devoted to children education in week days; leisure related activities done together with children are more likely to take place at weekend (e.g., sports with children and arts and crafts activities with them).

[25] Auxiliary nonparametric estimations of Engel curves using CEX restricted to household with 1 or 2 children (separately) for separate years resulted in noisy variation of shares with income. Engel curves for food displayed a convex shape, which is conform with previous estimates.

total expenditure), but are normal goods for richer families (this explains the large negative marginal effect for expenditures in children for families in the first quartile of the income distribution). Columns (6) and (7) present estimates for goods usually analyzed: food at home and services. The share of expenditures of this last set of goods is convex with total expenditure, being necessities up to percentile 50 of expenditure and normal goods thereafter.

These estimates suggest that changes in family resources will have effects on the allocation of expenditures: the larger elasticities found in poorer families imply that shocks in this group may expose young children to more damaging effects due to deficit of food, but also due to other expenditures that contribute to the quality of child's environment such as child cloth, toys, child care and school[26].

Time Use Income elasticities for several shares of time use of mothers are presented in Table2-Panel B[27]. Column (1) includes estimates for hours of work: this is a luxury good for mothers of 0-2 children in first quartile of income distribution and for mothers at percentiles 50 or 75 of income distribution whose youngest child is 5-14 years old.

Time spent by mothers in child care is more sensitive to income changes if there are children 0-5 years old. In particular, it is an inferior good for mothers in first quartile of income distribution, suggesting that as their income decreases they spend more time with children (these mothers more likely to become unemployed), but it turns into luxury good for mothers in 50th and 75th percentiles of income distribution. Dividing time mothers spend caring for children into time helping in child's education (child care-teach) and recreational care (child care-play) I find that both these measures are normal goods for all age groups and across income distribution, except for time in recreational care for children 3-5 years old (an inferior good for poor mothers).

Columns (5) and (6) present measures of time for activities not related with child care: sleeping and personal care are normal goods.

To conclude, the large income elasticities found in expenditures and time related to children in poorer families and families with younger children (0-5) indicate that this is potentially the group that responds the most to fluctuations in resources.

5 Empirical strategy

Optimality conditions for model presented in Section 2 show that (i) parental investments at period t depend on past investments and expected return of future investments, and (ii) with perfect credit markets investments at period t, decisions are independent of current income. The second implication means that family f is full-insured against income fluctuation if consumption is determined by aggregated consumption, independently of the history of shocks (see Townsend, 1994). In particular, under full insurance $\beta = 0$ in model below:

$$\ln c_{fct} = \beta \ln y_{fct} + \nu_{fct} \tag{12}$$

[26]Figure A1 in Appendix A shows that most of the expenditures typical of children in CEX are complements: there is a monthly co-movement between expenditures in school tuition, school books and child cloth's. These expenditures pick in August and September, just before the start of academic year.

[27]I restrict estimates of Engel curves to time of mothers because information from CNLSY is collected from mothers. Notice that some of time use estimates in main regressions include activities of the family, including time of both mother and father (if mother is married).

where $\ln c_{fct}$ is the log of per capita family consumption of family f living in county c in year t and $\ln y_{fct}$ is the log of family per capita income. However, income and consumption are likely correlated through omitted variables included in ν_{fct}. For example, the error term ν_{fct} will include taste shocks (e.g., the arrival of a new child to the family) and measurement error in income and consumption (i.i.d. measurement error in income causes attenuation bias, which may lead to false non-rejections of full insurance). Therefore, any variable uncorrelated with preference shocks and with measurement error in income and consumption is valid instrument for $\ln y_{fct}$. So, the first step is to find exogenous variation for measures of family income. Given that most individuals in the sample are employed (participation rate in NLSY79 is about 75% among women and 90% among men), I use local business as exogenous variation for unanticipated income changes, following an approach similar to the use of weather shocks by Wolpin, 1982, and Paxson, 1992.

Measure of income shock There are two ways to study how consumption/parental investment responds to unanticipated income changes. One approach relies on identifying episodes which unexpectedly change family resources, such as weather shocks in developing countries (Wolpin, 1982, Paxson, 1992), lay-offs (Gruber, 1997, Browning and Crossley, 2001, Stephens, 2002), illness (Cochrane, 1991, Gertler and Gruber, 2003, Angeluci et al., 2009) or randomization in introduction of policies (Johnson, Parker and Souleles, 2008). A second approach measures shocks as deviations from observable income determinants and uses covariances restrictions on these shocks imposed by a theoretical income process, such as in Hall and Mishkin, 1982, Blundell and Preston, 1998, Heathcote, Storesletten and Violante, 2007, Attanasio and Pavoni, 2007, Blundell, Pistaferri and Preston, 2008, and Guvenen and Smith, 2009. I use the variation induced by local business cycle in family resources.

I obtain local business cycles from an external data set. Official local unemployment rate in the U.S. is measured from the Current Population Survey (CPS), the monthly household survey that is designed to represent the civilian noninstitutional population[28]. The time-series of unemployment rate for each county from 1976 to 2006 is available from the Bureau of Labor Statistics. I assume that county unemployment rate is composed by three components: county and year effects and county-year shock, ε_{ct}, which I call the *local business cycle*:

$$u_{ct} = \pi_c + \pi_t + \varepsilon_{ct} \tag{13}$$

the county fixed effects π_c accounts for counties' characteristics that are stable in time and that affect unemployment rate (e.g., the level of resources, size and legal relation of county's authorities with federal, state and municipal entities that are constant in time and determine counties' government scope for intervention) and the year effects π_t account for uninsurable economy-wide shocks.[29] I also study the time series properties

[28]The CPS sample covers approximately 60,000 households and is twenty times larger than the representative subsample of the NLSY79 used as baseline sample is this paper.

[29]Counties in U.S. are the local level of government below the state and there are 3,141 counties or county-equivalent administrative units in total with an average 62 counties per state. The average county population is about 100,000 inhabitants, with the most heavily populated county being Los Angeles County, California (with a population of 9,880,000) and the least populated county is Loving County, Texas (58 inhabitants). The scope of power of the counties' governments varies from state to state, as it does the relationship between counties and municipal governments. It is possible to group the scope of counties' power in three groups (see http://www.naco.org.): (i) minimal scope, typical of New England counties, where most of the power is either executed at state or municipality level, (ii) moderate scope, where counties provide, at a minimum, courts, public utilities, libraries, hospitals, public health services, parks, roads, law enforcement, but few counties provide public transportation themselves, and jails, and (iii) broad scope, as in more populated counties which provide many facilities, such as airports, convention centers,

of local business shocks to relate persistency in aggregate and idiosyncratic shocks.

The use of local business cycles as exogenous variation to families' resources is not without problems. First, the relevance of the measure of shock used could be undermined by the difference between county of residence and place of work. From the NLSY79 is only possible to identify respondents' county of residence but the County-to-County Flow Files from the 2000 Census show that 1/3 of employed individuals do not work in county of residence. However, this mismatch should not be a concern as substate labor force estimates from the BLS are measured by place-of-work but adjusted using Census data to develop "residency adjusted measures" for each Labor Market Areas (LMA).

Second, although local business cycles are likely exogenous to families' decisions, other possible sources of endogeneity can result in biased estimates of β in (12). Families can insure against some shocks, but others are insurable at family level. To account for common shocks to all families I include controls for year effects in the model to be estimated, which should account for annual shocks at the US level. But because different counties have different characteristics (e.g., natural resources, county size and type of neighborhood and local networks) which may affect transference of local business cycles to families, I also include county fixed effects when estimating model (12). The county fixed should have a dual role: they account for cross-county differences in with respect to possibility of insurance, but also for the difference in sampling of counties in the NLSY79 and the CPS[30].

Third, even after accounting for year and county effects there are still common shocks to families living in a county, for example, (i) taste shocks ν_{fct} may not be independent across individuals and rejections of full insurance could result from sorting more informed individuals can sort across better counties; (ii) or it is possible that supply of local services might be correlated with county shocks. For example, the effects of a positive employment shock in county might be overestimated if, simultaneously, local authorities decide to expand public child care services, so that more women enter in the labor market (this is unlikely to be the case as effects of increase in provision of services are not immediate, specially if supply of services is limited by current capacity). I account for these possibilities in two ways. I start by including a set of county-year variables in (12), X^c, which can be either a county specific trend or county's per capita wage obtained from an external data set - the Bureau of Economic Analysis (BEA)[31]. Therefore, the model to be estimated will be:

$$\ln c_{fct} = \beta\varepsilon_{ct} + \alpha X^c_{ct} + \pi_t + \pi_c + \nu_{fct}. \tag{14}$$

Finally, to account for possible for omitted family characteristics at family level that may correlated with the taste shock ν_{fct} I estimate models that include controls for a polynomial in mother's age (which are associated with differences in earnings capacity across ages), marital status, education and age structure of children in family (presence of children age 0-2, 3-5, 6-9 and 10-14). However, if the shock, ε_{ct}, is truly exogenous to families' decisions it should be orthogonal to X_{fct}.

Unbalanced Panel The NLSY79 is not a balanced panel with some mothers (and their families) not participating in the sample in some years. Out of the 11 years of data used, on average, mothers (and their

museums, beaches, harbors, zoos, clinics, law libraries, public housing, courts, law enforcement and child and family services and other welfare services.

[30]Note that individuals were first selected to the NLSY79 in 1978 and move their site of residence over the years, whereas households are sampled into the CPS in an annual basis.

[31]County's per capita wage is obtained dividing total wages by total employment from the BEA.

families) are surveyed 6.8 times (standard deviation is 2; 26% are present in 5 or less waves). I account for differences in families that select into the survey in different years making some assumptions about the error term. Specifically, I assume that error ν_{fct} is divided into two components: a permanent component, π_f, and an independently and identically distributed error u_{fct}. Therefore,

$$\ln c_{fct} = \beta\varepsilon_{ct} + \alpha X_{fct} + \pi_t + \pi_c + \pi_f + u_{fct}. \tag{15}$$

Identifying Assumptions One difficulty in evaluating the effects of idiosyncratic changes in resources on household decision is to find testable variables unrelated with the error term (see review in Japelli and Pistaferri, 2009, and discussion in Ham and Jacobs, 2000). However, the unpredictable component of county unemployment rate is based on individuals outside the NLSY79 and not decision variables for these families. Additionally, the use of external data set for shock minimizes potential correlation with measurement error in income and consumption.

First, local business cycles should provide marginal variation to family resources once aggregated shocks are accounted for. This might not be the case if families do not value local information or if incorporate it slowly in their decisions (see Pischke, 1995). For example, if a worker is laid-off he might not recognize immediately if this is due to his own performance, firm specific conditions or local recession. But, as the level of information used here is set a much more disaggregated level than economy wide conditions, local labor market shocks are likely to impact individuals. Therefore, this strategy assumes that at county level consumption/income is part of consumers' information set (as in Deaton and Paxson, 1994, and Blundell and Preston, 1998).[32]

Second, families should not be able to predict shocks, $\varepsilon_{ct+k} \perp \ln y_{fct}$ for $k > 0$. Third, error u_{fct} should be serially unrelated within families, $Cov\left(u_{fct}, u_{fct-k}\right) = 0$ for all k. Fourth, error u_{fct} should be unrelated across families, $Cov\left(u_{fct}, u_{f'ct}\right) = 0$ for $f \neq f'$.

Finally, I also estimate models with family earnings and income as endogenous, using the local business cycles as exogenous variables. This allows to learn about what type of families' resources are affected by the local business cycles. Also different families may be differently affected by the type of shock used, so in empirical analysis I allow the effects of shocks to vary with families' characteristics.

Comparison with other approaches[33] The use of local business cycles as exogenous variation provides a clear source of variation for families' resources, which can be interpreted as shocks in labor demand. Alternative statistic decomposition of residual income imposes usually too many data restrictions when selecting the relevant sample (see studies for the US by Blundell, Pistaferri and Preston, 2008, or Lillard and Weiss, 1978, that focus on families of married males among other restrictions). The NLSY has some limitations to apply this type of procedure. First, the panel of the Children of the NLSY is based only on children from women in the NLSY79. Second, restricting the sample to families of continuously married mothers will likely underestimate the risks faced by families, in particular, will ignore the group of credit

[32] An alternative way of measuring local business is to use the same type of decomposition for county wage. However, wage is only observed for employed individuals, so this measure of local business cycles would provide larger marginal variation for resources for families closer to the top of income distribution, who are less likely to move and out of the market.

[33] Future drafts will include explicitly estimated effect using a statistical decomposition of residual income distinguish between permanent and transitory shocks. One difficulty of NLSY79 in using this technique is the biannual nature of income in this survey after 1994.

constrained families, who may use poverty alleviation programs such as the AFDC/TANF, Head Start or Medicaid. Finally, the underlying sources of risk are not specified.

Papers that use a statistical decomposition of shocks assume that

$$\ln y_{fct} = \theta_1 \varepsilon_{ct} + \theta_2 X_{fct} + \pi_t + \pi_c + u_{fct} \quad (16)$$

$$u_{fct} = p_{fct} + v_{fct} + m_{fct} \quad (17)$$

where p_{fct} is a permanent component that follows a random walk, $p_{fct} = p_{fct-1} + \xi_{fct}$, v_{fct} is a transitory shock that follows an $MA(q)$ process and m_{fct} is classical i.i.d. measurement error[34]. Using local business cycles as exogenous variation leaves unspecified the process for families residual income u_{fct}.

The approach followed in this paper is closer to Attanasio and Davis, 1996, Ham and Jacobs, 2002. The first paper uses grouping techniques and instrument current wage with past and/or future wages to correct for measurement error in wages. The second paper uses the unemployment rate in the household head's occupational category as testing variable for the hypothesis of full insurance.

6 Results

The goal of this paper is to study how well parents can isolate children from fluctuations in family resources. This matters because parents' financial resources can be used to buy goods and better environments for their children, and time can be spent in several activities with children either developing their cognitive or noncognitive skills or both. For this purpose I re-scaled parenting measures in CNLSY to infer the mechanism through which resources affect a child's human capital. In this section I carry out formal tests of insurance to income shocks, starting by estimating the effects of shocks on families' decisions.

The sample used in main results covers 11 years of data (CNLSY is biannual) and contains 889 counties. So I am left with 9779 cells of unique values for the shock - this is the exogenous variation used in the paper.

Figures 7 and 8 provide descriptives of the shock used. Figure 7a shows the density of shock and Figure 7b presents yearly variation of shocks. The shock varies between unexpected decreases of 4% in unemployment and increases of 6%. Figure 7b shows yearly variation across counties since 1976 and 2006: the standard deviation of the shock is 1.8%, and inequality has been fairly stable since 1986. Figure 8 demonstrates the variation of income measures and labor market outcomes with unemployment shocks: (i) increases in unemployment decrease average number of hours worked by mothers; (ii) family income decreases smoothly with increases in unemployment rate, and increases steeply if unemployment decreases; (iii) average family earnings decrease with unemployment, and (iv) family unearned income is convex, increasing steeply with large decreases in unemployment (via increase of private transfers) and increasing smoothly with unemployment (via increase in public transfers).

All results are presented for three main samples: a representative sample of families and by mothers' education (non-college and at least some college). All standard errors are obtained by block-bootstrap with 250 replications to account for common shocks within county (the block is the county).

[34] See, for example, MaCurdy, 1982, Abowd and Card, 1989, Gottschalk and Moffitt, 1995, Meghir and Pistaferri, 2004.

6.1 How do labor market shocks change family resources?

Table 3 presents estimates for the following model for measures of family income and labor market participation (mothers' labor market participation, family earnings and total family income)[35]:

$$\ln y_{fct} = \gamma_0 + \gamma_1 X_{fct} + \gamma_2 \varepsilon_{ct} + \pi_f + \pi_c + \pi_t + \eta_{fct} \tag{18}$$

where γ_2 captures the variation of income induced by the shock. X_{fct} controls for tastes shifters determined by demographic structure, in particular it includes: quadratic of mother's age, quadratic of family size, indicators for the presence of children 0-2, 3-5, 6-9 and 10-14 years old in family and mother's education. Model also includes family effects, π_f, year effects, π_t and county effect, π_c (see Section 5).

Column (1) shows that a 1 percentage point increase in unexpected unemployment decreases participation of mothers by 0.8 percent. As expected the main variation of this shock on family resources comes through family earnings: a 1 percentage point shock implies a drop of 1.6 percent in earnings; in comparison the effect of the same shock on total family income is 1.1 percent.

Regarding the results presented in columns (1) to (3) of Table 3 three questions arise: (1) Are families whose members have permanent labor contracts affected by shocks to the same extent as families whit temporary contracts?, (2) Do families perceive the unexpected unemployment rate as shock? Or, can they predict it?, finally, (3) Does the scope to insure shocks vary across families? This is the first set of questions I handle before presenting evidence on the response of families' consumption choices and allocation of time to shock.

Does shock affect all families equally? To answer the first question I divide the sample by mother's education: non-college and at least some college attendance[36]. I use this as a proxy for stability of attachment to labor market. As expected families in the less educated group are more vulnerable to unexpected increases in the unemployment: only participation of mothers that hold a high school degree or less is affected by shock, and their family's earnings are also more vulnerable to the shock (1.6% vs 1.4% for more educated families).

To assess the power of these responses to shocks, I performed two additional tests: (i) I re-estimated model (18) using the entire sample of the NLSY79 for the years of 1986-2006 in results presented in Table C1 - including males and females without children; (ii) as shock may affect families with more than one earner differently, I allow the effects to vary by marital status. Estimates in columns (1) to (3) of Table C1 suggest that the shock does not affect participation rate but a shock of 1pp is associated with a 3.8 percent change in earnings and no effect on total family income. In results not included in paper I investigated whether the effects on earnings could have been driven by changes in the intensive margin of participation: I find that a shock is associated with decrease in both the number of hours worked per week and in the number of weeks worked per year[37]. Columns (4)-(6) and (7)-(9) present estimates separately for females and males,

[35] See Appendix B for definition of income measures.

[36] Results are qualitatively the same if sample is divided by family's permanent income setting a threshold for low-high permanent income at the median (see Appendix B for computation of permanent income).

[37] For sample used in columns (1)-(3) of Table C1 point estimates on the unemployment shock are -30.66(9.08) and -25.07(11.01) for hours worked per week and weeks worked per year, respectively (standard errors presented in parenthesis). For the sample of females the coefficient estimates for hours worked per week and weeks worked per year are -31.81(12.99) and -26.15(16.11). For males these coefficients are -27.80(11.36) and -20.86(10.93), respectively.

respectively, allowing the effect to vary by education group. There are no effects on participation rate in the college group; the large effect on earnings is driven by families in the low education group, and effects on total family income appear only the group of non-college group.

Columns (1)-(4) of Table C2 in Appendix C present estimates for married women from main sample and columns (5)-(7) for single women. All specifications allow effects to vary with mother's education. Columns (1) and (2) reveal that the shock does not affect participation of women or their spouses in married families. However, a 1pp shock is associated with a 4.8% change in family earnings for families in the non-college group (which are driven by effects on the intensive margin of participation for females); column (4) shows that the effect on earnings is passed onto income of families in both education groups. Single mothers of both education groups are quite sensitive to labor market shocks: their participation rate decrease and there is a large drop in earnings (see columns (5) and (6)); but, for both education groups, the shock is not transferred to total income.

Concluding, single mothers account for most of the movements in and out of the market due to shocks[38]. Inspection using the entire sample of the NLSY79 (regardless of gender of respondent) reveals that the number of hours worked in the non-college group decreases (either females or males), which decrease family earnings. Individuals affected by lay-offs may seek alternative forms of employment (temporary jobs), so that the annual effects of the shock is only detected at the intensive margin, therefore affecting total earnings. Finally, Table 3 shows that only total family income in families of college mothers responds to this shock.

Can families anticipate the shock? As discussed in Section 5, the identification approach used will not be valid if families can anticipate local labor market shocks. If this is the case then they will incorporate it in their plans and the shock will not affect consumption. Table 4 suggests that this unlikely: family unearned income and family total income in period t does not predict shock families receive in period $t+1$. The shock is a true "surprise" to families and future shocks are not part of families' information set.[39]

Confirmation that shock is truly a shock to families is especially important because local labor shocks are fairly persistent. I studied the time series properties of the residual unemployment rate. Combined evidence from variance-autocovariance matrix and partial autocorrelations suggests that the stochastic process can be described by an ARMA(1,1)[40]. I then estimated the parameters of the process for the time series of unexpected county unemployment rate and separately for the time-series of each county. Panel A of Table 5 presents estimates of the stochastic process of county shock by Equally Weighted Minimum Distance for AR(1) and ARMA(1,1) processes; Panel B of same table presents the distribution of estimates of an ARMA(1,1) model for each county's shock. The autoregressive coefficient estimates in columns (1) and (2) of Panel A present values very close to .8 (.78 and .83 assuming an AR(1) and ARMA(1,1), respectively). The moving

[38]This is accordance with Meyer, 2002, that argues that adjustments of single mothers to EITC occur at extensive, not intensive, margin.

[39]This assumption is similar to the "No foresight" assumption used by Blundell, Pistaferri, and Preston, 2008, to identify the effect of transitory shocks.

[40]By estimating the unrestricted (time-varying) variance-covariance matrix of the shock estimated from the BLS time series for unemployment rate (not included in paper) it is possible to infer about the transitory component of shock. The signs of first order autocovariances are positive, and most of them are significant suggesting that the shock persists for at least one year; although smaller than first order autocovariances, second order autocovariances tend to be significant in most years. The large drop from first to second order autocovariances suggests a first order moving average process. Using data from the PSID, Blundell, Pistaferri and Preston, 2008 document an increase in income inequality up to 1985; I find an increase in county inequality increasing until 1986.

average component estimate is -.16 and both coefficients are significant at 1 percent. The distribution of county estimates for estimation county-by-county shows heterogeneity on the persistency of shock.

Overall, this shock is less persistent than suggested by statistical decomposition approaches that decompose idiosyncratic shocks into permanent and transitory components, but it is not predicted by families, because they slowly incorporate labor market shocks into their information set (see Pischke, 2005) .

Mechanisms of insurance To isolate consumption of the effects of shocks, families may use private and/or public transfers or savings. Table 6 presents estimates of model (18) using as dependent variable total unearned income (public and private transfers), public transfers and assets. Given the large proportion of zeros in unearned income and welfare income the dependent variable is $log(X+1)$. Columns (1), (4) and (7) show that total unearned income is irresponsive to local labor market shocks[41], but a 1pp unemployment shock increases welfare income in $40 per year. Comparing columns (5) and (8) reveals that the effect is due to the increase on welfare use by the group of non-college mothers[42]; no effect exists for sample of college mothers. Instead, these families rely on accumulated assets to buffer against labor market shocks, which is shown by an average decrease of $4200 in the value of assets. These results (together with estimates using private transfers as dependent variable) suggest that private transfers are not used to ameliorate the effect of the shock.

6.2 Insurance Test

Table 7 presents the main results in this paper. I estimate the effect of county's shock ε_{ct} on several measures of family consumption, c_{fct}, including expenditures in children specific goods (such as, child care or school tuition, school books, toys and hobbies and expenditures in newspapers or magazines), child clothes and nondurable consumption, and on measures of time spent with children, either teaching and involved in education activities or leisure activities, such as eating or socializing.

The effect of shock is estimated for each family f living in county c in year t model (15). Families can fully insure against shock if the null hypothesis that $\beta = 0$ cannot be rejected: the shock is orthogonal to families' consumption decisions. In the model X_{fct} are controls for taste shocks related to family structure, and family, π_f, county, π_c and year effects, π_t, control for families' permanent characteristics, county's quality and uninsurable aggregate shocks, respectively.

Columns (1) and (2) of Table 7 show that it is not possible to reject the hypothesis that the shock does not affect decisions of spending on children, and this holds for the three samples analyzed: for the whole sample, and for families of non-college mothers and college educated mothers in Panels B and C. But some caution should be taken with the interpretation of these point estimates. First, both estimates in Panel A are imprecise; this worsens when sample is separated by mothers' education. Indexes of expenditures are obtained from an external data, which adds an extra source of measurement error, and the smaller the information set used to match data, the larger is this measurement error. As there is no information on purchases of child's clothes in the CNLSY, imputation is based on the degree of complementarity of these expenditures with

[41] Although the coefficients in columns (1) and (4) are small, the standard error are implausible large. This could be due to the small sample used in estimation. Precision increases when supplemental sample of disadvantaged families is included.

[42] In results not included in the paper I estimated which are the welfare programs used by the low education group. I found an increase of almost 1 percent in the take-up of Food Stamps and AFDC/TANF in 0.93 percent (0.33) and 0.90 (0.34), respectively, in the sample of low educated sample (standard errors in parenthesis).

observed variables in the main data set[43]. Nevertheless, the magnitude of the effects of the shocks suggests no effects on expenditures related with child's education for the least educated group and a mild negative effect in the sample of college educated (though it is not possible to reject the hypothesis of full insurance).

Figures in columns (1) and (2) can be directly compared with column (6) which presents the effects of the shock on household nondurable consumption. Information used to impute information from CEX is based on family characteristics and parenting variables in the NLSY79 (Table A8 in Appendix A shows that 42-59 percent of variation in nondurable expenditure can be explained by these variables). Panel A suggests that a 1pp increase in unemployment rate is associated with a drop of .9% in household consumption, which corresponds to an average drop of 476 dollars in annual expenditure, rejecting the hypothesis of full insurance. Estimating the same effect by education group in Panels B and C (i) increases the imprecision in estimated effect, and (ii) shows that the drop in total expenditures estimated on the overall sample is mainly due to the large drop in expenditures from more educated households, whose expenditure drops by 1.7 percent (an average decrease of US$1200 per year). Only this last set of families was affected by changes in total family income, as the effect on earnings for families in the non college group is compensated by an increase in welfare income.

Columns (3) to (5) present the estimated effect on the allocation of time to children in family. Zeros in the time measures is account for by using $log(time + 1)$ as the dependent variable. To compare with changes in availability of time introduced by the shock, I include in column (7) the change in weekly hours worked by mothers[44]. The effects on allocation of time are remarkably different by education group[45]. Panel A-column (3) shows that a 1 pp increase in unemployment rate is associated with a decrease of 0.6 percent in the average daily hours parents spend helping their children with homework, reading to them or in activities related with their education (for example, school meetings), and this effect corresponds to a decrease of 3 minutes per week. If the measure of time use is augmented to include the time mothers spend reading for their own interest the sign of the effect is reverted and the effect adds to 7 minutes per week[46]. The time parents spend organization and planning for household children, attending household children's events or socializing (I refer to this as "time socializing")[47] increases by 4 minutes per week with 1pp shock.

Investigating the effects by group of education reveals that the negative effect of the shock on time spent on education is driven by the sample of less educated mothers. If this measure is augmented by the time mothers read for their own interest than magnitude of the effect is similar in both samples. Also, changes in time socializing are driven by the sample of non-college mothers. Although the changes in time out of the

[43]Table A8 shows that variability explained by proxy variables observed in the NLSY79 and family characteristics never exceeds 35 percent for expenditures in child clothes.

[44]In general, I reject that null hypothesis that shock does not have effects on annual hours worked by men if mother is married. The estimated coefficients on shock are (standard errors in parenthesis) are -22.28 (12.03), -8.48 (14.36) and -43.(18.2), respectively, for the overall sample, sample of less educated mothers and college. The large standard error in the sample of spouses of non-college education can be due to its smaller size: this is the sample of majority of single mother and there are less 400 observations than in the college group.

[45]The main results only include estimates for three of the time aggregates created. Table A11 in Appendix A presents the definition for the nine aggregates created. The comparison between original and imputed variable is presented in Table A12.

[46]Some caution should be taken with this second measure of time spent in child's education. The NLSY measure for reading to child is explicitly derived from a question to mothers "How often do you read to your child?", which suggest that this action is taken specifically towards the child. Therefore, the matching variable in the ATUS is more likely to be activity "Time reading to household children" excluding "Time spent reading for own interest".

[47]The actual definition of the measure includes organization and planning for household children, arts and crafts with household children, attending household children's events, playing with household children children (includes sports and nonsport activities) and socializing with friends or relatives. See Table A8 in Appendix A for correspondence between CNLSY and ATUS.

market available to parents in both samples is very similar, most of the variation in the use of time arises from the sample of less educated mothers. It should be note that the magnitude of changes in time allocated towards children amounts to half a dozen of minutes per week in the population, but not everyone is affected by shock. So, it will be important to evaluate to which extent this is translated to child's human capital.

If families can fully insure against shock, than consumption and investment decisions should be independent of current and past shocks. Table C3 in Appendix C shows that the shock has lasting effects on participation and earnings of families in low education group. Table 8 confirms that effects on time allocation are only persistent in group of low educated mothers, whereas the effect on decisions of investment in goods in t are independent of paste shocks; there are no effects the effects on expenditures of less educated families when lagged shocks are accounted for.

Summing up: families of non college mothers insure against shocks using public transfers (which is reflected on the full-insurance in nondurable consumption). However, these families present large responses on parental use of time: they substitute time dedicated to children education by leisure activities with their children. The hypothesis of full insurance to shocks is rejected on the group of college education and, in general, I cannot reject the hypothesis of no effect on time with children. If reaction of parents occurs when children are young, then the large substitution effect on parents allocation of time in the non college group, even under public insurance, may explain why simple cash transfers are not effective in ameliorating the effects of income shortages in early childhood. I address this issue in subsection 6.6.

6.3 2SLS Estimates: Effect of income changes on allocations

To compare with other papers that study the effects of income or earnings shocks, Table 9 presents 2SLS estimates of the effects of the shock to earnings or income, $\ln y_{fct}$, instrumented by the local labor market shock, ε_{ct}, on time and consumption allocations. The model estimated for each family f living in county c in year t is:

$$\ln c_{fct} = \kappa_0 + \kappa_1 \ln y_{fct} + \kappa_2 X_{fct} + \pi_f + \pi_c + \pi_t + \xi_{fct} \tag{19}$$

Columns (1) and (2) in Table 9-Panel A show that a 10 percent increase in earnings is associated with a 3.5% increase in expenditures in education, but this is not statistically significant; this value increases to 5.3% if the increase is in family income, and it is still insignificant. It is not possible to reject that income/earnings changes have no effect on expenditures in child clothes (the sign of estimates is the expected by Engel curve estimates: child clothes are necessity goods - see Table 2-Panel A). These estimates can be compared with changes in nondurable consumption presented in column (6): 10 percent income shock changes nondurable consumption by 8.5 percent. Recently Blundell, Pistaferri and Preston (BPP), 2008, find that a 10 percent permanent change in income is associated with a 6 percent change in consumption, but transitory shocks have no effects on consumption. They also find that the effect of a permanent change in family earnings drops to 3 percent, whereas I find a change of 6%.

Columns (3)-(5) in Panel A include estimates of effects of income changes in time use. Comparing column (3) and (5) reveals an almost one-to-one substitution of time spent socializing by educational activities. Of course these two measures of time do not exhaust all time parents spend with children, but, together with estimates in column (4), they suggest a substitution of leisure by investments in children education when

income/earnings increases. When income/earnings increase mothers have less time out of the labor market (see column (7)).

How to interpret 2SLS estimates? Table 3 presents estimates that can be interpreted as first stage. Not all families are equally affected by local labor market shocks. Table 7 present estimates of a reduced form model. Then, 2SLS estimates can be interpreted as weighted average causal effect of the income shock for different groups of families (see Kling, 2001; around half of the sample is comprised by families with non-college mothers).[48]

When looking at heterogeneity by mother's education, a 10% increase in earnings is associated with a 12% increase in expenditures in education in the group of non-college mothers (Panel B), but income changes do not affect this type of expenditures (shock does not affect income for these families). Column (6) shows that a change in earnings has a similar effect on expenditures in education and nondurable consumption, but that families can use welfare income as insurance against variation in resources induced by labor market shocks. In the group of college mothers (Panel C) a 10 percent income change is associated with 9% change in expenditures on children (but not changes when earnings are the endogenous variable) [49].

The effect of income changes on time allocation within the family varies by education group. Panel B shows that substitution of leisure by investments in children education when earnings increase in the entire sample is result of behavior in the non college group. Panel C shows that changes in family income/earnings are not associated with substitution between time in leisure and children's education.

6.4 Child's life cycle

Early childhood investments are different than later investments. For example, returns to late childhood investments and remediation for young adolescents from disadvantaged backgrounds are low, while returns to early investments are high (see Cunha and Heckman, 2007). This difference in returns of investments will cause different reactions to shocks across children's life cycle, so I allow parents' response to vary by age of youngest children in family.

Table C5 in Appendix C shows variation in resources when the effect of shock varies with the age of youngest child in the family. Panel A shows that the shock affects participation of mothers whose youngest child is 6-14 years old, and it is associated with a decrease in family earnings especially if there are children 0-5 years old in family. Earnings of families whose youngest child is 6-9 years are not affected by shock. Family income decreases only in families whose youngest child is 0-5 years, despite an increase in welfare income for these families. Most of the effects are driven by the sample of non-college mothers: (1) their participation rate drops, independently of the age of youngest child in family, (2) in general, family earnings decrease, (3) there are no effects on family income, because (4) there is an increase in public transfers in families where youngest child is 0-5. For families of college mothers there are no effects on labor market participation, and the effect on family earnings detected in Table 3 is driven by families with young children (0-5), which causes a drop in family income (there are no effects on total unearned income or welfare income for these families).

Columns (1) and (2) of Table 10-Panel A show that expenditures in education and child clothes do no react to shock. However, estimates for nondurable consumption in Column (5) reject the hypothesis of full

[48]The local labor market shock used to identify changes in family resources, but it can be also used as variation for maternal employment for non-college mothers (see Table 3).

[49]BPP, 2008, find that permanent changes in family income are associated with 9% and 4% changes in consumption for families whose head did not attend college and college educated heads, respectively.

insurance on nondurable consumption for the group of families with young children (0-5 years old). Columns (3) and (4) show that the substitution of time in education related activities and socializing is driven mainly by families with very young children, in which different uses of time are likely to be more substitutable. I cannot reject the null hypothesis of no effects in time allocated to education if there are only school age children in family (6 to 14 years old).

Panels B and C of Table 10 show the effects for non-college and college educated mothers, respectively. Estimates presented in columns (1), (2) and (5) do not reject the hypothesis of full insurance on either child specific or nondurable consumption in the sample of non-college mothers. However, columns (3) and (4) show a large substitution of time between education and socialization only for families with children 0-5 years old. In contrast, there is evidence of failure of full insurance for more educated families: a "surprise" increase in unemployment is associated with a decrease in expenditures in families where the youngest child in 0-5 (see columns (1) and (5) in Panel C), but no effects on the allocation of time (columns (3) and (4)).

6.5 Effects on child human capital

This subsection links the shocks to child's human capital. The human capital at age t is a function of the history of inputs up to that age (see (2)). To simplify, suppose there are only two types of investments (which were studied above), time and goods. Then, the effect of an income shock at age j on age t's human capital is:

$$\frac{dh_t}{dy_j} = \frac{\partial h_t}{\partial g_j}\frac{dg_j}{dy_j} + \frac{\partial h_t}{\partial i_j}\frac{di_j}{dy_j}.$$

In previous subsections I have estimated partial derivatives $\frac{\partial g_j}{\partial y_j}$ and $\frac{\partial i_j}{\partial y_j}$ and showed that surprise increases in unemployment rate are associated with a substitution of time parents spends in children's education by leisure activities on the group of non college mothers with children 0-5 years old. Is this reaction passed onto child's human capital? Evidence on the effect of family income on child human capital, which relates to estimates of total derivative $\frac{dh_t}{dy_j}$, is mixed (see Section 2). Two recent studies suggest that family income has a significant effect on child's achievement. Dahl and Lochner, 2008, use exogenous variation introduced by non-linearity in EITC (Earned Income Tax Credit) and find that temporary increases in income are associated with improvement in children math and reading scores; though the effects are not lasting and are concentrated on younger children from more disadvantage backgrounds. Using administrative data from Norway, Tominey, 2009, distinguishes between the effect of permanent and transitory income shocks on human capital; she finds that effects of permanent shocks on measures of early adulthood human capital decline with child's age, whereas effects of transitory shocks are constant across ages.

Using child level data from CNLSY I estimate how the effect of shock varies across child's age estimating the following model:

$$\ln i_{kfct} = \alpha_0 + \sum_{j=0}^{14} \left(\alpha_{1j}\varepsilon_{ct} \times 1\left[Age_{kfct} = j\right] + \alpha_{2j} \times 1\left[Age_{kfct} = j\right]\right) + \alpha_3 X_{fct} + \pi_k + \pi_c + \pi_t + e_{kfct} \quad (20)$$

where i_{kfct} is a measure of investment in child k's human capital (from family f) living in county c in year t. $1\left[Age_{kfct} = j\right]$ is an indicator variable that takes value 1 if child k is j years old. X includes the same set

of controls used to estimate model (18).

Figure 9 includes estimates for α_{1j}, $j = 0, ..., 14$. Figures in the first column shows estimates for the full sample: the effect of shocks on expenditures cannot be distinguished from zero at any age, but an increase in unemployment rate is associated with a decrease in time spent in activities related to education and an increase in time socializing. Magnitude of effects is decreasing by age and for time in education the null of no effect on time allocation cannot be rejected after age 4, whereas for the shock has no effect on time socializing after age 8. Substitution between time in education and leisure is driven by behavior of families of non college mothers (second and third columns of Figure 9).

Figure 10 includes estimates for α_{1j}, $j = 5, ..., 14$ when dependent variable i_{kfct} is a measure of child's human capital, which include the Peabody Individual Achievement Tests (PIAT) for Maths and Reading Recognition (measures of child's cognitive skills) and the Behaviors Problems Index (BPI) (measure of noncognitve skills). The shock is measured one year before the test score. Figure 10 uses only measures taken after age 5 and suggest that current shock is uncorrelated with test scores, although an increase in county unemployment seems to be associated with an increase in behavioral problems before age 10 in children of non college mothers[50]

Summing up, changes in re-allocation of time can explain the positive effects of extra income on achievement of children less than 10 years old in Dahl and Lochner, 2008. Similarly, they can explain the larger effects of permanent labor market shocks received at young age on young adult outcomes in Tominey, 2009.[51]

6.6 Discussion: Excess smoothing/excess sensitivity to shocks?

Table 9 presented evidence of rejection of full insurance hypothesis on families' consumption and allocation of time: (i) increases in family resources are associated with increase in time parents spend in children's education, decrease in leisure activities, and an increase in expenditures in education in families of non-college mothers, but (ii) there are almost no changes in the allocation of time by more educated parents.

One could one explain theses results? First, time spent in educational activities can be complement of expenditures in education. For the non-college group, when parents face a shock children are less likely to be enrolled in child care. If time parents spend in education related activities is complement with formal education, then one can explain the type of behavior in (i). Furthermore, the type of substitution is not present in families with only school-age children (youngest child in family older than 5), to whom the distribution of daily time is more rigidly scheduled.

Alternatively, one can justify (i) if parents are hyperbolic consumers (see Harris and Laibson, 2001). If parents discount present more than future and if they face a negative shock they may decide to spend more time in leisure related activities with their children (such as, taking them out to visit friends and relatives) than in education related activities (e.g., reading to children). Parents marginal utility from leisure might be larger than marginal utility spent teaching children: the return of investing in education will be collected in future, but return of leisure is collected today. Additionally, substitution of time in education by leisure is only present in families with very young children (less then 5) to whom there is a larger substitutability in use of time, and to whom benefits of investments in education are collected later.

[50] Including the oversample of disadvantaged families provides more precise estimates. Estimates of model (22) for children ages 3-15 using PPVT (Peabody Picture Vocabulary Test) as outcome show a similar pattern than that for PIAT.

[51] I have estimated the (i) effects of past shocks on test scores at ages 13-14 and (ii) effects of shocks in $t-2$ or $t-3$. I could not distinguish any effects from zero.

Table 11 presents estimates when shocks divided into positive and negative, to understand whether differences in discounting short and long run events mentioned in previous paragraph could have been due to some differential marginal variation of resources with positive and negative shocks (see Figure 8). Table C4 in Appendix C shows that unemployment shocks are a better predictor for changes in families' resources for negative than for positive shocks for families in the non-college group. Unexpected increases in the unemployment rate result in drop in labor market participation of mothers (a 1pp shock is associated with a decrease in 1.78% in participation) and this causes a decrease in earnings of 2.3 percent for non-college families. In contrast, positive shocks are better predictors of earnings increases in the college educated group.

Despite no changes in time spent in market activities for non college mothers, Table 11 shows that time spent involved in educational activities is more elastic to positive than to negative shocks (see Panel B), and it is inelastic to any shocks for college mothers (see Panel C). Human capital is similar to savings - it is used to transfer consumption to future. If families are credit constrained and (transitory) shock is negative, then savings (investments in human capital) should not vary. However, savings (investments in human capital) increase with positive shocks. This may explain why investment in education increases with positive shocks for non-college mothers.

Finally, I estimated the effects of local business cycles on parents' expectations about children completed education. For each child in sample, the mother is asked in each year about the maximum degree she expects the child will achieve. I do not find any statistically significant effect of unexpected increases in county unemployment rate on the expected probability of obtaining a college degree. This may result from identifying a shock that is not permanent.

Magnitude of Effects How large are estimated effects on families affected by shock? Suppose a worst case scenario. Families face a 0.5SD shock on unemployment (corresponds to an increase of 1pp in unemployment rate). Then, non-college mothers become unemployed with probability 1.54%. Newly unemployed mothers of children less than 5 spend more 1200hrs/year (50days) out of market, but spend on average less 788hrs/year (33days) educating children. To compensate for income loss they receive US$6,000 per year from welfare, excluding Unemployment Benefits (if these are included, average unearned income for non-college mothers who become unemployed adds up to US$11,000 per year). The annual cost per child of Head Start, which as been shown to have positive effects on noncognitive skills, is US%10,000.

6.7 Sensitivity Analysis

I briefly summarize other results which are not included in current version of the paper.

First, I analyzed the effects of shocks if model (15) is estimated without including controls for family demographics, X_{fct}. If shock ε_{ct} is orthogonal to X_{fct} (which is expected because the shock is taken from a data set external to the NLSY79), then results should not be affected by the inclusion of such controls. This is indeed the case. Also results do not change if county's permanent characteristics are captured by average county unemployment rate between 1979-2006 measured from the CPS-BLS (or average wage per job from the BEA for the same period).

Second, because the main results of the paper use as dependent variables measures constructed with auxiliary data sets, they are subject to additional uncertainty, and may not be robust. I re-estimated models (15) and (19) changing the model used to link CNLSY with CEX and ATUS (see Appendix A). The results

are robust to small changes in the model used for imputation.

Third, it might be of interest to analyze the effect shocks on the specific components of indexes used to construct the indexes of expenditures and time use. I find that facing an unexpected increase in county unemployment rate parents in the non-college group substitute private child-care by home care. Therefore, children in this group spend actually more time with their mothers, when they face negative shocks.

7 Conclusion

The aim of this paper has been to study the link between income shocks and parental investment in children, distinguishing between time and goods investments. For this purpose I used measures of parenting behavior available in the Children in the NLSY79. To obtain indexes, that can be interpreted in terms of use of financial and time resources, I use common information available in CEX, ATUS and NLSY.

County business cycles are the exogenous variation for unexpected income changes. They are an unpredicted component of local unemployment rate obtained after year and county effects are accounted for. This approach is similar to weather shocks used in developing countries (e.g., Paxson, 1992), but this source of variation had not been exploited for U.S. data.

I find different responses to shocks according to mothers' education, type of shock (positive or negative) and by structure of age of children in family. Local labor market shocks affect differently family resources: a surprise increase in county unemployment decreases earnings in families of college and non-college educated mothers. The later group shields from shock resorting on welfare income, whilst the college group uses accumulated assets. There is only partial insurance to labor market shocks as families' nondurable consumption is sensitive to shocks, but expenditures related to children are less sensitive to income changes. A negative shock also causes a potentially perverse effect on time allocation of families with small children: parents substitute time involved in children's education, which is likely to develop their cognitive skills, by time in leisure activities, such as socializing with relatives and friends and playing games or sports with children. This substitution is driven by the behavior of families with non-college educated mothers.

Understanding how parents change the allocation of their financial and time resources when facing income shocks is of primary importance for the design of antipoverty programs that target families with children. The findings described in previous paragraphs suggest that effectiveness of income support programs in ameliorating the consequences of poverty improves if are provided together with in-kind programs with a component that compensates parents response towards the use of time, such as the Head Start or Perry Preschool Program.

This paper is the first step on an ongoing project. At this stage the goal was to understand how families react facing income shocks re-allocating their expenditures and time and which mechanisms of insurance are used. In the next installment I will estimate the structural parameters of the production function using orthogonality conditions from Euler equations for investment in human capital sketched in model of Section 3. This would allow learn how different investments, including public investments, contribute to the formation of human capital[52].

[52]Human capital could be a vector. Different investment of parents contribute to formation of different skills.

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Tables: main results

Table 1 - Comparison: NLSY, CEX, Time Use

	(1) NLSY 80-00	(2) CEX 80-00	(3) NLSY 04-06	(4) Time Use 03-07
Mother's age	32.60	31.92	43.77	43.56
	(4.625)	(5.630)	(2.292)	(3.173)
Born in 1955		0.101		0.0387
		(0.302)		(0.193)
Born in 1956		0.102		0.0527
		(0.303)		(0.223)
Born in 1957	0.116	0.104	0.0725	0.0633
	(0.320)	(0.306)	(0.259)	(0.244)
Born in 1958	0.115	0.102	0.0699	0.0739
	(0.319)	(0.303)	(0.255)	(0.262)
Born in 1959	0.124	0.102	0.0925	0.0817
	(0.329)	(0.303)	(0.290)	(0.274)
Born in 1960	0.139	0.0969	0.133	0.0985
	(0.346)	(0.296)	(0.340)	(0.298)
Born in 1961	0.144	0.0915	0.160	0.102
	(0.351)	(0.288)	(0.367)	(0.303)
Born in 1962	0.138	0.0832	0.173	0.116
	(0.345)	(0.276)	(0.378)	(0.320)
Born in 1963	0.126	0.0795	0.152	0.121
	(0.332)	(0.270)	(0.359)	(0.327)
Born in 1964	0.0982	0.0746	0.147	0.122
	(0.298)	(0.263)	(0.355)	(0.327)
Born in 1965		0.0628		0.130
		(0.243)		(0.336)
Family size	3.919	3.950	4.042	3.891
	(1.291)	(1.247)	(1.188)	(1.174)
Mother is high school dropout	0.119	0.161	0.0488	0.0783
	(0.324)	(0.368)	(0.216)	(0.269)
Mother has high School	0.479	0.366	0.357	0.228
	(0.500)	(0.482)	(0.479)	(0.420)
Mother attended some college/college gradu	0.401	0.473	0.595	0.693
	(0.490)	(0.499)	(0.491)	(0.461)
Number of children 0-2	0.367	0.476	0.0277	0.107
	(0.560)	(0.618)	(0.170)	(0.342)
Number of children 3-5	0.427	0.473	0.113	0.184
	(0.585)	(0.622)	(0.346)	(0.431)
Number of children 6-9	0.550	0.561	0.382	0.461
	(0.670)	(0.700)	(0.591)	(0.626)
Number of children 10-14	0.456	0.511	0.910	0.893
	(0.665)	(0.746)	(0.703)	(0.726)
Married	0.719	0.756	0.741	0.706
	(0.449)	(0.429)	(0.438)	(0.456)
White	0.795	0.790	0.832	0.892
	(0.404)	(0.407)	(0.374)	(0.310)
Labor supply of mother				
Proportion working	0.755	0.752	0.770	0.715
	(0.430)	(0.432)	(0.421)	(0.452)
Hours worked per week	28.03	32.70	28.88	17.69
	(18.87)	(22.55)	(18.66)	(26.24)
Observations	12752	23342	1946	4723

Comparison of the 3 data sets in terms of demographics.

Table 2 - Panel A: Parametric estimates for Engel Curves for expenditures (data: CEX 1980-2000).

Dependent variable: Share	(1) Expenditures in children	(2) Child care and tuition	(3) Child care	(4) Children cloth	(5) Hobbies Toys	(6) Food at home	(7) Services
Marginal effects: age of youngest child 0-2							
at the 25th percentile of expenditure	-0.1018	-0.0180	-0.0144	-0.0523	-0.0212	-0.3352	-0.2981
	(0.4373)	(0.0196)	(0.2558)	(0.0089)***	(0.0065)***	(0.0461)***	(0.0503)***
at the 50th percentile of expenditure	-0.0438)	-0.0057	-0.0031	-0.0224	-0.0103	-0.1610	-0.1329
	(0.2637)	(0.0073)	(0.1920)	(0.0030)***	(0.0023)***	(0.0162)***	(0.0168)***
at the 75th percentile of expenditure	0.0034	0.0045	0.0061	0.0020	-0.0015	-0.0194	0.0012
	(0.3083)	(0.0077)	(0.2266)	(0.0032)	(0.0019)	(0.0170)	(0.0187)
Marginal effect: age of youngest child 3-5							
at the 25th percentile of expenditure	-0.0937	-0.0408	-0.0185	-0.0276	-0.016	-0.2624	-0.2126
	(0.4793)	(0.0254)	(0.1744)	(0.0057)***	(0.0038)***	(0.0280)***	(0.0389)***
at the 50th percentile of expenditure	-0.0462	-0.0163	-0.0085	-0.0159001	-0.0091	-0.1515	-0.1132
	(0.3987)	(0.0185)	(0.1224)	(0.0021)***	(0.0017)***	(0.0130)***	(0.0140)***
at the 75th percentile of expenditure	-0.0076	0.0036	-0.00047	-0.0064	-0.0033	-0.0614	-0.0325
	(0.4528)	(0.0130)	(0.1443)	(0.0035)*	(0.0020)***	(0.0173)***	(0.0208)
Marginal effect: age of youngest child 6-9							
at the 25th percentile of expenditure	-0.0997	-0.0059	-0.0063	-0.0619	-0.0194	-0.4430	-0.3671
	(0.1546)	(0.0125)	(0.1409)	(0.0198)***	(0.0077)***	(0.0903)***	(0.0960)***
at the 50th percentile of expenditure	-0.0421	-0.0044	-0.0018	-0.0220	-0.0099	-0.1801	-0.1413
	(0.0580)	(0.0120)	(0.0947)	(0.0035)***	(0.0022)***	(0.0188)***	(0.0191)***
at the 75th percentile of expenditure	0.0047	-0.0033	0.0018	0.0103	-0.0023	0.0335	0.0422
	(0.0829)	(0.0123)	(0.1102)	(0.0118)	(0.0041)	(0.0528)	(0.0563)
Marginal effect: age of youngest child 10-14							
at the 25th percentile of expenditure	-0.1272	-0.0109	-0.0060	-0.0610	-0.0408	-0.4650	-0.4048
	(0.1695)	(0.0095)	(0.1282)	(0.0217)***	(0.0228)*	(0.1468)***	(0.1410)***
at the 50th percentile of expenditure	-0.0491	-0.0048	-0.0017	-0.0246	-0.0131	-0.1982	-0.1653
	(0.0351)	(0.0177)	(0.1258	(0.0048)***	(0.0042)***	(0.0303)***	(0.0293)***
at the 75th percentile of expenditure	0.0144	0.0002	0.0019	0.0050	0.0095	0.0186	0.0292
	(0.0647)	(0.0180)	(0.1447)	(0.0124)	(0.0128)	(0.0857)	(0.0816)
Observations	3093	3093	3093	3093	3093	3093	3093
Mean of outcome	0.04	0.03	0.01	0.06	0.01	0.16	0.04
SD	0.06	0.05	0.03	0.06	0.01	0.13	0.04
% of zeros	0.00	0.05	0.08	0.00	0.01	0.00	0.00

Note: The model estimated is

$$w_{ft} = \beta_0 + \beta_1 \ln TotalExp_{ft} + \beta_2 \ln TotalExp_{ft}^2 + \beta_3 \ln N_{ft} + \beta_4 \ln N_{ft}^2 + \beta_5 \mathbf{x}_{ft} + e_{ft},$$

where where N is family size, and $\mathbf{x}_{ft}$ is a set of controls including: quadratic on mother's age, number of children ages 0-2, 3-5, 6-9 and 10-14 in household, number of household members older than 16, marital status, education of mother (indicators for high school degree and college attendance), indicator for labor market participation of household head, indicator for mother being white and year FE. Total expenditure is instrumented with total family income. The effect of total expenditures is allowed to vary with the age of youngest child in family (0-2, 3-5, 6-9 and 10-14). Expenditures in children is the sum of expenditures in child care and school tuition, newspapers, magazines, hobbies and toys, child cloth and school books. Services includes: food out, cloth, fuel and heating. Total expenditure includes: food, alcohol, apparel and footwear, clothing services, tobacco, heating, utilities (gas, electricity, water and sewerage), public transportation, vehicle expenses, gasoline and oil, vehicle maintenance and repairs, parking fees, newspapers and magazines, books, club membership fees, ticket admissions, miscellaneous entertainment expenses, home rent, home insurance, home maintenance and repairs, telephone and cable, child care, school and college tuition, educational books, domestic services, other home services, rentals, personal care, toys, games and hobbies.

Standard errors for marginal effects are obtained by nonparametric bootstrap (250 replications). Marginal effects are computed at percentiles 25, 50 and 75 of distribution of total expenditures and by age of youngest child in household. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2 - Panel B: Parametric estimates for Engel Curves for time use (data: ATUS 2003-2007).

Dependent variable: share	(1) Work	(2) Child care full	(3) Child care teach	(4) Child care play	(5) Sleeping	(6) Personal care
Marginal effects: age of youngest child 0-2						
at the 25th percentile of earnings	0.0224	-0.0265	-0.0011	-0.0043	0.0001	0.0038
	(0.0112)**	(0.0083)***	(0.0027)	(0.0035)	(0.0064)	(0.0018)**
at the 50th percentile of earnings	0.0024	0.0154	-0.0004	0.0007	-0.0024	-0.0021
	(0.0099)	(0.0071)**	(0.0021)	(0.0029)	(0.0054)	(0.0015)
at the 75th percentile of earnings	0.0008	0.0188	-0.0003	0.0011	-0.0026	-0.0026
	(0.0116)	(0.0083)**	(0.0025)	(0.0033)	(0.0063)	(0.0018)
Marginal effects: age of youngest child 3-5						
at the 25th percentile of earnings	0.0054	-0.0178	-0.0008	-0.0060	0.0082	0.0029
	(0.0096)	(0.0047)***	(0.0017)	(0.0020)***	(0.0048)*	(0.0014)**
at the 50th percentile of earnings	0.0230	0.0110	-0.0003	0.0044	-0.0101	-0.0018
	(0.0085)***	(0.0040)***	(0.0014)	(0.0017)**	(0.0038)***	(0.0011)
at the 75th percentile of earnings	0.0244	0.0133	-0.0003	0.0052	-0.0116	-0.0022
	(0.0099)**	(0.0046)***	(0.0016)	(0.0020)***	(0.0045)***	(0.0013)*
Marginal effects: age of youngest child 6-9						
at the 25th percentile of earnings	0.0068	-0.0035	-0.0016	-0.0002	0.0012	-0.0018
	(0.0054)	(0.0030)	(0.0012)	(0.0007)	(0.0028)	(0.0012)
at the 50th percentile of earnings	0.0204	-0.0012	-0.0002	-0.0007	-0.0035	0.0024
	(0.0049)***	(0.0025)	(0.0011)	(0.0005)	(0.0023)	(0.0010)**
at the 75th percentile of earnings	0.0215	-0.0010	-0.0001	-0.0008	-0.0039	0.0027
	(0.0057)***	(0.0029)	(0.0012)	(0.0006)	(0.0027)	(0.0012)**
Marginal effects: age of youngest child 10-14						
at the 25th percentile of earnings	-0.0071	0.0013	0.0000	0.0001	0.0054	0.0005
	(0.0057)	(0.0019)	(0.0009)	(0.0004)	(0.0033)	(0.0009)
at the 50th percentile of earnings	0.0348	-0.0037	-0.0014	-0.0004	-0.0097	0.0004
	(0.0051)***	(0.0017)**	(0.0008)	(0.0004)	(0.0028)***	(0.0008)
at the 75th percentile of earnings	0.0381	-0.0041	-0.0015	-0.0005	-0.0109	0.0004
	(0.0059)***	(0.0020)**	(0.0009)*	(0.0004)	(0.0033)***	(0.0009)
Observations	4723	4723	4723	4723	4723	4723
Mean of outcome	0.11	0.07	0.01	0.01	0.36	0.03
SD	0.16	0.08	0.03	0.03	0.09	0.03
% of zeros	0.62	0.27	0.66	0.89	0.00	0.16

Note: The model estimated is

$$w_f = \beta_0 + \beta_1 \ln Income_f + \beta_2 \ln Income_f^2 + \beta_3 \ln N_f + \beta_4 \ln N_f^2 + \beta_5 \mathbf{x}_f + e_f,$$ [1]

where where N is family size, and $\mathbf{x}_f$ is a set of controls including: quadratic on mother's age, presence of children ages 0-2, 3-5, 6-9 and 10-14 in household, marital status, education of mother (indicators for high school degree and college attendance), indicator for mother being white and year FE. *Child care-full* includes includes basic child, teach and play care. *Child care-teach* includes reading (household) children, talking with/listening (household) children, helping/teaching household children (not related to education) and activities related to household children's education. *Child care-play* includes playing with children, not sports, arts and crafts with household children, playing sports with household children.

Unit of dependent variable is % of weekly hours in a given activity.

Standard errors for marginal effects are obtained by nonparametric bootstrap (250 replications). Marginal effects are computed at percentiles 25, 50 and 75 of distribution of total expenditures and by age group of youngest child. * significant at 10%; ** significant at 5%; *** significant at 1%.

[1] Income variable used is mother's annual earnings - there is no continuous variable for family income in the ATUS. This can be obtained by merging CPS and ATUS.

Table 3 - Effect of labor market shock
Sample: cross-sectional sample (CNLSY 1986-2006)

Dependent variable	(1) Participation	(2) Log family earnings	(3) Log family income	(4) Participation	(5) Log family earnings	(6) Log family income	(7) Participation	(8) Log family earnings	(9) Log family income
Sample	All			Mothers education ≤12 years			Mothers education >12 years		
Shock in t	-0.823	-1.622	-1.089	-1.154	-1.665	-0.543	-0.196	-1.435	-1.924
	[0.319]***	[0.466]***	[0.527]**	[0.416]***	[0.657]**	[0.822]	[0.509]	[0.845]*	[0.937]**
Observations	13227	13227	13227	6919	6919	6919	6308	6308	6308
Number of mothers	2241	2241	2241	1169	1169	1169	1072	1072	1072
Effect of 1pp increase in unemployment	-0.82	-583.18	-403.46	-1.15	-456.99	-155.12	-0.20	-682.66	-943.16
Mean	0.76	10.49	10.52	0.72	10.22	10.26	0.8	10.77	10.8
SD	0.43	1.14	1.04	0.45	1.21	1.05	0.4	0.99	0.96
Mean (2000US$)		35954.16	37049.12		27446.67	28566.79		47572.02	49020.80
% of observations without earnings		8.51%			12.60%			3.99%	
Difference in outcome by education group									
P-Value	11.15	27.3	30.77						

Note: Regressors excluded from table include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable for columns (2), (5) and (8) is Log(Earnings +1) to account for families without earnings. Sample used in estimation: cross-sectional sample of NLSY. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4 - Dependent variable: Shock in t+1
Sample: cross-sectional sample (CNLSY 1986-2006)

Decision variable in t	(1) Log family income	(2) Log unearned Income
Sample	Panel A: All	
Decision variable in t	-0.000111	-0.000007
	[0.000158]	[0.000049]
Observations	13263	13263
Number of mothers	2244	2244
Sample	Panel B: Mothers without college	
Decision variable in t	0.000095	-0.000046
	[0.000237]	[0.000072]
Observations	6925	6925
Number of mothers	1169	1169
Sample	Panel C: Mothers with college	
Decision variable in t	-0.000430	0.000027
	[0.000279]	[0.000063]
Observations	6338	6338
Number of mothers	1075	1075

Note: Variables presented in each column the conditioning decision at period t. Regressors excluded from table include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable for columns (2) is Log(X+1). Sample used in estimation: cross-sectional sample of NLSY. * significant at 10%; ** significant at

Table 5 - Time series process of residual unemployment rate.

Panel A - All counties

Model	(1) ARMA(1,0)	(2) ARMA(1,1)
coefficient on AR	0.782	0.829
	(0.006)***	(0.006)***
coefficient on MA		-0.158
		(0.004)***
N	96672	
Number of counties	3021	
Number of observations/county	32	

Note: Estimation of stochastic process for residual unemployment by Equally Weighted Minimum Distance. The process is estimated jointly for all counties.

Model estimated is:

$$u_{it} = \rho u_{it-1} + \varepsilon_{it} + \theta \varepsilon_{it-1}$$

Panel B - ARMA(1,1): distribution of estimates by county.

Coefficient on AR		Coefficient on MA	
Percentile 25	0.530	Percentile 25	-0.343
Median	0.818	Median	-0.091
Percentile 75	1.121	Percentile 75	0.125

Table 6 - Mechanisms of insurance
Sample: cross-sectional sample (CNLSY 1986-2006)

Dependent variable	(1) Unearned Income	(2) Welfare Income	(3) Assets	(4) Unearned Income	(5) Welfare Income	(6) Assets	(7) Unearned Income	(8) Welfare Income	(9) Assets
Sample	All			Mothers education ≤12 years			Mothers education >12 years		
Shock in t	0.236	4.888	-191,580.75	-0.633	5.781	-57,893.69	1.53	3.109	-421,761.83
	[2.598]	[1.761]***	[131,271.607]	[3.326]	[2.404]**	[107,044.075]	[5.230]	[3.418]	[290,640.199]
Observations	13227	13227	11093	6919	6919	5970	6308	6308	5123
Number of mothers	2241	2241	2217	1169	1169	1158	1072	1072	1059
Effect of 1pp increase in unemployment ($US)	5.52	39.79	-1915.81	-15.59	70.28	-578.94	33.75	11.60	-4217.62
Mean (2000US$)	2340.57	813.95	111786.58	2463.6	1215.79	66801.1	2205.62	373.19	164211.09
SD	4877.29	2363.08	269195.67	4587.47	2813.69	181774.1	5173.56	1629.37	336627.37
% of observations with 0 dependent variable	45.0%	86.0%	14.5%	46.0%	79.0%	18.0%	43.0%	93.0%	10.0%
Difference in outcome by education group									
P-Value	3.04	20.81	19.31						

Note: Regressors excluded from table include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable for columns (1), (2), (4), (5), (7) and (8) is Log(X +1). For assets "% of families with 0 dependent variable" include negative and zero assets. Sample used in estimation: cross-sectional sample of NLSY. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7 - Effect of shock on household allocation
Sample: cross-sectional sample (CNLSY 1986-2006)
Units of dependent variables: Expenditures measured in log(X); effect in time measured in minutes per week.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Children			Household	
Dependent variable	**Log Expenditures**		**Time use**			**Log nondurable**	**Hours worked**
	in education	**in child clothes**	**Education**	**Education/reading**	**Socializing**	**consumption**	**per week**
				Panel A: All			
Shock in t	-0.574	0.107	-0.558	1.218	0.543	-0.932	-26.274
	[0.622]	[0.427]	[0.197]***	[0.187]***	[0.153]***	[0.418]**	[12.620]**
Observations	13227	13227	13227	13227	13227	13227	13227
# of mothers	2241	2241	2241	2241	2241	2241	2241
Effect of 1pp increase in unemployment	-3.86	0.34	-2.77	7.16	3.92	-475.52	-15.76
Mean (log)	6.51	5.75	1.18	1.4	1.72	10.84	24.32
SD	1.12	0.82	0.68	0.92	0.68	0.83	18.64
Mean (2000US$, hours/week)	671.83	314.19	8.26	9.80	12.04	51021.38	
				Panel B: Mothers education ≤12			
Shock in t	0.199	0.173	-0.759	1.095	0.967	-0.442	-25.683
	[1.028]	[0.582]	[0.275]***	[0.261]***	[0.221]***	[0.625]	[14.861]*
Observations	6919	6919	6919	6919	6919	6919	6919
# of mothers	1169	1169	1169	1169	1169	1169	1169
Effect of 1pp increase in unemployment	1.01	0.52	-4.11	7.17	7.43	-173.88	-15.41
Mean (log)	6.23	5.71	1.29	1.56	1.83	10.58	22.59
SD	1.11	0.76	0.73	1.01	0.79	0.81	18.78
Mean (2000US$, minutes/week)	507.76	301.87	9.03	10.92	12.81	39340.11	
				Panel C: Mothers education >12			
Shock in t	-1.728	0.146	-0.201	1.446	-0.113	-1.741	-26.732
	[1.076]	[0.809]	[0.252]	[0.207]***	[0.178]	[0.771]**	[18.643]
Observations	6308	6308	6308	6308	6308	6308	6308
# of mothers	1072	1072	1072	1072	1072	1072	1072
Effect of 1pp increase in unemployment	-15.67	0.49	-0.90	7.47	-0.76	-1199.06	-16.04
Mean (log)	6.81	5.81	1.07	1.23	1.60	11.14	26.21
SD	1.04	0.87	0.60	0.78	0.50	0.76	18.3
Mean (2000US$, minutes/week)	906.87	333.62	7.49	8.61	11.20	68871.66	

Note: Regressors excluded from table include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable in columns (3)-(5) is log(X+1). Effects of 1pp change in unemployment are measured in $US for expenditures and minutes per week for time. Sample used in estimation: cross-sectional sample of NLSY. There are no zeros in expenditures for education in the sample used in this table. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8 - Effect of past shocks
Sample: cross-sectional sample (CNLSY 1986-2006)

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Expenditures in Education			Time in Education			Socializing		
	Panel A: All								
Shock in t	-0.574	-0.757	-0.947	-1.453	-1.381	-2.027	2.27	2.48	3.033
	[0.622]	[0.894]	[1.045]	[0.459]***	[0.683]**	[0.655]***	[0.566]***	[0.660]***	[0.739]***
Shock t-1		0.118	0.619		-0.127	2.171		-0.322	-1.994
		[0.938]	[1.394]		[0.772]	[0.780]***		[1.006]	[0.987]**
Shock t-2			-0.919			-3.586			3.292
			[1.108]			[0.752]***			[0.892]***
Shock t-3			0.721			2.444			-2.13
			[1.212]			[0.910]***			[0.815]***
Shock t-4			-0.219			-1.248			-0.468
			[0.801]			[0.661]*			[0.583]
Observations	13227	13185	12885	13227	13185	12842	13227	13185	12842
P-Value: Effect =0		0.32	0.34		0	0.03		0	0.1
	Panel B: Mothers education ≤12 years								
Shock in t	0.199	-0.771	-1.391	-1.908	-2.009	-2.931	3.791	4.458	5.416
	[1.028]	[1.311]	[1.422]	[0.694]***	[0.947]**	[0.922]***	[0.848]***	[1.277]***	[1.105]***
Shock t-1		1.125	2.996		0.073	2.825		-0.924	-2.839
		[1.167]	[1.762]*		[1.026]	[1.170]**		[1.506]	[1.303]**
Shock t-2			-2.339			-3.795			3.598
			[1.613]			[1.080]***			[1.152]***
Shock t-3			1.019			2.179			-2.384
			[1.503]			[1.204]*			[1.150]**
Shock t-4			-0.564			-0.416			-1.484
			[1.130]			[0.680]			[0.882]*
Observations	6919	6894	6722	6919	6894	6722	6919	6894	6722
P-Value: Effect =0		0.74	0.82		0.01	0.02		0	0.01
	Panel C: Mothers education >12 years								
Shock in t	-1.728	-0.523	0.116	-0.678	-0.408	-0.72	-0.115	-0.529	-0.378
	[1.076]	[1.594]	[1.672]	[0.550]	[0.841]	[0.826]	[0.528]	[0.706]	[0.724]
Shock t-1		-1.692	-3.881		-0.349	0.852		0.515	-0.192
		[1.531]	[1.947]**		[0.892]	[0.967]		[0.761]	[1.000]
Shock t-2			2.192			-2.579			1.746
			[1.621]			[1.042]**			[0.858]**
Shock t-3			-0.28			2.237			-1.173
			[1.539]			[0.971]**			[0.770]
Shock t-4			0.627			-0.899			-0.872
			[1.243]			[0.700]			[0.613]
Observations	6308	6291	6163	6308	6291	6163	6308	6291	6146
P-Value: Effect =0		0.06	0.41		0.21	0.15		0.98	0.86

Note: see Table 7. The test included in table tests the null hypothesis of sum of all lagged shocks being 0.

Table 9 - Two Stage Least Squares Estimation.
Sample: cross-sectional sample (CNLSY 1986-2006)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	**Log Expenditures**		**Children Time use**			**Household**	
	in education	**in child clothes**	**Education**	**Education/reading**	**Socializing**	**Log nondurable consumption**	**Hours worked per week**
				Panel A: All			
Endogenous variable							
Log Earnings	0.353	-0.066	0.344	-0.75	-0.335	0.575	16.194
	[0.377]	[0.197]	[0.103]***	[0.095]***	[0.070]***	[0.259]**	[5.734]***
Log income	0.527	-0.098	0.512	-1.118	-0.499	0.856	24.125
	[0.561]	[0.294]	[0.154]***	[0.141]***	[0.104]***	[0.386]**	[8.542]***
Observations	13227	13227	-2.531	12.974	5.727	13227	13227
# of mothers	2241	2241	2241	2241	2241	2241	2241
				Panel B: Mothers education ≤12			
Log Earnings	1.205	-0.102	0.456	-0.657	-0.581	1.214	0.707
	[0.635]*	[0.375]	[0.135]***	[0.109]***	[0.083]***	[0.421]***	[0.304]**
Log income	-0.367	-0.32	1.399	-2.017	-1.782	0.815	47.323
	[1.441]	[0.795]	[0.415]***	[0.333]***	[0.256]***	[1.061]	[23.203]**
Observations	6919	6919	6919	6919	6919	6919	6919
# of mothers	1169	1169	1169	1169	1169	1169	1169
				Panel C: Mothers education >12			
Log Earnings	-0.12	-0.104	0.14	-1.008	0.079	0.266	15.421
	[0.470]	[0.259]	[0.173]	[0.146]***	[0.099]	[0.346]	[7.561]**
Log income	0.898	-0.076	0.105	-0.751	0.059	0.905	13.894
	[0.473]*	[0.279]	[0.129]	[0.109]***	[0.074]	[0.314]***	[8.332]*
Observations	6308	6308	6308	6308	6308	6308	6308
# of mothers	1072	1072	1072	1072	1072	1072	1072

Note: Regressors excluded from table include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable in columns (3)-(5) is log(X+1). There are no zeros in expenditures for education in the sample used in this table. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 10 - Interaction with age of youngest child in sample
Sample: cross-sectional sample (CNLSY 1986-2006)

	(1)	(2)	(3)	(4)	(5)
	Log Expenditures		Time use		Log nondurable
Dependent variable	**in education**	**in child clothes**	**Education**	**Socializing**	**consumption**
			Panel A: All		
Shock in t	-0.691	-0.225	-1.814	3.022	-1.749
	[0.864]	[0.440]	[0.667]***	[0.725]***	[0.520]***
ShockX1[Age youngest 6-9]	-0.439	0.44	0.994	-1.567	1.818
	[1.393]	[0.697]	[0.770]	[1.041]	[0.865]**
ShockX1[Age youngest 10-14]	-0.176	0.787	0.833	-2.329	1.841
	[2.176]	[1.334]	[0.956]	[1.116]**	[1.052]*
Observations	13227	13227	13227	13227	13227
P-Value					
Shock+1[Age youngest 6-9]=0	0.36	0.65	0.15	0.09	0.92
Shock+1[Age youngest 10-14]=0	0.63	0.75	0.12	0.42	0.93
Joint Test	0.56	0.9	0.01	0	0.01
			Panel B: Mothers education ≤12 years		
Shock in t	0.499	0.401	-2.542	5.074	-0.97
	[1.255]	[0.586]	[1.079]**	[1.166]***	[0.781]
ShockX1[Age youngest 6-9]	-0.814	-0.448	1.744	-2.722	1.715
	[1.599]	[0.734]	[1.327]	[1.645]*	[1.106]
ShockX1[Age youngest 10-14]	-2.486	-1.057	1.063	-4.014	0.39
	[2.466]	[1.266]	[1.410]	[1.740]**	[1.039]
Observations	6919	6919	6919	6919	6919
P-Value					0.59
Shock+1[Age youngest 6-9]=0	0.82	0.95	0.25	0.4	0.4
Shock+1[Age youngest 10-14]=0	0.38	0.6	0.15	0.06	0.46
Joint Test	0.78	0.8	0.04	0	
			Panel C: Mothers education >12 years		
Shock in t	-2.756	-1.231	-0.672	-0.223	-2.988
	[1.331]**	[0.762]	[0.795]	[0.661]	[0.807]***
ShockX1[Age youngest 6-9]	0.374	2.278	-0.152	0.226	1.717
	[2.445]	[1.274]*	[0.956]	[0.867]	[1.267]
ShockX1[Age youngest 10-14]	4.68	4.588	0.257	0.399	4.851
	[2.966]	[2.186]**	[1.310]	[0.969]	[1.908]**
Observations	6308	6308	6308	6308	6308
P-Value					
Shock+1[Age youngest 6-9]=0	0.29	0.12	0.33	1	0.29
Shock+1[Age youngest 10-14]=0	0.43	0.44	0.62	0.84	0.32
Joint Test	0.17	0.08	0.62	0.98	0

Note: see Table 7.

Table 11 - Reaction to positive and negative shocks
Sample: cross-sectional sample (CNLSY 1986-2006)
Units of dependent variables: Expenditures measured in log(X); time measured in minutes per week.

	(1)	(2)	(3)	(4)	(5)
	Children				
Dependent variable	**Log Expenditures**		**Time use**		**Log nondurable consumption**
	in education	**in child clothes**	**Education**	**Socializing**	
	Panel A: All				
Positive shock in t	1.189	0.489	1.255	-0.335	1.151
	[1.986]	[1.085]	[0.545]**	[0.330]	[1.242]
Observations	7592	7592	7592	7592	7592
# of mothers	2088	2088	2088	2088	2088
Effect of 1pp decrease in unempl.	7.99	1.54	6.22	-2.42	598.77
Negative shock in t	-1.696	-0.769	-0.167	0.611	-0.672
	[1.198]	[0.836]	[0.342]	[0.260]**	[0.850]
Observations	5635	5635	5635	5635	5635
# of mothers	1944	1944	1944	1944	1944
Effect of 1pp increase in unempl.	-11.39	-2.42	-0.83	4.41	-349.58
	Panel B: Mothers education ≤12				
Positive shock in t	0.212	1.768	2.061	-1.119	0.458
	[2.484]	[1.238]	[0.815]**	[0.536]**	[1.617]
Observations	4110	4110	4110	4110	4110
# of mothers	1097	1097	1097	1097	1097
Effect of 1pp decrease in unempl.	1.08	5.34	11.17	-8.60	180.18
Negative shock in t	-2.327	-0.561	-0.399	0.961	-0.895
	[1.752]	[0.907]	[0.527]	[0.270]***	[1.072]
Observations	2809	2809	2809	2809	2809
# of mothers	1001	1001	1001	1001	1001
Effect of 1pp increase in unempl.	-11.82	-1.69	-2.16	7.39	-352.09
	Panel C: Mothers education >12				
Positive shock in t	1.89	-1.031	0.176	0.334	1.973
	[2.929]	[1.778]	[0.563]	[0.454]	[1.966]
Observations	3482	3482	3482	3482	3482
# of mothers	991	991	991	991	991
Effect of 1pp decrease in unempl.	17.14	-3.44	0.79	2.24	1358.84
Negative shock in t	-0.004	-1.253	0.322	0.298	0.07
	[2.578]	[1.839]	[0.721]	[0.384]	[1.647]
Observations	2826	2826	2826	2826	2826
# of mothers	943	943	943	943	943
Effect of 1pp increase in unempl.	-0.04	-4.18	1.45	2.00	48.21

include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable for columns (3)-(5) is Log(X+1). Effects of 1pp change in unempl. are measured in $US for expenditures and minutes per week for time. Sample used in estimation: cross-sectional sample of NLSY. * significant at 10%; ** significant at 5%; *** significant at 1%.

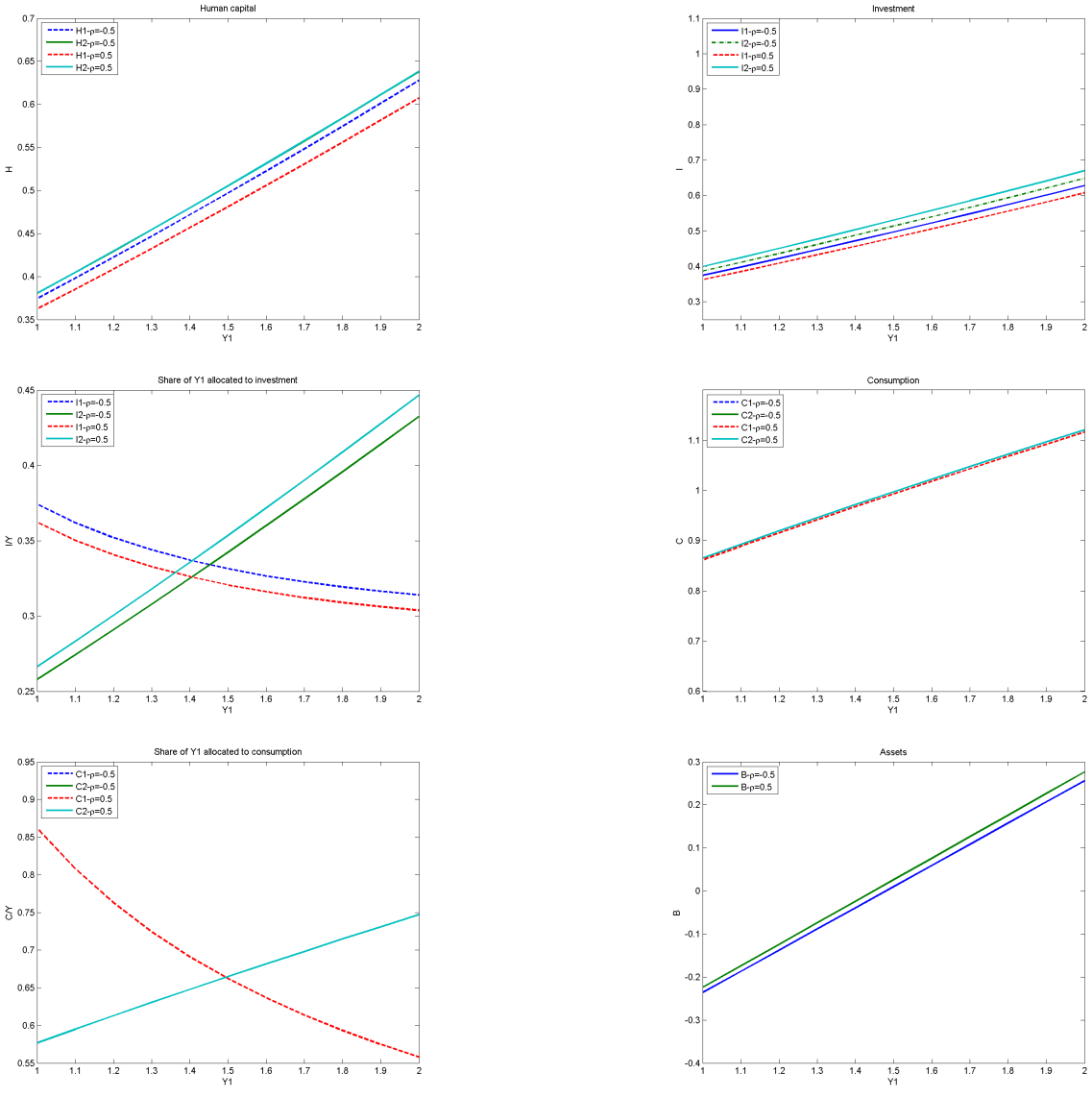
Figures

Figure 1A: No uncertainty, no credit constraints, relative productivity equal across periods[1]

The model simulated here assumes that $\rho_1 = \rho_2 = \rho$, so that:

$$\begin{aligned} h_2 &= \left[\theta_2 g_2^{\rho} + (1-\theta_2)\,\theta_1 g_1^{\rho} + (1-\theta_2)\,(1-\theta_1)\,\omega^{\rho}\right]^{\frac{1}{\rho}} \\ h_1 &= \left[\theta_1 g_1^{\rho} + (1-\theta_1)\,\omega^{\rho}\right]^{\frac{1}{\rho}} \end{aligned}$$

Start with $\omega = 0$ (endowment). Then, $h_2 = [\tau g_2^{\rho} + (1-\tau) g_1^{\rho}]^{\frac{1}{\rho}}$, where $\theta_2 = \tau$, $\theta_1 = 1$.
Parameters: $\beta = 0.96, r = 0.05$, $\sigma_1 = \sigma_2 = 2$ $\gamma = 1$, $\tau = 0.5$.
Income: between 1 and 2 in $t = 1$, 1.5 for everyone in $t = 2$.



[1] The initial conditions and tolerance levels used solving the model are the same in all models.

Figure 1B: No uncertainty, credit constraints $a \geq 0$

Parameters: $\beta = 0.96, r = 0.05$, $\sigma_1 = \sigma_2 = 2$ $\gamma = 1$, $\theta_2 = 0.5$, $\theta_1 = 1$, $\omega = 0$

Income: between 1 and 2 in $t = 1$, 1.5 for everyone in $t = 2$.

Parents are no longer able to smooth their consumption if credit constraint. Constrained families with $\rho = -0.5$ need spend a relatively high proportion of period's 1 income to compensate for low substitutability of investment across periods.

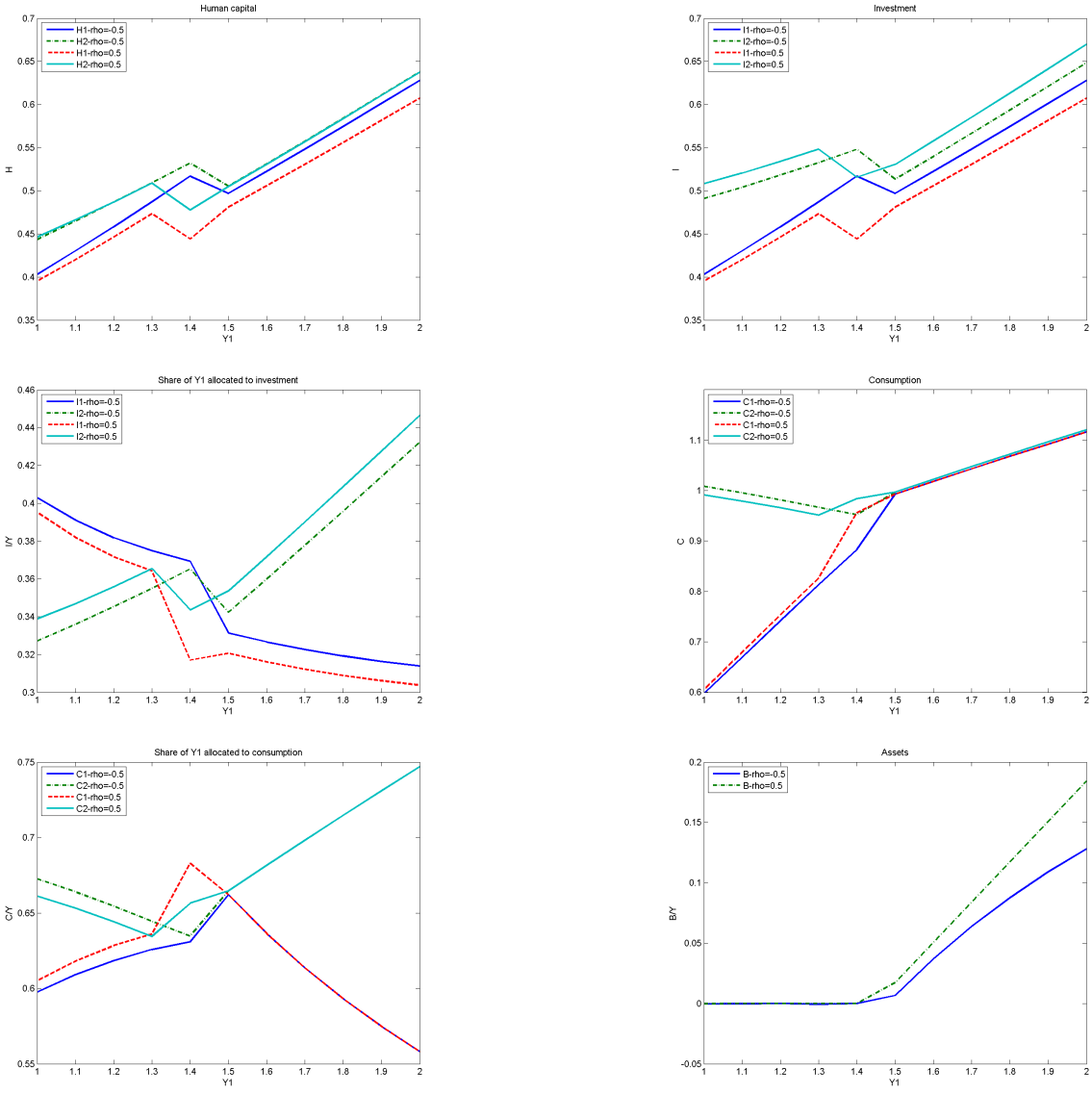


Figure 2 - Distribution of hours worked per week by mothers (data source: Mothers of Children of NLSY79 1979-2006).

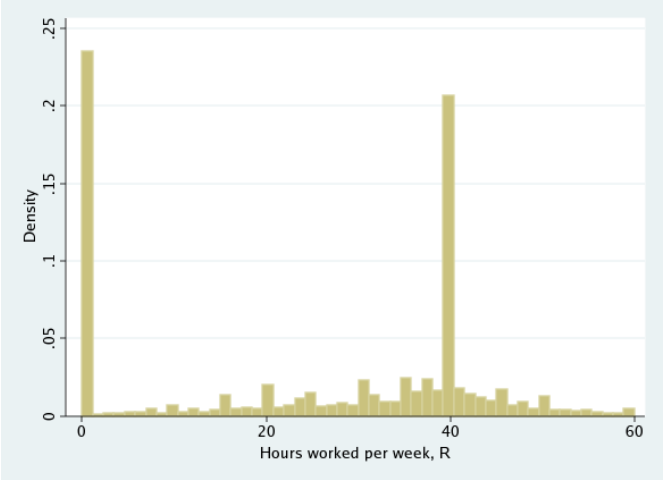


Figure 3 - Average hours worked and income across child's life cycle (data source: Mothers of Children of NLSY79 1979-2006).

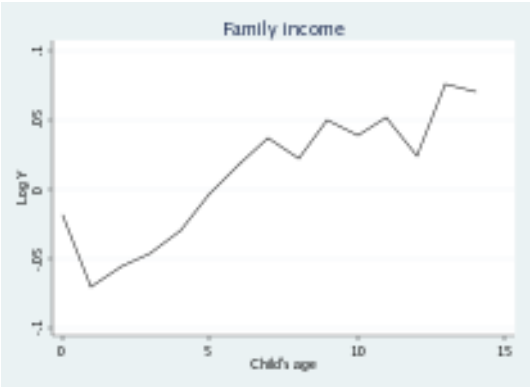
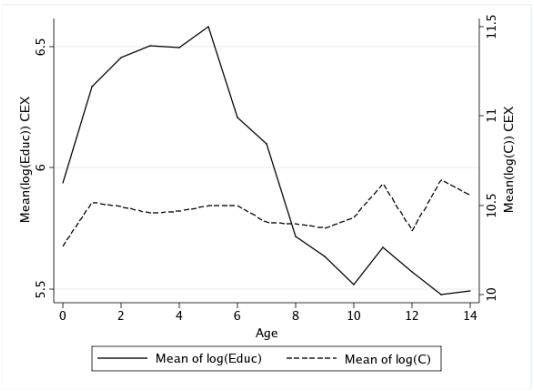
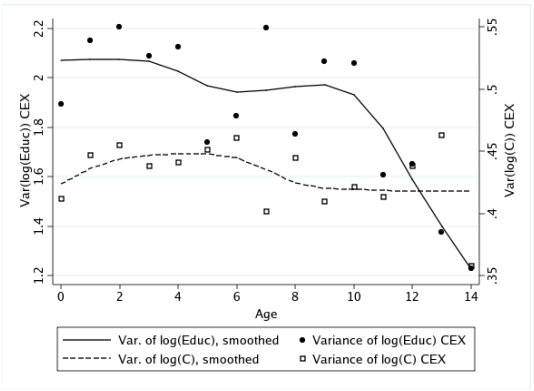


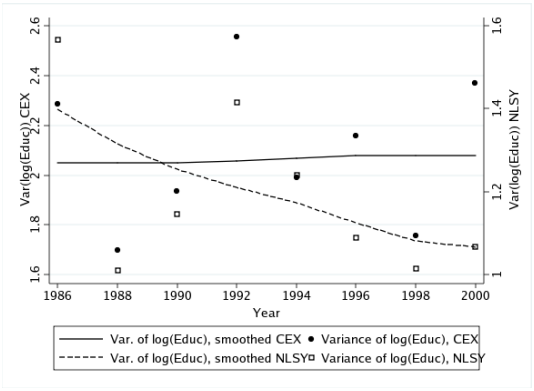
Figure 4 - Mean and variance of (log) expenditures in children and nondurable consumption over child's life cycle (source: CEX 1983-2000).





Note: Sample of households with children less than 14 years old whose head (if female) or spouse was born between 1955 and 1965. Only households surveyed at least 11 times in the CEX. Age is age of youngest child in family

Figure 5 - Variance of log expenditures in education of children in CEX and NLSY - original and re-scaled variable:



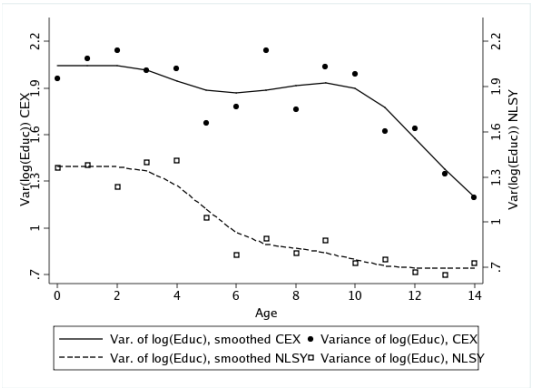
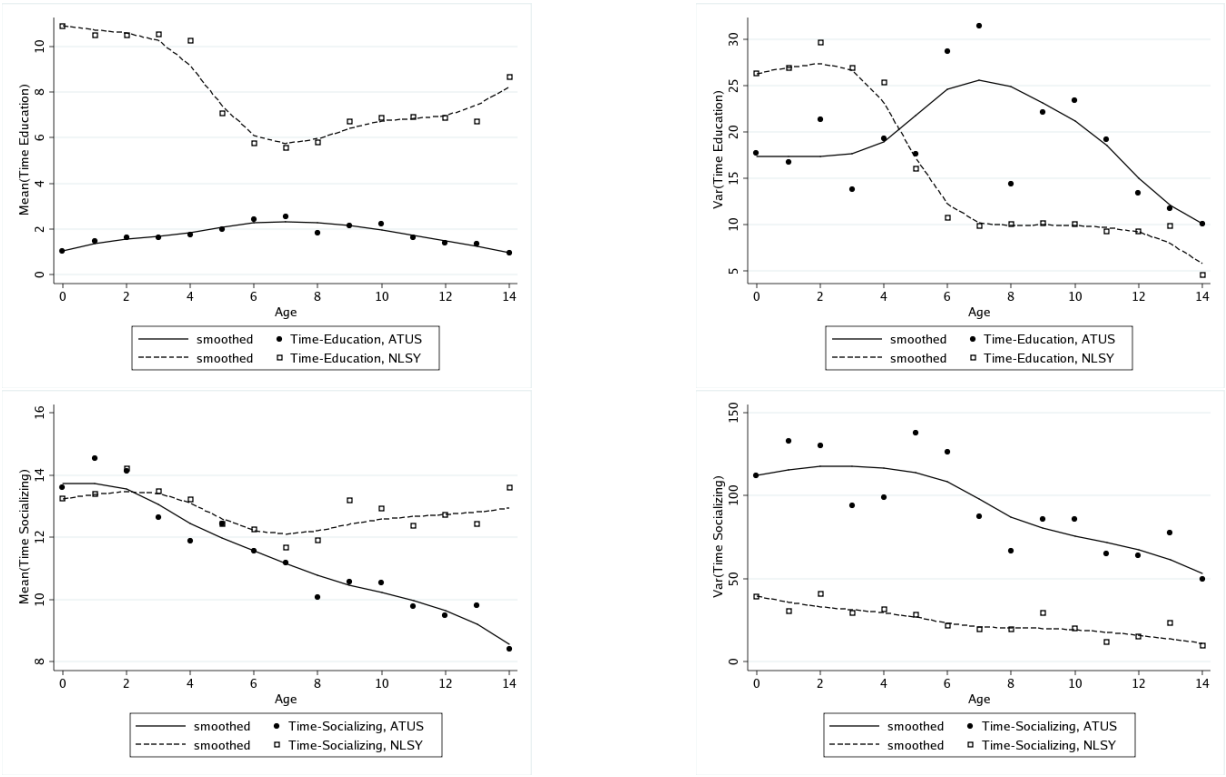


Figure 6 - Mean and variance of for time use variables in ATUS and NLSY - original and re-scaled variable:



Note: Mean and variance of main time use variables used in empirical analysis. Unit: hours per week.
Time in Education includes:

- in NLSY: time helping children with homework or learning simple things as numbers and alphabet, talking to child, discussing TV programs or reading to child;
- in ATUS: "Teaching household children (helping, teaching and activities related with educational activities), "Talking/listening household children", "Reading to household children". This variable only includes time mother spends with child.

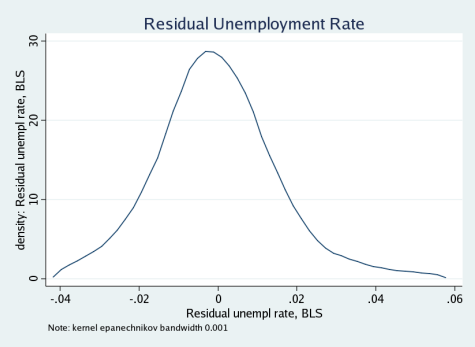
Time socializing/leisure includes

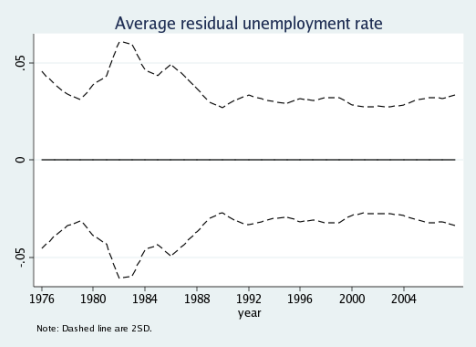
- in NLSY: going out with of house or meeting friends and relatives, going shopping with child, doing things together (cooking, sewing, building something), going to movies, going out for dinner or playing games or sports;
- in ATUS: "socializing", "organization and planning for household children", "arts and crafts with household children, attending household children's events", "playing with household children children (includes sports and nonsport activities)".

See Tables A6 and A11 in Appendix for construction of NLSY and ATUS variables.

Characteristics of shock

Figure 7: (A) Density of county shock and (B) Yearly variation of shock (data source: BLS 1976-2006).

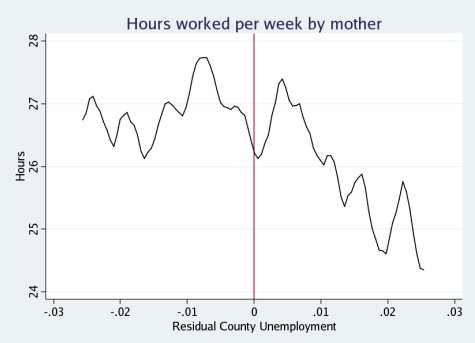


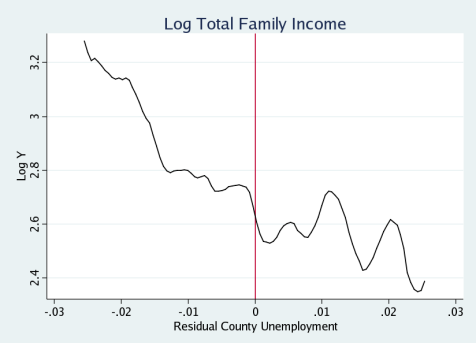


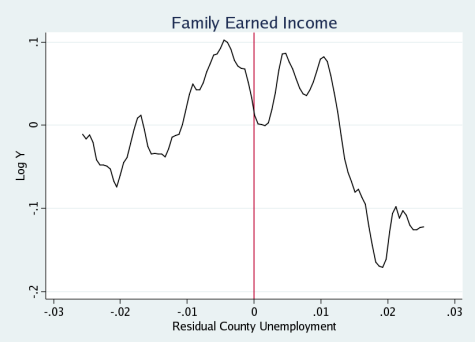
Note: Annual mean and standard deviation of unexplained unemployment rate.

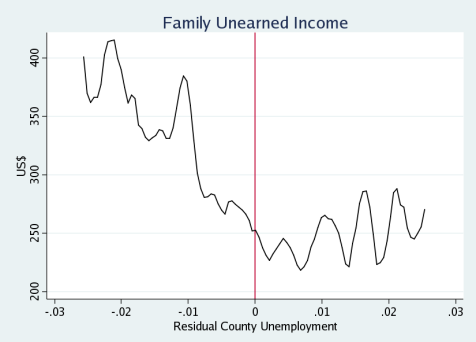
Observations	Mean	SD	P25	P50	P75
103531	0.00000	0.01840	-0.01040	-0.00093	0.00900

Figure 8 - Variation of hours worked per week by mothers, family income, earnings and unearned income with county shock (data: Children of NLSY79 1986-2006).









Note: Graphs present kernel regressions of income and labor supply measures on unexpected unemployment rate (bandwidth = 2, kernel epanechnikov). The left-hand side of each graph present relation between unexpected decreases in unemployment and each variable; the right-hand side includes increases of unemployment.

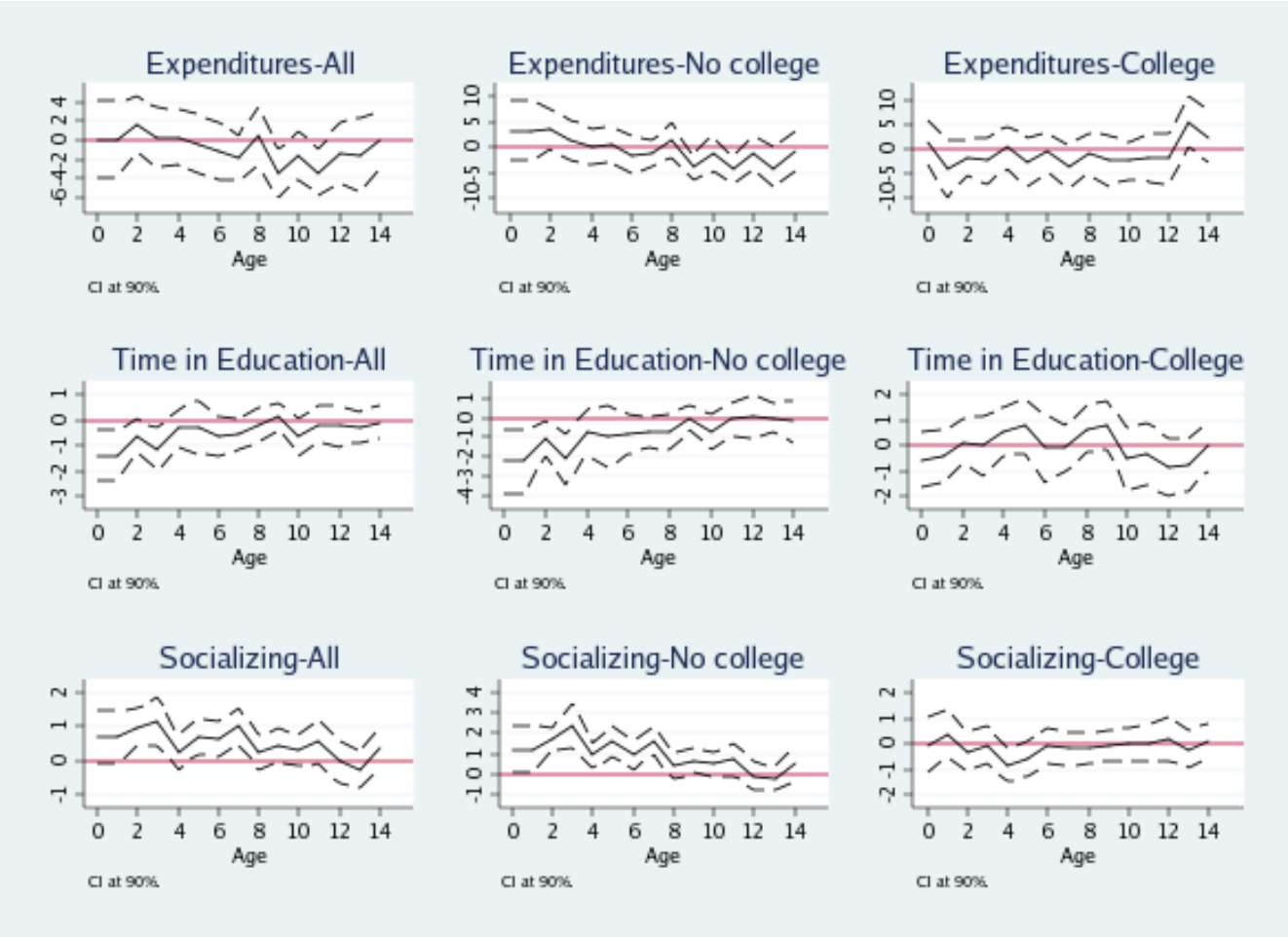


Figure 9 - Effect of shock on investments in human capital across child's life cycle (Data: CNLSY, unit: child)

Note: children 0-14 years in cross sectional sample of NLSY. The model estimated is

$$i_{kfct} = \alpha_0 + \sum_{j=0}^{14} \alpha_{1j} \left(\varepsilon_{ct} \times 1 \left[Age_{kfct} = j \right] \right) + \alpha_2' X + \sum_{j=0}^{14} \alpha_{3j} \times 1 \left[Age_{kfct} = j \right] + \pi_k + \pi_c + \pi_t + e_{kfct}$$

where i_{kfct} is an a measure of investment in child's human capital from the CNLSY of child k of family f, living in county c in year t, ε_{ct} is the residual county unemployment rate. $1\left[Age_{kfct} = j\right]$ is an indicator variable that takes value 1 if child k is j years old. X includes quadratic of mother's age, (quadratic of) family size, for the presence of children 0-2, 3-5, 6-9 and 10-14 years old in family, mother's education and marital status, π_k is a child fixed effect, π_c is a county effect and π_t are year fixed effects. The dependent variable in "Time in Education" and "Socializing" is $log(X + 1)$.

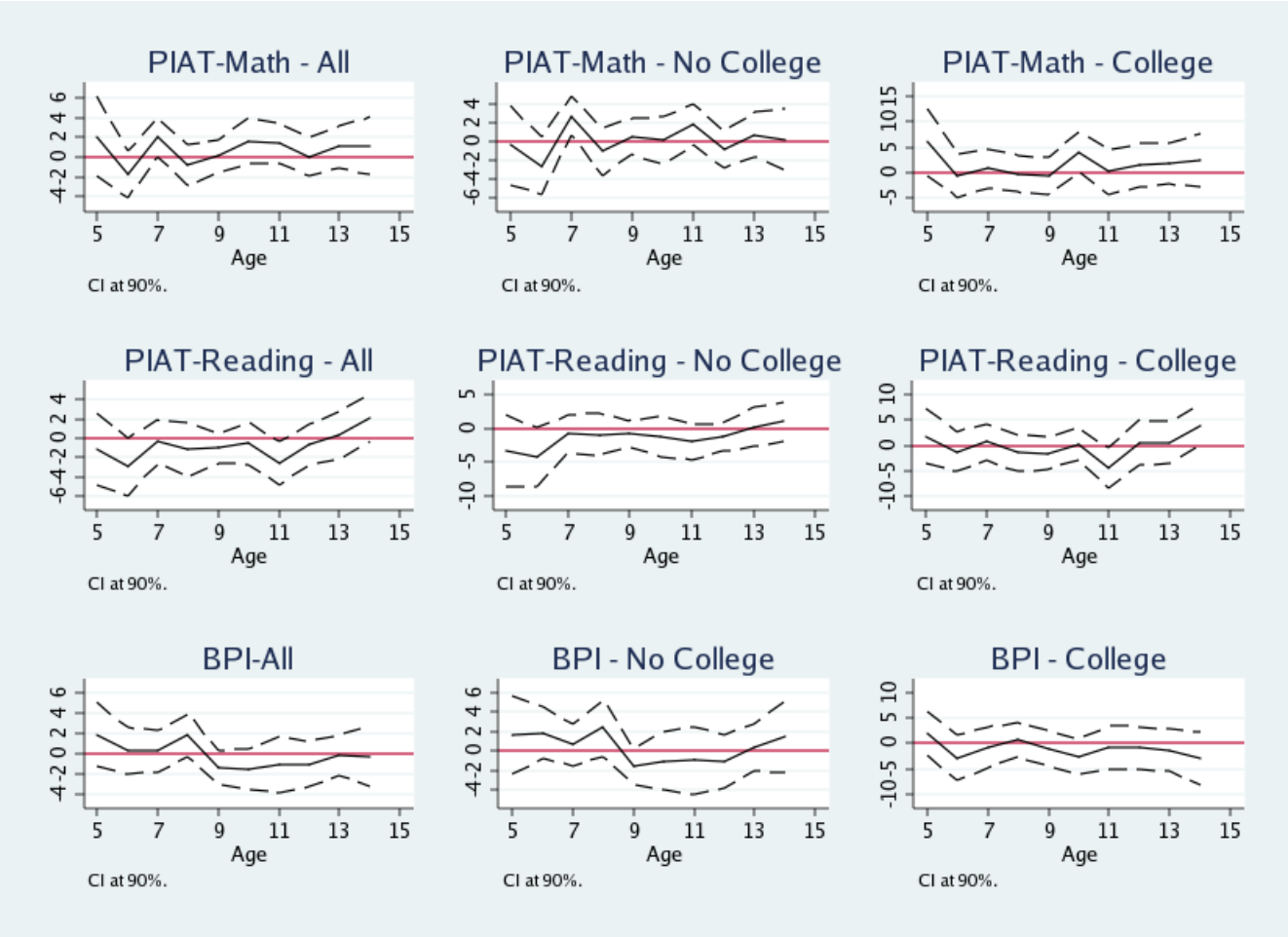


Figure 10 - Effect of shock on investments in human capital across child's life cycle (Data: CNLSY, unit: child)

Note: children 5-14 years in cross sectional sample of NLSY. The model estimated is

$$Outcome_{kfct} = \alpha_0 + \sum_{j=5}^{14} \alpha_{1j} \left(\varepsilon_{ct} \times 1 \left[Age_{kfct} = j \right] \right) + \alpha_2' X + \sum_{j=5}^{14} \alpha_{3j} \times 1 \left[Age_{kfct} = j \right] + \pi_k + \pi_c + \pi_t + e_{kfct}$$

where $Outcome_{kfct}$ is measure of child's human capital from the CNLSY of child k of family f, living in county c in year t, ε_{ct} is the residual county unemployment rate. $1\left[Age_{kfct} = j\right]$ is an indicator variable that takes value 1 if child k is j years old. X includes quadratic of mother's age, (quadratic of) family size, for the presence of children 0-2, 3-5, 6-9 and 10-14 years old in family, mother's education and marital status, π_k is a child fixed effect, π_c is a county effect and π_t are year fixed effects. The shock is measured in $t-1$. Test scores are standardized by child's age, so that mean and standard deviation are 0 and 1 for each age, respectively.

Appendix A: Re-scale measures of parental investment in CNLSY using CEX and ATUS

Econometric setup for the re-scaling procedure

Given the lack of a panel for consumption expenditures there have been several attempts to impute nondurable consumption from CEX in PSID. For example, Skinner, 1987, imputes total consumption in PSID using estimated coefficients of a regression of total consumption on a series of consumption items (food, utilities, vehicles, etc.) available in both data sets. Blundell et al., 2008, also use a variable present both in PSID and CEX to impute total consumption from the later into the first[1]. Other methods have been used to combine different data. For example, using two-sample instrumental variables, Arellano and Meghir, 1992, estimate female labor supply using data from UK's Labor Force Survey (LFS) after imputing wages and unearned income estimated from the Family Expenditure Survey (FES); Angrist and Krueger, 1992, estimate the effect of age at school entry on completed years of education computing school entry from 1960 Census and completed education from 1980 Census. The type of incompleteness of CNLSY's information on expenditures with children specific goods and time measures is slightly different than the incompleteness in the previous examples: measures of goods and time parents spend with children are observed over the life-cycle of all children in the sample, but, although they represent use of resources - time and money - they are not measured in a metric that allows such interpretation.

The general econometric problem can be described as follows. Suppose, one wants to identify β_0 from the following moment condition:

$$E\left[m\left(X^*, Z, \beta_0\right)\right] = 0 \tag{1}$$

where $m(.)$ is a known function, Z is a vector of observed variables and X^* is unobserved in this data. Instead, I observe a mismeasured version of true value X^*, X, so that $X = X^* + \varepsilon^X$.

Chen, Hong and Tarozzi, 2008, and Chen, Hong and Tamer, 2005[2], propose a method that relies on the use of an auxiliary data set containing information about the conditional distribution of the true value X^* given the mismeasured variables, X. In particular, they consider the use an auxiliary of data set - data set 2 - in which (X_2^*, X_2, Z) are observed[3], that can be used to recover information about correlation between X_1^* and X_1. To settle ideas, I start by explaining the notation used. Let f_{X_k} and $f_{X_k^*}$ be the marginal densities of proxy variable and latent variable in data set k, $k = \{1, 2\}$; let $f_{X_k^*|X_k}$ be the conditional density of the latent variable given proxy variable in data set k, $k = \{1, 2\}$. Let E_k denote the expectations taken in data set k, $k = \{1, 2\}$. The vector of variables Z is common to data sets 1 and 2 and condition on Z is kept implicit in previous definitions. Let

$$g\left(x, \beta\right) \equiv E\left[m\left(X_1^*, \beta\right)|X_1 = x\right] = \int m\left(x^*, \beta\right) f_{X_1^*|X_1 = x}\left(x^*\right) dx^* \tag{2}$$

then using (1) and the law of interated expectations, it is possible to uniquely identify β_0 from data set 1 if:

$$E_1\left[g\left(X, \beta_0\right)\right] = \int g\left(x, \beta_0\right) f_{X_1}\left(x\right) dx = 0 \tag{3}$$

The assumption that must hold to allow the use of data set 2 to recover the correlation between the mismeasured and true variable is the following: $f_{X_2^*|X_2 = x} = f_{X_1^*|X_1 = x}$, for all x in the support of X_1. This would imply that

$$g\left(x, \beta\right) = E\left[m\left(X_2^*, \beta\right)|X_2 = x\right] = \int m\left(x^*, \beta\right) f_{X_2^*|X_2 = x}\left(x^*\right) dx^* \tag{4}$$

and it is possible to use data 2, the auxiliary data (here CEX or ATUS), to estimate β and replace X_1^* by the projection of X_2^* on X, which is common to data sets 1 and 2.

Procedure to re-scale variables in Children of the NLSY79 (CNLSY)

The CNLSY is a child level data where parenting information is collected at child level and most of the items can be matched with variables on expenditures and time use data. However, both expenditure and time use data information is collected at household level. For example, information collected from CEX is household expenditure

[1] Blundell et al., 2008 use the inverse of coefficients of a regression of food consumption on nondurable consumption, relative prices of food, transports, fuel and utilities and alcohol and tobacco, and household demographics

[2] See also Ichimura and Martinez-Sanchis, 2008.

[3] The subscript on X and Z variables indicates the data set being considered.

on school tuition and in ATUS there is information on how many minutes a day mother/father spent reading to children. Therefore, child level information can only directly be matched across data sets for one-child families. An inspection of within family variation in measures of parental investment available in the CNLSY for families with more than one child reveals that: (i) some of these measures relate to family-level behaviors (e.g., family receives daily newspaper or family eats together) and (ii) there is little within family variation even for those measures that are child specific (e.g., number of times mother reads to child).[4]

To combine the three data sets I proceed in three steps: (1) I first aggregate children level variables for each family in the CNLSY, (2) I construct indexes of family expenditures and time use measures by matching NLSY with CEX and ATUS, and (3) I recover child level expenditures and time use for the CNLSY using information on household composition.

Step 1: Aggregation of CNLSY's measures

To match the NLSY with the other data sets I start by redefining investment variables at family level.

First, all variables of parenting in the CNLSY are recoded to be 0-1 indicators; the procedure followed is explained in Table A4 in Appendix A.[5]

Second, as CEX and ATUS contain household level measures of expenditures and time, I construct indicators of activities from the NLSY79 at family level. Family levels indicators of activity in NLSY are obtained by taking the mode of variables within family (for example, if a mother of two children reads at least once a week to one of her children, then this mother mother spends some time per week reading to her children). Next, I explain the method used to re-scale expenditure and time indicators.

Step 2: Re-scaling expenditures and time

To re-scale expenditure and time measures in the NLSY79 I assume a parametric model that describes the relation between an aggregate expenditure/time allocation, g^*_{ft} (which is the sum of M components) and the indicators included in the aggregate, g_{mft}, $m = 1, ..., M$,. This aggregate is only available in CEX or ATUS and can be written as a (parametric) function h of M indicators of expenditure or time use, g_{mft}, $m = 1, ..., M$, available in the CNLSY and CEX/ATUS for each family f in year t, socio-economic and demographic characteristics and unobserved heterogeneity, ε^g_{ft}, which is assumed to have zero mean, $E[\varepsilon^g_{ft}] = 0$:

$$g^*_{ft} = h\left(g_{mft}, \mathbf{z}_{ft}\right) + \varepsilon^g_{ft} \tag{5}$$

This relation is estimated in the CEX and ATUS, and the coefficient estimates are then used to impute an index of allocation of time or financial resources in the CNLSY. Given specific issues related with expenditures and time measures I explain separately the procedures used to match the data sets.

Combining CNLSY and CEX I start by collecting common variables indicating expenditures in CEX and CNLSY. Table A5 includes a description of the variables to be matched one-by-one in CNLSY and CEX.

CNLSY measures age specific parenting attitudes. For example, CEX contains a category of expenditures for newspapers, magazines and books; the matching variables in CNLSY are (i) "Does family gets daily newspaper?", which is available for families with children ages 6-14 and (ii) "About how many magazines does your family gets regularly?", available for mothers of children 3-5. So, (i) and (ii) from the CNLSY are aggregated in one variable which takes value 1 if (i) "Does family gets daily newspaper?" or (ii) "About how many magazines does your family gets regularly?" take value 1, and 0 otherwise (this variable will be missing in the CNLSY if the family only have children 0-2 years old).

To replicate in the CEX each variable g_{mft} available in the NLSY79 I use the distribution of the variable in the NLSY79 by family structure. In particular, as availability of variables in CNLSY depends on the age structure of children in family, I consider four groups of families defined by the age of the youngest child in family, 0-2, 3-5, 6-9 or 10-14. The distribution of variables in CNLSY by family structure is presented in columns (4), (6), (8) and (10) of Table A6. To create an indicator in CEX the correspondent threshold is set at the correspondent percentile

[4]For the sample used in main analysis of the paper, for families of 2, 3 and 4 children, the reported value in the number of times parents eat with child varies only on average in 5-10% of times within family-year. The figures are similar for the number of time children are taken to museum. For these families there is almost no variation within family in report for whether parents discuss TV programs with their children or if they receive newspaper at home. Depending on the number of children per family, within family reports for "whether mother reads to children in family at least once per week" varies on average between 6% and 14% of times.

[5]This method follows closely the recoding procedure to recode components of HOME score into dichotomic variable followed by the Bureau of Labor Statistics. See CHRR, 2002.

of expenditure. If the expenditure item does not have enough variation, the indicator takes value 1 as long as expenditure in an item is above US$1. For example, indicators for expenditures in "Magazines and newspapers" and "Toys and hobbies" are created using variation available from the distribution of expenditures per each family structure; "Children's books" and "Child care, elementary and high school tuition" are indicators that take value 1 if expenditure is above US$1. The distribution of indicators of expenditures, g_{mft}, which are used to match the two data sets is therefore very similar in both data sets (see Table A6).

To justify the parametric specification assumed for model (5), I plotted average expenditures in education by number of children (the relation between the two variables is concave). This is used as guide for the functional form of the empirical specification used[6]. I investigate several specifications for the model (5), where $\mathbf{z}_{ft}$ captures demographic and socioeconomic differences across households that determine expenditures in children and that are observed in CNLSY and CEX. In particular, $\mathbf{z}_{ft}$ includes functions of mother's age, demographic structure of household composition, mother's education (indicator for high school completion and college attendance or college graduate), mother's marital status, a dummy for white race, year fixed effects, weekly hours worked by mother and weeks worked per year and log family income after taxes.

Table A7 presents coefficients estimate for the specification of main measure used as children's expenditures. I then use the coefficients of this regression, and similar variables constructed in the CNLSY, to obtain an index of expenditures in CNLSY. Table A7 shows that expenditures in child care or school tuition and toys have the highest weight on total expenditures in education. Expenditures in newspaper have larger weight in families with older children. An extra child at ages 3-5 is associated with an increase of 24% in expenditures in education, whereas an extra child 10-14 years old is associated with a decrease in expenditures of 15%. Families of mothers with a high school degree spend 33% more in education than families of dropout mothers, and families of mothers who attended college spend 70% more than families of dropouts. Families of white mothers and those with working mothers spend more on education of children.

To assess the reliability of this procedure Figure A2 includes the distribution of original expenditures and re-scaled variable in the CNLSY. Both original and re-scaled distribution are very similar. Table A8 includes R_2 of alternative specifications for the imputation.

Combining CNLSY and ATUS There are several complications in matching CNLSY and ATUS:

1. There is no unique time use data set that covers most of the period from 1986-2006, and ATUS is only available for 2003-2007;

2. Activities in CNLSY refer to different periods of time, they cover daily, weekly or monthly activities (see for example, Table A4 for description of parenting variables in CNLSY), whereas ATUS refers to activities starting at 4am the previous day and ending at 4am on the interview day;

3. ATUS sample is not uniformly distributed across the days of the week. About 25 percent of the sample is assigned to report on each of the 2 weekend days and 10 percent of the sample is assigned to each of the 5 weekdays. To overcome this, all estimations in ATUS are weighted by provided weights[7].

4. Children can spend their activities with mother, father or both; in the NLSY some activities are developed specifically with mothers (e.g., time mother spend reading to her child), but others can take place with mother and father present[8] (e.g., visits to relatives or friends). Table A9 presents the person who might be with child for each activity in CNLSY to be matched with ATUS. This structure is accounted for when constructing the ATUS' variables;

5. Parents spend a small proportion of daily time in primary child care activities[9]. Table A13 documents that most of the time mothers spend with children is simultaneously spent doing some other activity: as expected mother spend most of time involved in education of their children when they are 6-9 (around 1.6 hours per week) and most of time mothers spend eating they do it with children around.

The procedure to match both data sets is the following.

[6] One can also expect complementarities in some types of expenditures. For example, Figure A1 suggests that expenditures in school tuition, child cloth and school are complements, and the number of school age children increases these type of expenditures. Economies of scale may be present if child's distribution of age are sufficiently close.

[7] The weights available in ATUS are constructed so that each day of the week is correctly represented for the sample month (in 2003 and 2004) or the sample quarter (in 2005 and later)

[8] Whether father is present during an activities depends on mother's marital status, and this is controlled for when matching ATUS and NLSY.

[9] Primary child care activities are those activities in which the parent's attention is only focused on children.

1. I recode all variables at the same time unit, in particular, activities in the CNLSY are recoded to daily. If an activity is done at least once per month (week) in CNLSY then it has probability 1/30 (1/7) of taking place at a given day. Table A4 list the frequency of CNLSY's variables; for example, "child eats with both mother and father at least once a day" is a daily activity, whereas socializing is a weekly activity ("child gets out at least once a once a week?, and "family gets together with friends and relatives at least once a week?").

2. As for CEX, I create an index of time in ATUS, $g_{ft}^{*,T}$, which is a combination of several variables, say, $g_{1mft}^{*,T}$ and g_{2mft}^{T}. Since h is a parametric function in (5):

$$g_{ft}^{*,T} = \beta_1 g_{1mft}^{T} + \beta_2 g_{2mft}^{T} + \beta_3' \mathbf{z}_{ft} + \varepsilon_{ft}^{T}.$$

   As $g_{ft}^{*,T}$ presents a large proportion of zeros (for example, see Column (1) in Table A10), this model is estimated by a Tobit. Therefore, to impute $g_{ft}^{*,T}$ in the CNLSY I compute

$$g_{ft}^{*,NLSY} = \widehat{\beta_1} g_{1mft}^{NLSY} + \widehat{\beta_2} g_{2mft}^{NLSY} + \widehat{\beta_3}' \mathbf{z}_{ft} + \widehat{\sigma} \frac{\phi\left(\widehat{\beta}' \mathbf{z}_{ft}\right)}{\Phi\left(\widehat{\beta}' \mathbf{z}_{ft}\right)} \text{ if } g_{ft}^{*,NLSY} > 0 \tag{6}$$

   To account for the daily structure of ATUS, I compute imputation equation (6) for each day of the year in the NLSY and obtain an average daily time. For each day of the year I draw a random variable X, and if activity g_{kmft}^{NLSY} is monthly (weekly) it is coded 1 if $X \leq 1/30(1/7)$ and otherwise activity is coded 0[10].

3. Table A11 presents several of the time use indexes created. Panel A in Table A12 presents the estimates for model (6) for the indexes used in main results of the paper, whereas Panel B presents a comparison between original variables in ATUS and imputed indexes in CNLSY.

Contrary to CEX, the ATUS has information on individuals' state of residence, and I exploit this regional variation in the model of imputation. However, I am unable to exploit year variation. Because model (6) includes year fixed, the time effect for 1986-2002 in the CNLSY is the same as for 2003, the first year ATUS was collected.

Step 3: Procedure to recover individual level information from household level data

To understand how inputs affects child's human capital accumulation I recover individual level expenditure and time use decomposing the observed aggregate expenditure/time. The method used follows Chesher, 1998, and Deaton and Paxson, 2000.

I am interested in recover the extra expenditure (time) spent by an extra child with gender s, $s = \{w, m\}$, and age a in each family. Then, household expenditures/time use can be written as a function of number of children gender s and age a, $a = 0, ..., 14$ (14 is the oldest age to which I observe parental investments in CNLSY) and household's characteristics, $\mathbf{z}_{ft}$:

$$g_{ft} = \beta_0 h\left(\mathbf{z}_{ft}\right) + \sum_{a=0}^{14} \left(\beta_{1am} n_{ftam} + \beta_{1aw} n_{ftaw}\right) + \varepsilon_{ft}^{g}$$

where n_{ftas} is the number of children age a, gender s in family f in year t. In this specification, $\beta_0 h\left(\mathbf{z}_{ft}\right)$ is a location measure that accounts for the fact that families with different levels of resources will have different level of expenditures or use of time. The model above is estimated in CNLSY and the effect of an extra child with gender s, $s = f, w$, and age a is β_{1as} (this may vary with mother's education and year).

[10] I also try to impute each variable from ATUS on CNLSY by estimating a model of a time activity on exogenous variables available in both data sets. This method resulted in distributions different from the original distribution observed in the ATUS.

Tables for Appendix A

Table A1 - Sample selection NLSY (1979-2006)

	(1) Dropped	(2) Number of observations	(3) Number of children
Original sample		332,601	11,469
Drop if belongs to supplemental military sample	12,122	320,479	11,051
Mother has no information on education	0	320,479	11,051
Drop if no information on county/state of residence	40,732	279,747	11,051
Drop if no information on county unemployment rate	1,335	278,412	11,051
Drop if mother has no yearly info on marital status (after imputation)	4,992	273,420	11,051
Drop if mother has no yearly info on family size (after imputation)	68	273,352	11,051
Drop if observations without info on welfare income or labor supply	3,685	269,667	11,051
Drop children without any information on income	0	269,667	11,051
Drop children with less than 4 observations in income	75	269,592	11,029
Drop if child never has information on HOME score (complete score)	24,114	245,478	9,670
Drop if child is never in outcomes sample	4,353	241,125	9,496
Final sample - all	91,476	241,125	9,496
Number of families			4,221
Final sample - cross-sectional		137,669	5,111
Number of families			2,295

Note: Original number of observations includes all yearly records between 1978 and 2006. The number of observations excluding years with without survey (1995, 1997, 1999, 2001, 2003, 2005) is 263787.

Table A2 - Sample Selection (CEX: 1980-2000)

Sample	(1) Households Dropped	(2) Households Remain
Original: month-household observations		1,407,043
Original: households		232,453
Missing non durable consumption	1,277	231,176
Drop households in student housing	1572	229,604
Must have children in household	147,081	82,523
Must have complete income report	17956	64,567
Drop income outliers: income < food at home	757	63,810
Mother born between 1955-1965	39,212	24,598
Final sample	207,855	24,598
% households present less than 12 months in sample		91%
Number of children ≤ 14	1041	23,557

Table A3 - Sample Selection (ATUS: 2003-2007)

Sample	(1) Households Dropped	(2) Households Remain
Original: households		72,922
keep if age youngest child ≤ 14	42,699	30,223
Keep if mother born between 1955-1965	20,825	9,398
Final sample	20,825	9,398
Males		4,251
Females		5147

Table A4 - Definition of parenting variables in CNLSY.

1	C*	Number of books	Variable takes 4 values: one if the child has no books, two if the child has one or two books, three if the child has between 3 or 9 books, and four if the child has ten or more books. Variable is recoded to 1 if child has 10 or more books and to 0 otherwise.
2	C	How often mom reads to child	Variable takes six values: 1 if the never activity is never done; 2 if the less than once a month; 3 if more than once a month; 4 if once a week; five if three times a week; and six everyday. Variable is recoded to 1 if mother reads at least once a week and to 0 otherwise.
3	C	How often does child gets out of house?	Variable takes five values: 1 if the mother reports that the child is too young to do such activity, 2 if once a month or less, 3 if a few times a month, 4 if about once a week, and 5 if out more than once a week. It is recoded to 1 if takes value 3, 4 or 5, and to 0 otherwise.
4	C	How often does child is taken to grocery?	Variables takes four values: 1 if twice a week or more, 2 if once a week, 3 if once a month and 4 if hardly ever (goes alone). Variable is recoded to 1 if takes value 1 or 2 and to 0 otherwise.
5	C	How many cuddly, soft, or role-playing toys does child have?	Actual number reported. Variable is recoded to 1 if child has at least 10 toys and to 0 otherwise.
6	C	How many push or pull toys does child have?	Actual number reported. Variable is recoded to 1 if child has at least 10 toys and to 0 otherwise.
7	E	How often do you talk to child while you are working?	The Variable takes five different values: 1 if always; 2 if often; 3 if sometimes; 4 if rarely; 5 if never. Variable is recoded to 1 if takes values 1 or 2 and to 0 otherwise.
8	C	Do you help your child with numbers?	Variable takes two values: zero if no; one if yes.
9	C	Do you help your child with alphabet?	Variable takes two values: zero if no; one if yes.
10	C	Do you help your child with colors?	Variable takes two values: zero if no; one if yes.
11	C	Do you help your child with shapes?	Variable takes two values: zero if no; one if yes.
12	C	Do you help your child with none of the above?	Variable takes two values: zero if no; one if yes.
13	C	About how many magazines does your family get regularly?	Actual number reported. Variable is recoded to 1 if it takes at value 4, and to 0 otherwise.
14	C	Does child have the use of a CD player, tape deck at home and at least 5 childrens records or tapes?	Variable takes two values: zero if no; one if yes.
15	C	How often was child taken to museum last year?	The variable takes five values: 1 if the mother reports that the child is too young to do such activity, 2 if once a month or less, 3 if a few times a month, 4 if about once a week, and 5 if out more than once a week. Variable is recoded to 1 if it takes at least value 3, and to 0 otherwise.
16	C	Does your family get a daily newspaper?	Variable takes two values: zero if no; one if yes.
17	C	Does child get special lessons/extracurricular activities?	Variable takes two values: zero if no; one if yes.
18	C	How often was child taken to any performance in past year?	Variable takes six values: 1 if the never activity is never done; 2 if the less than once a month; 3 if more than once a month; 4 if once a week; 5 if three times a week; and 6 everyday. Variable is recoded to 1 if it takes at least value 3, and to 0 otherwise.

Table A4 - Definition of parenting variables in CNLSY (cont.).

19	E	How often does your whole family get together with relatives or friends? Variable is recoded to 1 if it takes at least value 4, and to 0 otherwise.	Variable takes six values: 1 if the never activity is never done; 2 if the less than once a month; 3 if more than once a month; 4 if once a week; five if three times a week; and six everyday.
20	C	Is there a musical instrument that child can use here at home?	Variable takes two values: zero if no; one if yes.
21	C	Family encourage child to start and keep doing hobbies?	Variable takes two values: zero if no; one if yes.
22	C	When family watches TV, do you discuss programs with child?	Variable takes two values: zero if no; one if yes.
23	E	How often does child eat a meal with both you and his/her father/step/father-figure?	Variable takes six values: 1 if more than once day; 2 if once a day; 3 if several times a week; 4 if once a week; 5 if once a month or less; 6 never. Variable is recoded to 1 if takes value 1 or 2 and to 0 otherwise.
24		About how many hours is the TV on in your home each day?	Actual number reported. Variable is recoded to 1 if 5 or less hours and to 0 otherwise.
		Weekly activities with parents (not part of HOME scale)	
25		Worked on schoolwork together	Variable takes two values: zero if no; one if yes.
26		Done things together (build or make things, cook, or sew)	Variable takes two values: zero if no; one if yes.
27		Played game/sport w/ parents	Variable takes two values: zero if no; one if yes.
		Monthly activities with parents (not part of HOME scale)	
28		Gone out to dinner	Variable takes two values: zero if no; one if yes.
29		Gone to the movies together	Variable takes two values: zero if no; one if yes.
30		Gone on an outing together	Variable takes two values: zero if no; one if yes.
31		Gone shopping for child	Variable takes two values: zero if no; one if yes.

Table A5 - Correspondence of variables: CNLSY and CEX.

CEX (1980-2000)	CNLSY (1986-2006)	Age of child in the NLSY
School tuition	Attendance of formal care/private school	0-14
School books	Number of books child has?	0-14
Expenditures in newspapers, magazines, books	Family receives newspapers	6-14
	Family receives magazines	3-5
Expenditures on hobbies, toys	Child has soft/push toys?;	0-2
	Parents encourage hobbies;	6-14
	Attends extracurricular activities;	6-14
	Child has musical instruments?	6-14

Table A6 - Comparison of indicators of expenditure common to CNLSY and CEX.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Age of youngest child in household	All		0-2		3-5		6-9		10-14	
	CEX	NLSY	CEX	NLSY	CEX	NLSY	CEX	NLSY	CEX	NLSY
Children's books	0.232	0.813	0.169	0.790	0.237	0.910	0.330	0.900	0.345	0.681
	(0.422)	(0.390)	(0.374)	(0.407)	(0.425)	(0.286)	(0.470)	(0.300)	(0.475)	(0.466)
Child care, elementary and high school tuition	0.461	0.482	0.603	0.491	0.662	0.620	0.433	0.591	0.207	0.0982
	(0.499)	(0.500)	(0.489)	(0.500)	(0.473)	(0.485)	(0.496)	(0.492)	(0.405)	(0.298)
Magazines and newspapers	0.423	0.427	0.360	0.302	0.593	0.544	0.549	0.498	0.486	0.450
	(0.494)	(0.495)	(0.480)	(0.459)	(0.491)	(0.498)	(0.498)	(0.500)	(0.500)	(0.498)
Toys and hobbies	0.699	0.758	0.763	0.700	0.699	0.595	0.869	0.958	0.819	0.940
	(0.459)	(0.429)	(0.425)	(0.458)	(0.459)	(0.491)	(0.337)	(0.201)	(0.385)	(0.238)
Observations	23342	12752	4602	4247	3075	3168	2623	2968	1795	1946

Note: Table presents means of variables; standard errors are included in parenthesis. Sample use for NLSY79 only includes representative subsample.

Table A7 - Regression of log expenditures in education

Variable	Estimate	Variable	Estimate
1[Expenditures in child care/school]	2.5771	1[Exp. in toys/hobbies]Xnumber children 0-2	0.2554
	[0.4112]***		[0.0663]***
1[Expenditures in school books]	0.2455	1[Exp. in toys/hobbies]Xnumber children 3-5	-0.101
	[0.3660]		[0.0594]*
1[Expenditures in newspapers/magazines]	0.3415	1[Exp. in toys/hobbies]Xnumber children 6-9	0.1323
	[0.4075]		[0.0573]**
1[Expenditures in toys/hobbies]	1.1874	1[Exp. in toys/hobbies]Xnumber children 10-14	-0.0154
	[0.3853]***		[0.0600]
1[Expenditures in child care/school]Xhigh school degree	-0.0262	number of children 0-2	-0.0775
	[0.0850]		[0.0676]
1[Expenditures in child care/school]Xcollege attendance	-0.1466	number of children 3-5	0.2378
	[0.0850]*		[0.0617]***
1[Exp. newspapers/magazines]Xhigh school degree	-0.1419	number of children 6-9	-0.0421
	[0.0793]*		[0.0604]
1[Exp. newspapers/magazines]Xcollege attendance	-0.2128	number of children 10-14	-0.1523
	[0.0800]***		[0.0624]**
1[Expenditures in school books]Xhigh school degree	0.0064	number of persons older than 64	0.1118
	[0.0810]		[0.0751]
1[Expenditures in school books]Xcollege attendance	0.0798	number of persons 16-64	-0.0598
	[0.0791]		[0.0206]***
1[Exp. in toys/hobbies]Xhigh school degree	-0.2115	Mother's age	-0.024
	[0.0997]**		[0.0303]
1[Exp. in toys/hobbies]Xcollege attendance	-0.4209	Mother's age (squared)	0.0005
	[0.1052]***		[0.0005]
1[Exp. in child care/school]Xnumber children 0-2	-0.0793	Mother has high school degree	0.326
	[0.0455]*		[0.0969]***
1[Exp. in child care/school]Xnumber children 3-5	0.0581	Mother attended some college	0.6973
	[0.0415]		[0.1077]***
1[Exp. in child care/school]Xnumber children 6-9	-0.0721	Married	0.0038
	[0.0364]**		[0.0412]
1[Exp. in child care/school]Xnumber children 10-14	-0.2069	White	0.1511
	[0.0368]***		[0.0357]***
1[Exp. in magazine/newspaper]Xnumber children 0-2	-0.0537	Weeks worked by mother	0.0037
	[0.0428]		[0.0009]***
1[Exp. in magazine/newspaper]Xnumber children 3-5	-0.0347	Hours worked per week by mother	0.0041
	[0.0388]		[0.0010]***
1[Exp. in magazine/newspaper]Xnumber children 6-9	-0.0816	Log of after tax income	0.3815
	[0.0342]**		[0.0239]***
1[Exp. in magazine/newspaper]Xnumber children 10-14	0.1451		
	[0.0344]***		
1[Exp. in school books]Xnumber of children 0-2	0.0826		
	[0.0444]*		
1[Exp. in school books]Xnumber children 3-5	-0.0179		
	[0.0382]		
1[Exp. in school books]Xnumber children 6-9	0.0313		
	[0.0339]		
1[Exp. in school books]Xnumber children 10-14	0.1885		
	[0.0346]***		
Number of observations			5990
R2			0.66

Note: Variables excluded from table include interactions of indicators with year dummies and year fixed effects.

Table A8 - Robustness checks: functional forms used to match NLSY and CEX

Method	1	2	3	4	5	6	7	8
Variable: expenditures in education								
Observations	12478	12478	12478	5990	5658	5990	6121	5990
R-squared	0.64	0.6	0.6	0.66	0.58	0.7	0.42	0.7
Variable: expenditures in child cloth								
Observations	11716	11716	11716	5930	5349	5930	6121	5930
R-squared	0.24	0.18	0.18	0.24	0.17	0.31	0.29	0.35
Variable: nondurable consumption								
Observations	13211	13211	13211	6121	5998	6121	6121	6121
R-squared	0.54	0.52	0.52	0.55	0.5	0.59	0.42	0.59

Column (4) presents R^2 of model used in Table A8, which is the specification used in main results.

Description of functional forms used for imputation of expenditures from CEX into the NLSY79:

- Specification (1) uses all years of data available in CEX and right hand side variables include indicators of components of expenditures, and interactions with quadratic of number of children per household by gender in each age and education of mother, interaction of indicator, number of children per household by gender in each age and mother's education.

  Controls included are: quadratic of number of children per household by gender in each age, quadratic on mother's age, marital status, number of persons older than 64 years old, number of members over 15, mother's education (indicator for high school completion or college attendance), dummy for white and year fixed effects, hours worked per week by mother, weeks worked per year and log family income.
- Specification (2) uses all years of data available in CEX and interactions with indicators for number of children per household in each age group (0-2, 3-5,6-9,10-14) and its quadratic. The controls are the same as those included in specification (1).
- Specification (3) uses all years of data available in CEX and interactions with indicators for number of children per household in each age group (0-2, 3-5,6-9,10-14) and interaction of indicators of expenditure with year dummies. The controls are the same as those included in specification (1).
- Specification (4) is the same as specification (3), but use only families at least 9 months in sample.
- Specification (5) only includes indicators of expenditure and controls as right hand side variables.
- Specification (6) is the same as specification (2) but only uses years of data common to CNLSY and CEX (1980-1993, 1995, 1997, 1999).
- Specification (7) is the same as (6), but uses all years of data and families at least 9 months in sample.
- Specification (8) is the same as (1), but use only families at least 9 months in sample.
- Other functional forms were tested, namely variants of previous specifications with cubic splines in log income with knots at 10 and 11. The R_2 of these regressions was similar to those included here. Effects of income shocks after imputation in the NLSY79 are also similar to those presented included in the paper.

Table A9 - Correspondence of variables: ATUS and NLSY

ATUS	NLSY	Age of child in the NLSY	With whom?	Frequency in NLYS
Primary care				
Teaching household children (helping, teaching and activities related with educational activities)	Do you help your child learning ?	3-5	Both	Not specified
	Worked on schoolwork together?	10-14	Both	Weekly
Talk/listen household children	How often do you talk to child while you are working,	0-2	Mother	Not specified
	When family watches TV, do you discuss programs with child?	6-14	Both	Not specified
Reading to household children	How often mom reads to child	0-9	Mother	Weekly
Organization and planning for household children	How often does child gets out of house?	0-5	Both	Weekly
	How often does your whole family get together with relatives or friends?	6-14	Both	Weekly
Arts and crafts with household children, attending household children's events	Gone shopping for child	11-14	Both	Monthly
	Done things together (build or make things, cook, or sew)	11-14	Both	Weekly
Playing with household children children (includes sports and nonsport activities)	Played game/sport w/ parents	11-14	Both	Weekly
	Gone out to dinner	11-14	Both	Monthly
	Gone to the movies together	11-14	Both	Monthly
Secondary care				
Eating	Child eats meal with both parents at least once a day	0-14	Both	Daily
Meals	Done things together (build or make things, cook, or sew)	11-14	Both	Weekly
Socializing	How often does child gets out of house?	0-5	Both	Weekly
	How often does your whole family get together with relatives or friends?	6-14	Both	Weekly
Entertainment	How often was child taken to museum last year?	3-14	Both	Monthly
	How often was child taken to any performance in past year?	6-14	Both	Monthly
Obtaining goods	How often does child is taken to grocery?	0-2	Both	Weekly
	Gone shopping for child	11-14	Both	Monthly
TV	When family watches TV, do you discuss programs with child?	6-14	Both	Not specified
Exercise/sports	Played game/sport w/ parents	11-14	Both	Weekly

Note: Column "with whom?" indicates who was with child during activity according to NLSY question. Variable used from ATUS replicates this. To compare NLSY and ATUS I set to missing variables for the age groups not available in the NLSY - to use variation from the NLSY. Secondary care refers to activities that adults undertake with children under their supervision.

Table A10 - Indicator variables for daily activity (only representative sample from NLSY79).

Age of youngest child in household		(1) All		(2) 0-2		(3) 3-5		(4) 6-9		(5) 10-14	
		ATUS	NLSY	ATUS	NLSY	ATUS	NLSY	ATUS	NLSY	ATUS	NLSY
Primary care											
Teaching household children (helping, teaching and	Mean	0.14	0.51	0.09	0.82	0.12	0.96	0.18	0.06	0.12	0.05
activities related with educational activities)	SD	0.35	0.48	0.29	0.37	0.33	0.19	0.39	0.12	0.33	0.07
	N	9030	10406	724	2045	1522	3529	2883	1859	3901	2973
Talk/listen household children	Mean	0.11	0.89	0.06	0.93	0.09	0.86	0.12	0.88	0.13	0.85
	SD	0.32	0.32	0.24	0.25	0.29	0.35	0.33	0.32	0.34	0.36
	N	8906	13564	1092	4426	1030	2206	2883	3764	3901	3168
Reading to household children	Mean	0.13	0.11	0.13	0.12	0.17	0.12	0.10	0.10	NA	NA
	SD	0.33	0.06	0.34	0.05	0.37	0.05	0.30	0.07		
	N	5502	11810	1092	4463	1522	3570	2883	3753		
Organization and planning for household children	Mean	0.03	0.10	0.02	0.13	0.03	0.11	0.04	0.08	0.02	0.07
	SD	0.17	0.06	0.15	0.03	0.17	0.06	0.20	0.07	0.15	0.07
	N	9398	15123	1092	4499	1522	3598	2883	3823	3901	3203
Arts and crafts with household children, attending household	Mean	0.07	0.03	0.04	0.03	0.09	0.03	0.09	0.03	0.06	0.03
children's events	SD	0.26	0.01	0.21	0.01	0.28	0.01	0.29	0.01	0.24	0.01
	N	6359	5976	292	488	532	748	1634	1759	3901	2981
Playing with household children children (includes sports	Mean	0.07	0.11	0.26	0.10	0.14	0.11	0.10	0.11	0.03	0.10
and nonsport activities)	SD	0.25	0.06	0.44	0.06	0.35	0.06	0.30	0.06	0.17	0.06
	N	6359	5960	292	484	532	750	1634	1750	3901	2976
Secondary care											
Eating	Mean	0.74	0.64	0.88	0.74	0.89	0.67	0.90	0.58	0.54	0.53
	SD	0.44	0.48	0.32	0.44	0.32	0.47	0.30	0.49	0.50	0.50
	N	9398	14742	1092	4385	1522	3506	2883	3761	3901	3090
Preparation of meals	Mean	0.45	0.08	0.62	0.08	0.60	0.09	0.60	0.08	0.36	0.08
	SD	0.50	0.07	0.49	0.07	0.49	0.07	0.49	0.07	0.48	0.07
	N	6359	5942	292	744	532	483	1634	1745	3901	2970
Socializing	Mean	0.38	0.10	0.43	0.11	0.43	0.13	0.47	0.08	0.28	0.07
	SD	0.49	0.06	0.50	0.06	0.50	0.03	0.50	0.07	0.45	0.07
	N	9398	15123	1092	3598	1522	4499	2883	3823	3901	3203
Entertainment	Mean	0.11	0.01	0.10	0.02	0.14	0.01	0.12	0.02	0.09	0.01
	SD	0.31	0.02	0.30	0.02	0.35	0.02	0.33	0.02	0.28	0.02
	N	9030	13304	724	3588	1522	2691	2883	3823	3901	3202
Obtaining goods	Mean	0.35	0.07	0.42	0.03	0.43	0.12	0.44	0.03	0.27	0.03
	SD	0.48	0.06	0.49	0.02	0.50	0.05	0.50	0.01	0.44	0.01
	N	7160	9853	1092	771	532	4341	1635	1762	3901	2979
TV	Mean	0.56	0.86	0.67	0.86	0.65	0.86	0.68	0.88	0.44	0.85
	SD	0.50	0.34	0.47	0.35	0.48	0.35	0.47	0.32	0.50	0.36
	N	8307	10621	493	2187	1030	1507	2883	3760	3901	3167
Exercise/sports	Mean	0.12	0.08	0.10	0.09	0.15	0.07	0.18	0.08	0.09	0.07
	SD	0.33	0.07	0.29	0.07	0.36	0.07	0.38	0.07	0.29	0.07
	N	6359	5935	292	745	532	478	1634	1742	3901	2970

Note: Comparison of original indicator variables for undertaking a given activity available in the NLSY and constructed indicators in the ATUS.

See Table A5 with definition of parenting measures in NLSY for construction of indicator variables in NLSY. Weekly (monthly) variables from NLSY are multiplied by probability of taking place in a given day (1/7 and 1/30, respectively).

Indicators for an activity in ATUS take value 1 as long an activity takes place in a given day and 0 otherwise.

Table A11 - Aggregated variables created from ATUS

Aggregate index	Components from Time Use (2003-2007)
Time Teaching Children 1 only primary care	Teaching household children (helping, teaching and activities related with educational activities)
	Talk/listen household children
	Reading to household children
Time Teaching Children 2	Time Teaching Children 1 + mother reads for her personal interest
Leisure activities 1 (only primary care)	organization and planning for household children
	Arts and crafts with household children, attending household children's events
	Playing with household children children (includes sports and nonsport activities)
Also activities in which child was under parent's supervision	
Leisure activities 2	Recreational act. 1 + socializing
Leisure activities 3	Socializing + eating with parents
Leisure activities 4	Socializing + exercise/sports + eating + preparation of meals
Leisure activities 5	Socializing + exercise/sports + eating + tv
Leisure activities 6	Socializing + exercise/sports + eating + preparation of meals + tv + entertainment not tv

Note: Outcomes used in main results are *Time Teaching Children 1 (Education), Time Teaching Children 2 (Education/Reading), Leisure Activities 2 (Socializing).*

Table A12 - Panel A: Different measures for time allocation.

	(1) Time leisure 2 Primary care socializing	(2) Time leisure 3 Eating together +socializing	(3) Time teaching version 1	(4) Time teaching version 2
1[Play with children]	0.4803			
	[1.5825]			
1[Arts and crafts with children]	0.4942			
	[0.7763]			
1[Organizing care]	-6.3077			
	[2.5641]**			
1[Teaching children]			3.0444	3.1007
			[0.7483]***	[0.8147]***
1[Talking with children]			4.0148	3.0504
			[1.9709]**	[1.9451]
1[Reading to children]			-1.5456	
			[2.7853]	
1[Reading to children(1)]				2.689
				[0.6837]***
1[Eating with children]		2.9631		
		[0.7566]***		
1[Socializing]	0.425	1.6982		
	[0.4018]	[0.7390]**		
Observations	6242	9196	4587	4583

Note: Regressors excluded from table are: marital status, indicator for white race, indicators for high school degree and college attendance, square of family size, square of number of children in household ages 0-2, 3-5, 6-9, 10-14, square of state unemployment rate (and its interaction with square of number of children in household ages 0-2, 3-5, 6-9, 10-14 and indicators for high school degree and college attendance), indicator for labor market participation, hours worked per week, year fixed effects, state fixed effects. Also includes interactions of indicator variables for activities with square of state unemployment rate, square of number of children in household ages 0-2, 3-5, 6-9, 10-14 and indicators for high school degree and college attendance, and triple interactions of indicators with state unemployment rate and education dummies. Measure reading (1) includes mother reading with children around. Due to the large proportion of zeros in time use variables (see Table A10) model is estimated by tobit. Variables in columns (3) and (4) use a smaller sample because include variable "mother reads to child" so that only sample of mothers is used. Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A12 - Panel B: Distribution of original and time use variables.

	(1) Time leisure 2	(2)	(3) Time leisure 3	(4)	(5) Time teaching 1	(6)	(7) Time teaching 2	(8)
	Original ATUS	Imputed CNLSY	Original ATUS	Imputed CNLSY	Original ATUS	Imputed CNLSY	Original ATUS	Imputed CNLSY
N	9398	16344	9398	16344	9398	16344	9398	16344
Mean	1.56	1.69	1.68	5.31	0.25	1.14	0.48	1.35
SD	1.37	0.67	1.96	1.9	0.62	0.69	0.89	0.92
Percentile 25	0.67	1.31	0.25	3.43	0.00	0.65	0.00	0.65
Percentile 26	1.25	1.61	1.08	6.73	0.00	1.04	0.00	1.13
Percentile 50	2.00	1.97	2.33	6.87	0.17	1.49	0.67	1.91
Percentile 95	4.22	2.65	5.65	6.95	1.5	2.45	2.17	3.12

Note: Original distribution of time use variables for the sample of 1955-1965 cohort of ATUS (2003-2007) and correspondent imputed variable in CNLSY (cross-sectional sample).

Unit of observation: family. Measures in hours per day.

Matching for the other indexes in Table A11 is more imperfect than for these variables used in main results. In particular, the variance of imputes measures *Time Leisure 5 and 6* is four times smaller than in original data.

Table A13 - Distribution of weekly activities of leisure and child care. Time mothers spend in child care as primary and secondary activity per week.

Age of youngest child in hhld.	(1) All	(2)	(3) 0-2	(4)	(5) 3-5	(6)	(7) 6-9	(8)	(9) 10-14	(10)
	% of 1	hours	% of 1	hours	% of 1	hours	% of 1	hours	% of 1	hours
Child care as primary activity										
Education of children										
Teaching hhld. children (helping, teaching,	0.177	1.279	0.0998	0.905	0.165	1.116	0.240	1.684	0.154	1.134
time in any educational activities)	(0.382)	(3.867)	(0.300)	(3.842)	(0.371)	(3.878)	(0.427)	(4.130)	(0.361)	(3.661)
Reading to children	0.0985	0.366	0.170	0.662	0.227	0.857	0.142	0.518	0.0157	0.0555
	(0.298)	(1.357)	(0.376)	(1.790)	(0.419)	(2.027)	(0.349)	(1.523)	(0.124)	(0.596)
Playing with hhld. children children	0.106	1.100	0.389	4.997	0.227	2.260	0.0839	0.680	0.0262	0.237
	(0.308)	(4.146)	(0.488)	(8.840)	(0.419)	(5.436)	(0.277)	(2.717)	(0.160)	(1.816)
Arts and crafts with hhld. children,	0.0723	0.907	0.0374	0.485	0.0837	0.845	0.0814	1.020	0.0698	0.937
attending household children's events	(0.259)	(4.020)	(0.190)	(2.875)	(0.277)	(3.401)	(0.274)	(4.440)	(0.255)	(4.093)
Organization and planning for	0.0480	0.115	0.0457	0.113	0.0516	0.125	0.0681	0.150	0.0338	0.0898
household children	(0.214)	(0.724)	(0.209)	(0.655)	(0.221)	(0.765)	(0.252)	(0.753)	(0.181)	(0.704)
Home Production and Leisure										
Child care as secondary activity										
Eating (1)	0.737	6.151	0.917	7.600	0.902	7.791	0.909	7.688	0.534	4.329
	(0.441)	(7.023)	(0.276)	(6.042)	(0.297)	(7.466)	(0.287)	(7.621)	(0.499)	(6.166)
Eating - total	0.950	8.258	0.956	8.247	0.957	8.581	0.958	8.601	0.941	7.932
	(0.218)	(7.123)	(0.205)	(6.108)	(0.204)	(7.552)	(0.200)	(7.878)	(0.236)	(6.619)
Personal care (1)	0.596	3.549	0.692	3.749	0.738	4.263	0.729	4.354	0.444	2.752
	(0.491)	(4.347)	(0.462)	(3.779)	(0.440)	(4.204)	(0.444)	(4.697)	(0.497)	(4.109)
Personal care - total	0.834	5.277	0.792	4.354	0.842	5.111	0.830	5.217	0.843	5.555
	(0.372)	(4.602)	(0.406)	(3.726)	(0.365)	(4.755)	(0.376)	(4.761)	(0.363)	(4.583)
Care of other adults/children (1)	0.0845	0.622	0.123	1.245	0.113	0.761	0.0972	0.689	0.0596	0.407
	(0.278)	(3.407)	(0.328)	(5.448)	(0.317)	(3.489)	(0.296)	(3.615)	(0.237)	(2.580)
Care of other adults/children - total	0.127	1.002	0.137	1.360	0.132	0.953	0.123	1.000	0.126	0.945
	(0.333)	(4.401)	(0.344)	(6.050)	(0.339)	(3.896)	(0.329)	(4.544)	(0.332)	(4.034)
Preparation of meals (1)	0.620	5.527	0.811	8.116	0.778	7.507	0.758	6.506	0.441	3.743
	(0.485)	(7.173)	(0.392)	(8.312)	(0.416)	(7.647)	(0.428)	(7.103)	(0.497)	(6.333)
Preparation of meals - total	0.789	7.061	0.832	8.612	0.813	8.017	0.792	6.946	0.770	6.532
	(0.408)	(7.444)	(0.375)	(8.696)	(0.390)	(7.916)	(0.406)	(7.260)	(0.421)	(7.066)
Housework (1)	0.496	6.425	0.603	7.979	0.630	8.686	0.603	7.412	0.362	4.762
	(0.500)	(10.91)	(0.490)	(12.07)	(0.483)	(12.43)	(0.489)	(10.85)	(0.481)	(9.922)
Housework - total	0.661	8.742	0.640	8.780	0.672	9.248	0.661	8.400	0.662	8.811
	(0.473)	(11.97)	(0.480)	(12.45)	(0.470)	(12.55)	(0.473)	(11.37)	(0.473)	(12.08)
Shopping (1)	0.405	4.950	0.478	5.985	0.480	5.604	0.507	6.153	0.300	3.736
	(0.491)	(8.827)	(0.500)	(8.909)	(0.500)	(8.527)	(0.500)	(9.633)	(0.458)	(8.156)
Shopping - total	0.573	7.247	0.526	6.803	0.544	6.435	0.596	7.473	0.576	7.432
	(0.495)	(10.03)	(0.500)	(9.261)	(0.498)	(8.821)	(0.491)	(10.16)	(0.494)	(10.41)
Education (1)	0.0258	0.550	0.0187	0.351	0.0279	0.364	0.0353	0.926	0.0203	0.394
	(0.159)	(4.723)	(0.136)	(3.068)	(0.165)	(2.961)	(0.185)	(6.670)	(0.141)	(3.749)
Education - total	0.0361	0.860	0.0229	0.461	0.0321	0.524	0.0391	1.099	0.0381	0.882
	(0.187)	(6.020)	(0.150)	(3.585)	(0.176)	(3.983)	(0.194)	(7.239)	(0.191)	(6.023)
Exercise/sports (1)	0.115	1.350	0.0977	1.138	0.141	1.722	0.151	1.758	0.0867	1.006
	(0.319)	(5.275)	(0.297)	(4.565)	(0.348)	(6.266)	(0.359)	(6.123)	(0.281)	(4.365)
Exercise/sports - total	0.166	1.939	0.116	1.367	0.162	1.929	0.182	2.063	0.166	1.974
	(0.372)	(6.360)	(0.321)	(5.152)	(0.369)	(6.415)	(0.386)	(6.384)	(0.372)	(6.544)
Watching TV (1)	0.546	8.940	0.667	11.43	0.618	9.474	0.664	10.80	0.420	7.025
	(0.498)	(12.85)	(0.472)	(14.26)	(0.486)	(11.73)	(0.472)	(13.57)	(0.494)	(12.08)
Watching TV - total	0.734	12.52	0.757	12.48	0.671	10.52	0.730	12.19	0.750	13.35
	(0.442)	(14.13)	(0.429)	(14.01)	(0.470)	(12.37)	(0.444)	(14.14)	(0.433)	(14.58)
Socializing (1)	0.417	5.585	0.493	6.282	0.505	6.783	0.513	6.859	0.311	4.225
	(0.493)	(10.89)	(0.500)	(10.55)	(0.500)	(11.65)	(0.500)	(11.84)	(0.463)	(9.856)
Socializing - total	0.549	7.856	0.530	6.949	0.551	7.833	0.560	7.784	0.544	8.095
	(0.498)	(12.61)	(0.500)	(11.12)	(0.498)	(12.60)	(0.497)	(12.59)	(0.498)	(12.91)
Reading for personal interest (1)	0.259	1.740	0.231	1.193	0.329	2.179	0.324	2.273	0.199	1.361
	(0.438)	(4.555)	(0.422)	(3.046)	(0.470)	(5.121)	(0.468)	(5.545)	(0.399)	(3.779)
Reading for personal interest - total	0.365	2.548	0.274	1.500	0.389	2.577	0.370	2.598	0.374	2.720
	(0.482)	(5.375)	(0.447)	(3.605)	(0.488)	(5.299)	(0.483)	(5.799)	(0.484)	(5.382)
Observations	5147	5147	481	481	717	717	1585	1585	2364	2364

Note: There are two columns for each measure. First column is an indicator of some time in the activity and column two are actual weekly hours mothers spend on the activity. For each measure the first row, row (1), is the time with at least one household child under the adult supervision.

Figures for Appendix A

Figure A1 - Average monthly expenditures - source: CEX 1980-2000.

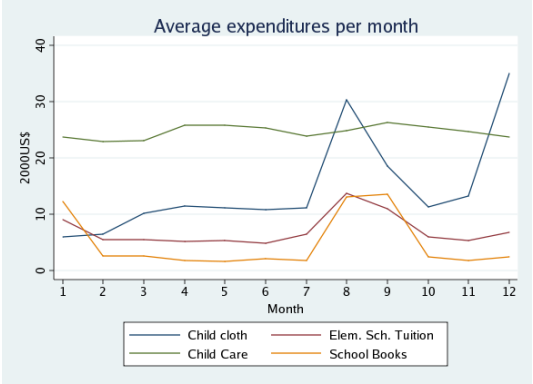
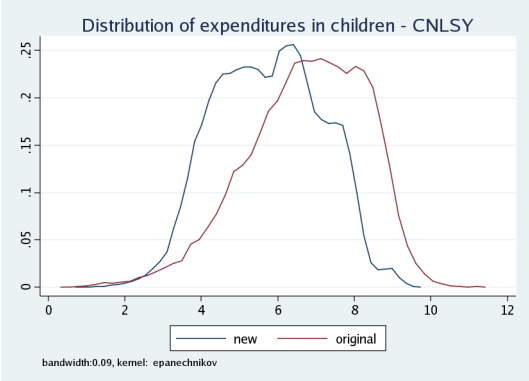
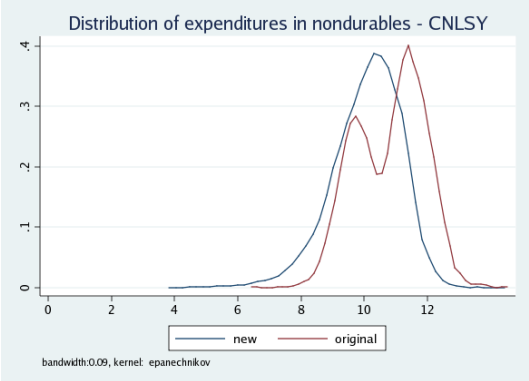
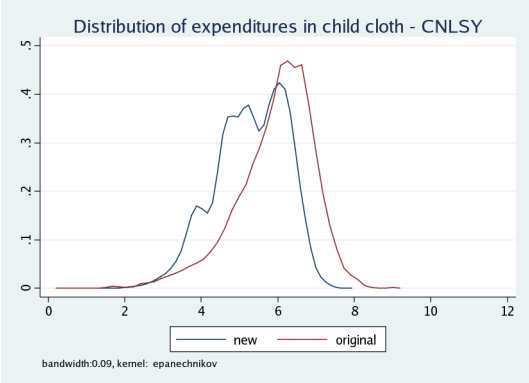


Figure A2 - Comparison of distribution of original and imputed expenditures (Data: CEX 1980-2000 and CNLSY 1986-2006).







Note: Specification uses all years of data available in CEX and interactions with indicators for number of children per household in each age group (0-2, 3-5,6-9,10-14) and interaction of indicators of expenditure with year dummies. It further controls for: quadratic of number of children per household by gender in each age, quadratic on mother's age, marital status, number of persons older than 64 years old, number of members over 15, mother's education (indicator for high school completion or college attendance), dummy of white and year fixed effects, hours worked per week by mother, weeks worked per year and log family income. Only families at least 9 months in CEX are used.

Appendix B: Description of NLSY, CEX and ATUS

The NLSY79

Definition of income variables used

Definition of income and assets variables from NLSY79:

1. **Wage** includes income received by the respondent in the past calendar year from wage, salary, commissions, or tips from all jobs, before deductions for taxes or anything else. If annual wages are missing but annual hours worked and hourly wage are available I use this information to compute the respondent annual wage.

2. **Earnings** include respondent's (or spouse/partner) 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.

3. **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, boarders, guardians, and other non-relatives are considered nonfamily members for the purposes of this variable.

4. **Net family income (or earnings)** is obtained subtracting federal income taxes from total family income (earnings)[11].

5. **Public Transfers** includes total amount of AFDC/TANF, Food Stamps, SSI/other public assistance income respondent or spouse received and unemployment compensation.

6. **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).

7. **Net Assets** are the sum of all asset values, subtracted of all debts. Top 2% of all values are topcoded.

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.

Permanent income is defined as the annualized sum of (non-missing) total family income between ages 0 and 18: $\sum_{t=0}^{18} \frac{y_t}{1+r_t}$, where r_t is market yield on U.S. Treasury securities at 1-year constant maturity[12].

Labor market information: Information regarding the number of (i) weeks worked, (ii) weekly hours worked, (iii) total numer of hours worked per year, (iv) unemployment status, (v) and weeks out of labor force is obtained from the "Work History Data files". This data contains weekly information for each individual labor force status since January 1, 1978 up to December 31, 2006. An individual is considered as participant in labor market if worked at least 100 hours per year.

[11] 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 I use the TAXSIM program (version 8a) maintained by the NBER (see http://www.nber.org/taxsim).

[12] See http://www.federalreserve.gov/releases/h15/data/Weekly_Friday_/H15_TCMNOM_Y1.txt.

Timing of income, investment in children and measures of human capital Income measures in survey of year t refer to year $t-1$. Measures of parenting refer to either last year (e.g., "how often was child taken to museum last year?", "how often was child taken to any performance last year?"), whereas some refer to an usual behavior (e.g., "about how many magazines does your family get regularly?", "does child get special lessons/extracurricular activities?"). Survey usual takes place in the second half of the year. However, given the phrasing of some questions regarding parents' behaviors (see first example) and the flow nature of others (second example), parenting measures from survey of year t are considered being referent to year $t-1$. Test scores used as measures of child's human capital are taken at year t. The timing of investment measures is important given the assumptions on the arrival of information that must hold to ensure that identification strategy is valid.

Imputations performed As NLSY79 surveys became biannual after 1994 I imputed the following variables in odd years without survey or whenever missing to maximize sample size: (i) number of children - using the of year of birth for each child in family, (ii) mother's marital status, using information available in adjacent years and on whether an individual ever married as of year t, and (iii) family size (using number of children and mother's marital status). If county and state are missing in year t they are imputed by previous year's information. In NLSY79 there are on average 54 observations per county/year and 445 by state/year after performing these imputations[13].

Child care choices and school attendance NLSY79 does not contain continuous report of child care choices or the number of hours child spends outside mother's care. The number of hours the child spends in child care is only available in survey years 1982, 1983, and 1984. For each child I reconstruct type of child care used before age 3 using retrospective information (including number of months in each type of care: home, center based or publicly funded care). For children ages 3 to 5 I can reconstruct partial history of child care attendance using information about current enrolment.

Since 1988 CNLSY provides information on the school type each child attends: whether child is enrolled in private, public or other/religious school. 88% of children in sample attend public schools.

The Consumer Expenditure Survey

For the US, the only household level data set with extensive information about a wide range of consumption expenditures is the Consumer Expenditure Survey (CEX). From 1980 onwards the survey is carried out on a yearly basis by the Bureau of Labor Statistics (BLS). The CEX is a rotating panel: each household in the sample is interviewed for four consecutive quarters and then rotated out of the survey. Hence in each quarter 20% of all households is rotated out of the sample and replaced by new households. In each quarter about 3000 to 5000 households are in the sample, and the sample is representative of the U.S. population.

The CEX is based on two components, the Diary survey and the Interview survey. The Diary sample interviews households for two consecutive weeks, and it is designed to obtain detailed expenditures data on small and frequently purchased items, such as food, personal care, and household supplies. The Interview sample follows survey households for a maximum of 5 quarters, although only inventory and basic sample data are collected in the first quarter. The data base covers about 95% of all expenditure, with the exclusion of expenditures for housekeeping supplies, personal care products, and non-prescription drugs. Consumption expenditure is reported in each quarter and refers to the previous quarter; income is reported in the second and fifth interview (with some exceptions), and refers to the previous twelve months.

The data used covers the period from 1980 to 2000. I create a measure of annual expenditures summing monthly expenditures of a family and weighting each household by the proportion of monthly observations that fall into that calendar year. For each household I impute the year as $t-1$ if last month of interview is March, and t if last month of interview April to December. This allows to have compatibility between timing of income and consumption, and to ensure compatibility between measures in NLSY79 and CEX. For further consistency with the NLSY79 and the timing of consumption only income from 5th interview is used.

The initial sample includes 1,407,043 monthly observations, corresponding to 232,453 households. I exclude from the sample households with missing report on total non durable consumption, households residing in student housing, those without children under 18, those with incomplete income report and those whose annual income is less then annual expenditure on food.

For consistency with the NSLY79, I keeup only those households whose wife of reference person (if reference person is male and married), or head (if reference person is female) was born between 1955 and 1965 (see Table A2).

[13] I only have information on county and state is up to 2004 so I assumed that families did not move between 2004 and 2006.

Some specific expenditure items were deflated using prices from *Table 705 - Consumer Price Indexes for All urban Consumers (CPI-U) for Selected Items and Groups: 1970 to 2006*, from Bureau of Labor Statistics[14]. Expenditures deflated using specific prices are: school books, school and child care tuition, transports and food.

To account for seasonal nature of expenditures in education and child cloth I only use families at least 9 months to perform re-scale of variables used in main results.

The American Time Use Survey 2003-2007

There is no unique time use survey that covers the period analyzed and the several data sets available do not have consistent measures of time activities, therefore I rely only the latest data, the 2003-2007 American Time Use Survey (ATUS).[15]

ATUS is conducted by the Bureau of Labor Statistics (BLS). This data surveys adolescents and adults at least 15 years old. The individual is sampled approximately three months after completion of the final CPS survey. At the time of the ATUS survey, the BLS updated the respondents employment and demographic information. The ATUS waves totalled 20,720, 13,973, and 13,038, 12,943 and 12,248 respondents in 2003, 2004, 2005, 2006 and 2007 respectively.

ATUS respondents are about how they spent their time on the previous day (starting at 4 a.m. the previous day and ending at 4 a.m. on the interview day), where they were, and whom they were with. The ATUS contains information about the amount of time spend doing unpaid, nonmarket work, which could include unpaid childcare and adult care, housework, and volunteering. The survey also provides information on the amount of time people spend in many other activities, such as religious activities, socializing, exercising, and relaxing. In addition to collecting data about what people did on the day before the interview, ATUS collects information about where and with whom each activity occurred, and whether the activities were done for ones job or business. Demographic information including sex, race, educational attainment, occupation, income and marital status for each household member is available for each respondent.

For consistency with the NLSY79 only individuals born between 1955 and 1965 are kept in sample.

Average unemployment rate per county (BLS)

County unemployment rate is constructed by the Bureau of Census using the Current Population Survey (CPS) and is available since 1976. Monthly statewide estimates of employment and unemployment are largely consistent over time from 1978 forward, with two exceptions: (i) a break in series caused by revisions to the CPS in 1994 and (ii) a discontinuity resulting from introduction of new CPS population controls for 1990 and later years. This later change results in an inconsistency between the pre- and post-1990 periods.

Unemployment rate is simply the ratio of number of unemployed per county by the labor force. Most employment data available for use in developing substate labor force estimates are based on a place-of-work concept. Since local unemployment estimates are required by place of residence, the place-of-work employment data inputs must be adjusted. Decennial census data are used to develop "residency adjustment factors" for each LMA (Labor Market Areas) for this purpose.

Appendix C: supplemental tables

[14] Available at http://www.bls.gov/cpi.

[15] Other data available are 1985 Americans' Use of Time and the 1992-1994 National Human Activity Pattern Survey. These data present some limitations: the former does not have information on the structure of age of children in family; whereas the second data does not have information on the family size, number of children or individuals marital status.

Table C1 - Effect of labor market shock
Sample: All NLSY79 sample

Dependent variable	(1) Participation	(2) Log family earnings	(3) Log family income	(4) Participation	(5) Log family earnings	(6) Log family income	(7) Participation	(8) Log family earnings	(9) Log family income
Sample		All			Females			Males	
Shock in t	-0.322	-3.839	-1.089	-0.411	-1.841	0.009	0.03	-0.362	0.509
	[0.132]**	[0.947]***	[0.314]***	[0.262]	[1.371]	[0.523]	[0.133]	[1.165]	[0.675]
Shock in tX1[HS degree or less]				-0.102	-3.872	-1.392	-0.297	-5.161	-2.854
				[0.349]	[3.085]	[0.708]**	[0.182]	[1.550]***	[0.853]***
Observations	79255	79255	79255	42054	42054	42054	37201	37201	37201
Number of mothers	10993	10993	10993	5575	5575	5575	5418	5418	5418
Effect of 1pp increase in unemployment									
All	-0.322	-437.05	-333.65						
High Euducation				0.03	-71.17	2.00	0.00	-70.02	130.26
Low Education				-0.27	-220.87	-307.69	0.00	-1068.22	-600.11
P-Values									
H0: HS degree/dropout = 0				0.06	0.03	0.01	0.05	0	0
H0: Joint test on Shock in t				0.07	0.03	0.05	0.14	0	0
Mean	0.87	9.34	10.33	0.79	8.26	10.01	0.92	9.87	10.15
SD	0.33	2.92	1.19	0.41	1.39	1.19	0.27	1.29	1.20
Mean (2000US$)		11384.41	30638.11		3866.09	22247.84		19341.34	25591.10
% of families without earnings		2.87%			15.18%			6.81%	

Note: Regressors excluded from table include quadratic on mothers' age and family size, dummies for mother's education (indicators for high school completion and college attendance), mother's marital status (1 if married, 0 otherwise), indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family and family, county and year fixed effects. Standard errors are clustered by county. Dependent variable in columns (1), (3) and (5) is an indicator variable that takes value 1 if mother works at least 100h hours per year and 0 otherwise. Dependent variable in columns (2), (5) and (8) is Log(Earnings +1) to account for families without earnings. Sample used in estimation: cross-sectional sample of NLSY.
The marginal effect of 1 percentage point increase in unemployment rate is computed at the mean of outcome variable and is percentage for labor market participation and measured in 2000US$ for effects on log earnings and family income.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table C2 - Effect of labor market shock (by marital status)
Sample: cross-sectional sample (CNLSY 1986-2006)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	**Participation**		**Log family earnings**	**Log family income**	**Participation**	**Log family earnings**	**Log family income**
	Woman	**Spouse**					
Sample	**Married**				**Single**		
Shock in t	0.294	0.155	-4.008	-1.956	-2.327	-19.84	-2.594
	[0.622]	[0.384]	[3.580]	[0.981]**	[1.672]	[16.934]	[4.723]
Shock in tX1[HS degree or less]	-0.481	-0.548	-0.828	-0.021	0.58	3.311	2.478
	[0.780]	[0.430]	[5.067]	[1.520]	[1.943]	[19.459]	[4.548]
Observations	9691	9691	9691	9691	3572	3572	3572
Number of mothers	1930	1930	1930	1930	1014	1014	1014
P-Values							
H0: HS degree/dropout = 0	0.71	0.16	0.03	0.08	0.04	0.04	0.95
H0: Joint test on Shock in t	0.83	0.3	0	0.03	0.03	0.04	0.86

Note: Regressors excluded from table include quadratic on mothers' age and family size, dummies for mother's education (indicators for high school completion and college attendance), mother's marital status (1 if married, 0 otherwise), indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family and family, county and year fixed effects. Standard errors are clustered by county.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table C3 - Effect of past shocks
Sample: cross-sectional sample (CNLSY 1986-2006)

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Participation			Log family earnings			Log family income	
					Panel A: All				
Shock in t	-0.823	-0.428	-0.6	-1.622	-1.726	-1.588	-1.089	-1.214	-0.957
	[0.319]***	[0.346]	[0.381]	[0.466]***	[0.552]***	[0.597]***	[0.527]**	[0.676]*	[0.781]
Shock t-1		-0.516	0.031		0.116	-0.489		0.139	-0.793
		[0.350]	[0.418]		[0.552]	[0.751]		[0.668]	[1.066]
Shock t-2			-0.254			1.066			1.576
			[0.418]			[0.826]			[0.893]*
Shock t-3			-0.499			-0.615			-1.118
			[0.381]			[0.642]			[0.818]
Shock t-4			0.224			-0.203			0.547
			[0.297]			[0.445]			[0.585]
Observations	13227	13185	12885	13227	13185	12885	13227	13185	12885
P-Value: Effect =0		0	0		0	0		0.06	0.29
					Panel B: Mothers education ≤12 years				
Shock in t	-1.154	-0.839	-1.078	-1.665	-2.088	-1.845	-0.543	-0.865	-0.441
	[0.416]***	[0.545]	[0.507]**	[0.657]**	[0.748]***	[0.798]**	[0.822]	[0.919]	[1.090]
Shock t-1		-0.416	0.177		0.538	-0.097		0.415	-0.873
		[0.464]	[0.558]		[0.835]	[0.964]		[1.063]	[1.548]
Shock t-2			-0.379			1.055			1.962
			[0.546]			[1.029]			[1.390]
Shock t-3			-0.354			-0.52			-1.028
			[0.458]			[0.886]			[1.161]
Shock t-4			0.183			-0.607			-0.021
			[0.335]			[0.658]			[0.861]
Observations	6919	6894	6722	6919	6894	6722	6919	6894	6722
P-Value: Effect =0		0	0		0.05	0.03		0.65	0.76
					Panel C: Mothers education >12 years				
Shock in t	-0.196	0.215	0.152	-1.435	-1.13	-1.036	-1.924	-1.661	-1.459
	[0.509]	[0.601]	[0.581]	[0.845]*	[1.066]	[1.065]	[0.937]**	[1.284]	[1.240]
Shock t-1		-0.527	-0.174		-0.441	-1.109		-0.399	-0.845
		[0.532]	[0.781]		[0.814]	[1.099]		[1.271]	[1.471]
Shock t-2			0.059			0.961			0.614
			[0.778]			[0.995]			[1.791]
Shock t-3			-0.697			-0.777			-1.286
			[0.778]			[0.881]			[1.276]
Shock t-4			0.384			0.721			1.712
			[0.483]			[0.580]			[0.816]**
Observations	6308	6291	6163	6308	6291	6163	6308	6291	6163
P-Value: Effect =0		0.58	0.67		0.11	0.32	0.28	0.03	0.32

Note:Regressors excluded from table include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-16 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable for columns (4)-(6) is Log(Earnings +1) to account for families without earnings. Sample used in estimation: cross-sectional sample of NLSY. * significant at 10%; ** significant at 5%; *** significant at 1%. The P-Value of test included in table tests for the null hypothesis of sum of all lagged shocks being 0.

Table C4 - Positive and negative shocks

Dependent variable	(1) Participation	(2) Log family earnings	(3) Log family income	(4) Participation	(5) Log family earnings	(6) Log family income	(7) Participation	(8) Log family earnings	(9) Log family income
Sample	**All**			**Mothers education ≤12 years**			**Mothers education >12 years**		
	Positive shocks: residual unemployment rate ≤0								
Shock in t	-0.074	2.277	0.564	-0.992	1.327	-0.131	1.07	3.64	1.564
	[0.824]	[1.193]*	[1.586]	[0.924]	[1.481]	[2.489]	[1.123]	[2.121]*	[2.167]
Observations	7592	7592	7575	4110	4110	4110	3482	3482	3482
Number of mothers	2088	2088	2088	1097	1097	1097	991	991	991
Effect of 1pp increase in unemployment	-0.07	786.58	161.12	-0.99	364.22	-29.73	1.07	1857.18	729.29
Mean	0.76	10.45	10.26	0.73	10.22	10.03	0.81	10.84	10.75
SD	0.42	1.14	1.03	0.44	1.22	1.03	0.4	0.99	0.94
Mean (2000US$)		34544.37	28566.79		27446.67	22697.27		51021.38	46630.03
	Negative shocks: residual unemployment rate >0								
Shock in t	-1.088	-1.968	-1.083	-1.772	-2.318	-1.094	0.486	-1.123	-0.488
	[0.510]**	[1.233]	[1.482]	[0.745]**	[1.219]*	[1.958]	[1.088]	[2.251]	[2.329]
Observations	5635	5635	5635	2809	2809	2809	2826	2826	2826
Number of mothers	1944	1944	1944	1001	1001	1001	943	943	943
Effect of 1pp increase in unemployment	-1.09	-751.33	-413.46	-1.77	-636.21	-306.33	0.49	-503.12	-254.01
Mean	0.75	10.55	10.55	0.71	10.22	10.24	0.8	10.71	10.86
SD	0.43	1.15	1.07	0.46	1.22	1.07	0.4	0.99	0.97
Mean (2000US$)		38177.4	38177.4		27446.67	28001.13		44801.64	52052.08

Note: Estimation for separated samples by type of shock. Regressors excluded from table include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable for columns (2), (5) and (8) is Log(Earnings +1) to account for families without earnings. Sample used in estimation: cross-sectional sample of NLSY. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table C5 - Interaction with age of youngest child in sample

Dependent variable	(1) Participation	(2) Log family earnings	(3) Log family income	(4) Log unearned Income	(5) Log welfare Income
			Panel A: All		
Shock in t	-0.664	-1.767	-1.927	2.569	6.282
	[0.413]	[0.611]***	[0.626]***	[2.902]	[2.110]***
ShockX1[Age youngest 6-9]	-0.235	0.381	2.065	-4.42	-4.407
	[0.578]	[0.796]	[1.220]*	[4.527]	[3.083]
ShockX1[Age youngest 10-14]	-0.632	0.257	2.001	-8.544	-2.1
	[0.848]	[1.295]	[1.317]	[6.663]	[4.245]
Observations	13227	13227	13227	13227	13227
P-Value					
Shock+1[Age youngest 6-9]=0	0.06	0.17	0.90	0.65	0.26
Shock+1[Age youngest 10-14]=0	0.07	0.03	0.95	0.35	0.54
Joint Test	0.06	0.01	0.02	0.56	0.02
			Panel B: Mothers education ≤12 years		
Shock in t	-1.007	-1.549	-1.037	-1.482	6.867
	[0.481]**	[0.886]*	[1.044]	[3.704]	[2.879]**
ShockX1[Age youngest 6-9]	-0.078	0.224	1.93	2.487	-3.996
	[0.737]	[1.166]	[1.553]	[5.431]	[4.298]
ShockX1[Age youngest 10-14]	-0.862	-1.06	0.148	0.905	-1.829
	[1.141]	[1.669]	[1.772]	[8.531]	[4.867]
Observations					
P-Value	6919	6919	6919	6919	6919
Shock+1[Age youngest 6-9]=0	0.08	0.06	0.59	0.86	0.25
Shock+1[Age youngest 10-14]=0	0.07	0.13	0.48	0.94	0.48
Joint Test	0.05	0.05	0.61	0.96	0.1
			Panel C: Mothers education >12 years		
Shock in t	-0.022	-2.011	-3.31	2.459	5.052
	[0.596]	[1.014]**	[0.986]***	[4.695]	[4.199]
ShockX1[Age youngest 6-9]	-0.525	0.677	2.038	-9.38	-5.478
	[0.809]	[0.906]	[1.843]	[8.265]	[5.136]
ShockX1[Age youngest 10-14]	-0.33	2.629	5.572	-19.75	-4.321
	[1.018]	[1.878]	[1.971]***	[10.173]*	[6.372]
Observations	6308	6308	6308	6308	6308
P-Value					
Shock+1[Age youngest 6-9]=0	0.5	0.71	0.25	0.05	0.93
Shock+1[Age youngest 10-14]=0	0.7	0.14	0.49	0.31	0.89
Joint Test	0.9	0.22	0	0.23	0.61

Note: Regressors excluded from table include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable in columns (2), (4) and (5) is log(X+1). Effects of 1pp change in unemployment are measured in $US for expenditures and minutes per week for time. Sample used in estimation: cross-sectional sample of NLSY. There are no zeros in expenditures for education in the sample used in this table. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table C6 - Effect of labor market shock
Sample: cross-sectional sample and oversample of poor (CNLSY 1986-2006)

Dependent variable	(1) Participation	(2) Log family earnings	(3) Log family income	(4) Participation	(5) Log family earnings	(6) Log family income	(7) Participation	(8) Log family earnings	(9) Log family income
Sample	**All**			**Mothers education ≤12 years**			**Mothers education >12 years**		
Shock in t	-0.49	-1.189	-1.002	-0.812	-1.594	-1.17	0.092	-0.415	-0.775
	[0.236]**	[0.412]***	[0.454]**	[0.301]***	[0.548]***	[0.580]**	[0.399]	[0.671]	[0.655]
Observations	21731	21731	21731	11998	11998	11998	9733	9733	9733
Number of mothers	4070	4070	4070	2280	2280	2280	1790	1790	1790
Effect of 1pp increase in unemployment									
Mean	0.75	10.5	10.33	0.696	9.998	10.05	0.817	10.61	10.66
SD	0.433	1.14	1.093	0.46	1.332	1.098	0.387	1.063	0.99
Mean (2000US$)			30638.11		21982.46	23155.79		40538.20	42616.64
% of observations without earnings		0.12			0.18			0.05	
Difference in outcome by education group									
P-Value	20.56	35.05	42.12						

Note: Regressors excluded from table include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable for columns (2), (5) and (8) is Log(Earnings +1) to account for families without earnings. Sample used in estimation: cross-sectional sample of NLSY. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table C7 - Effect of shock on household allocation
Sample: cross-sectional sample and oversample of poor (CNLSY 1986-2006)
Units of dependent variables: Expenditures measured in log(X); effect in time measured in minutes per week.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Children								Household	
Dependent variable	Log Expenditures				Time use				Log nondurable consumption	
	in education		in child clothes		Education		Socializing			
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	Panel A: All									
Shock in t	-0.912		0.046		-0.843		0.75		-0.996	
	[0.518]*		[0.310]		[0.183]***		[0.139]***		[0.330]***	
Log Income		0.91		-0.046		0.841		-0.748		0.993
		[0.483]*		[0.287]		[0.143]***		[0.087]***		[0.312]***
Observations	21731	21731	21731	21731	21731	21731	21731	21731	21731	21731
# of mothers	4070	4070	4070	4070	4070	4070	4070	4070	4070	4070
Effect of 1pp increase in unemployment	-5.49		0.14		-4.39		5.39		-428.73	
Mean (log)	6.4		5.71		1.24		1.71		10.67	
SD	1.14		0.8		0.72		0.78		0.87	
Mean (2000US$, hours/week)	601.85		301.87		8.68		11.97		43044.94	
	Panel B: Mothers education ≤12									
Shock in t	-0.557		-0.015		-1.016		1.247		-1.036	
	[0.555]		[0.309]		[0.227]***		[0.226]***		[0.374]***	
Log Income		0.476		0.012		0.868		-1.066		0.885
		[0.543]		[0.289]		[0.154]***		[0.103]***		[0.353]**
Observations	11998	11998	11998	11998	11998	11998	11998	11998	11998	11998
# of mothers	2280	2280	2280	2280	2280	2280	2280	2280	2280	2280
Effect of 1pp increase in unemployment	-2.56		-0.04		-5.72		9.74		-340.43	
Mean (log)	6.13		5.65		1.34		1.86		10.4	
SD	1.13		0.75		0.77		0.92		0.83	
Mean (2000US$, hours/week)	459.44		284.29		9.38		13.02		32859.63	
	Panel C: Mothers education >12									
Shock in t	-1.45		0.327		-0.528		-0.092		-1.014	
	[0.849]*		[0.620]		[0.192]***		[0.149]		[0.580]*	
Log Income		1.871		-0.421		0.681		0.118		1.308
		[0.984]*		[0.650]		[0.248]***		[0.149]		[0.612]**
Observations	9733	9733	9733	9733	9733	9733	9733	9733	9733	9733
# of mothers	1790	1790	1790	1790	1790	1790	1790	1790	1790	1790
Effect of 1pp increase in unemployment	-12.26		1.06		-2.48		-0.59		-607.12	
Mean (log)	6.74		5.78		1.12		1.52		11	
SD	1.05		0.84		0.62		0.49		0.79	
Mean (2000US$, hours/week)	845.56		323.76		7.84		32.01		59874.14	

Note: Regressors excluded from table include quadratic on mothers' age and family size, indicators for high school completion and college attendance, mother's marital status and indicators of presence of children 0-2, 3-5, 6-9 or 10-14 years old in family year, indicator for living in parents family, family fixed effects, year FE and cubic of estimated county FE. Standard errors in are corrected for use of estimated regressor using block-bootstrap with 250 replications (block is county). Dependent variable in columns (3)-(5) is log(X+1). Effects of 1pp change in unemployment are measured in $US for expenditures and minutes per week for time. Sample used in estimation: cross-sectional sample of NLSY. There are no zeros in expenditures for education in the sample used in this table. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table D1 - Indicators of parenting variables available in NLSY.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Age of child	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Number of books (1 if 10 or more)	0.289	0.527	0.690	0.757	0.791	0.812	0.829	0.851	0.842	0.862	0.690	0.679	0.644	0.619	0.564
		(0.453)	(0.499)	(0.462)	(0.429)	(0.407)	(0.391)	(0.377)	(0.357)	(0.365)	(0.345)	(0.463)	(0.467)	(0.479)	(0.486)	(0.496)
2	How often does child eat a meal with both you and	0.296	0.307	0.294	0.272	0.284	0.245	0.250	0.217	0.235	0.213	0.201	0.204	0.187	0.164	0.165
	his/her father/step/father-figure?	(0.457)	(0.461)	(0.456)	(0.445)	(0.451)	(0.430)	(0.433)	(0.412)	(0.424)	(0.409)	(0.401)	(0.403)	(0.390)	(0.370)	(0.372)
3	How often mom reads to child	0.368	0.589	0.677	0.629	0.600	0.573	0.570	0.487	0.360	0.274					
		(0.482)	(0.492)	(0.468)	(0.483)	(0.490)	(0.495)	(0.495)	(0.500)	(0.496)	(0.463)					
4	How often does child gets out of house?	0.790	0.904	0.917	0.127	0.158	0.149									
		(0.408)	(0.295)	(0.276)	(0.334)	(0.365)	(0.356)									
5	How often does child is taken to grocery?	0.286	0.376	0.414												
		(0.452)	(0.485)	(0.493)												
6	How many cuddly, soft, or role-playing toys does child have?	0.381	0.533	0.555												
		(0.486)	(0.499)	(0.497)												
7	How many push or pull toys does child have?	0.0606	0.134	0.181												
		(0.239)	(0.340)	(0.385)												
8	How often do you talk to child while you are working?	0.854	0.878	0.873												
		(0.353)	(0.328)	(0.333)												
9	Do you help your child with numbers?				0.934	0.949	0.957									
					(0.249)	(0.220)	(0.202)									
10	Do you help your child with alphabeth?				0.887	0.923	0.950									
					(0.317)	(0.266)	(0.218)									
11	Do you help your child with colors?				0.935	0.945	0.947									
					(0.246)	(0.228)	(0.224)									
12	Do you help your child with shapes?				0.761	0.825	0.886									
					(0.427)	(0.380)	(0.318)									
13	Do you help your child with none of the above?				0.101	0.104	0.123									
					(0.302)	(0.305)	(0.328)									
14	About how many magazines does your family get regularly?				0.351	0.351	0.371									
					(0.477)	(0.477)	(0.483)									
15	Does child have the use of a CD player, tape deck at home				0.699	0.748	0.793									
	and at least 5 children's records or tapes?				(0.459)	(0.434)	(0.405)									
16	How often was child taken to museum last year?				0.285	0.327	0.351	0.371	0.407	0.384	0.387	0.365	0.367	0.320	0.301	0.264
					(0.452)	(0.469)	(0.477)	(0.483)	(0.491)	(0.486)	(0.487)	(0.482)	(0.482)	(0.467)	(0.459)	(0.441)
17	Does your family get a daily newspaper?							0.475	0.471	0.472	0.451	0.475	0.453	0.453	0.451	0.435
								(0.499)	(0.499)	(0.499)	(0.498)	(0.499)	(0.498)	(0.498)	(0.498)	(0.496)
18	Does child get special lessons?							0.468	0.550	0.566	0.608	0.638	0.654	0.659	0.653	0.626
								(0.499)	(0.498)	(0.496)	(0.488)	(0.481)	(0.476)	(0.474)	(0.476)	(0.484)
19	How often was child taken to any performance in past year?							0.581	0.602	0.612	0.612	0.624	0.619	0.611	0.613	0.576
								(0.493)	(0.490)	(0.487)	(0.487)	(0.484)	(0.486)	(0.488)	(0.487)	(0.494)
20	How often does your whole family get together							0.616	0.589	0.583	0.573	0.564	0.554	0.533	0.515	0.508
	with relatives or friends?							(0.486)	(0.492)	(0.493)	(0.495)	(0.496)	(0.497)	(0.499)	(0.500)	(0.500)
21	Is there a musical instrument that child can use here at home?							0.412	0.441	0.445	0.490	0.496	0.556	0.525	0.544	0.522
								(0.492)	(0.497)	(0.497)	(0.500)	(0.500)	(0.497)	(0.500)	(0.498)	(0.500)
22	Family encourage child to start and keep doing hobbies?							0.871	0.900	0.906	0.925	0.923	0.926	0.936	0.932	0.936
								(0.335)	(0.300)	(0.292)	(0.263)	(0.266)	(0.262)	(0.244)	(0.252)	(0.244)
23	When family watches TV, do you discuss programs							0.829	0.825	0.832	0.832	0.827	0.828	0.812	0.798	0.797
	with child?							(0.377)	(0.380)	(0.374)	(0.374)	(0.378)	(0.378)	(0.391)	(0.401)	(0.403)
	Weekly activities with parents															
24	Worked on schoolwork together												0.382	0.345	0.268	0.268
													(0.486)	(0.475)	(0.443)	(0.443)
25	Done things together (build or make things, cook, or sew)												0.518	0.527	0.505	0.481
													(0.500)	(0.499)	(0.500)	(0.500)
26	Played game/sport w/ parents												0.510	0.467	0.436	0.390
													(0.500)	(0.499)	(0.496)	(0.488)
	Monthly activities with parents															

27	Gone out to dinner											0.708	0.703	0.711	0.681
												(0.455)	(0.457)	(0.454)	(0.466)
28	Gone to the movies together											0.413	0.380	0.359	0.314
												(0.493)	(0.485)	(0.480)	(0.464)
29	Gone on an outing together											0.400	0.400	0.417	0.382
												(0.490)	(0.490)	(0.493)	(0.486)
30	Gone shopping for child											0.797	0.810	0.825	0.828
												(0.402)	(0.392)	(0.380)	(0.378)
	Aggregated scores														
31	HOME score	-0.0347	-0.150	-0.149	-0.174	-0.180	-0.162	-0.122	-0.122	-0.124	-0.104	0.00634	-0.0244	-0.0864	-0.187	-0.227
		(0.973)	(1.078)	(1.046)	(1.043)	(1.043)	(1.013)	(1.031)	(1.009)	(1.024)	(0.998)	(0.986)	(1.007)	(0.992)	(1.012)	(1.003)
32	Cognitive Stimulation	-0.0772	-0.166	-0.135	-0.183	-0.181	-0.162	-0.139	-0.142	-0.134	-0.106	-0.00561	-0.0419	-0.102	-0.197	-0.252
		(1.005)	(1.089)	(1.067)	(1.079)	(1.079)	(1.065)	(1.034)	(1.034)	(1.051)	(1.016)	(1.003)	(1.008)	(1.007)	(1.027)	(1.015)
33	Emotional Support	-0.0611	-0.104	-0.139	-0.136	-0.132	-0.156	-0.102	-0.111	-0.106	-0.0958	-0.0194	-0.0361	-0.0791	-0.153	-0.161
		(1.025)	(1.073)	(1.061)	(1.045)	(1.031)	(1.037)	(1.054)	(1.043)	(1.033)	(1.043)	(1.006)	(1.050)	(1.018)	(1.039)	(1.060)
	Observations	1715	2247	2371	2284	2524	2538	2767	2845	2763	2738	2615	2228	2053	2039	1052

Note: Mean (and standard deviation in parenthesis) of measures of investment in children's human capital at different ages. All variables were recoded to be 0-1 indicators. The original and recoded variables are defined as follows:
1 available for 8124 children at age 0 in sample.

Table D2 - Measures of child human capital by age - CNLSY.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Age of child	5	6	7	8	9	10	11	12	13	14
Behavior Problems Index										
BPI	0.250	0.227	0.368	0.367	0.357	0.384	0.350	0.448	0.392	0.435
	(0.969)	(1.001)	(0.969)	(1.026)	(0.980)	(0.988)	(0.999)	(0.991)	(0.961)	(0.977)
Observations	2443	2561	2691	2611	2602	2463	2319	2112	2054	1062
Test scores										
PIAT - Mathematics	-0.0279	0.0629	0.0921	0.106	0.148	0.123	0.127	0.0686	-0.0006	-0.0895
	(1.001)	(0.822)	(0.786)	(0.919)	(1.001)	(0.991)	(0.967)	(0.935)	(0.929)	(0.947)
PIAT - Reading Recognition	0.534	0.261	0.337	0.353	0.312	0.284	0.218	0.224	0.228	0.227
	(1.028)	(0.731)	(0.829)	(0.947)	(1.005)	(1.017)	(0.998)	(1.028)	(1.082)	(1.083)
Observations	2391	2672	2747	2691	2664	2556	2402	2192	2110	1085

Note: Mean (standard errors in parenthesis)